CHAPTER 4: RESULTS AND DISCUSSION

In this chapter, the results of the study and related discussions are reported in three main sections, which reflect the framework developed in the literature review. The first section provides a review of the Problem-Based Learning (PBL) environment in both courses and relies mainly on data provided by the representative academic leaders. It provides a macro view of factors impacting on the learning environments of both courses. The second section compares the PBL processes followed by both courses and examines how facets of the process impact on the students' perceptions of their learning experiences. The third section establishes the outcomes for students in the full PBL environments offered by both courses.

Data and findings are reported using representative respondents' comments and links are made to the literature. Propositions, which are grounded in that data, are made to inform further research and future practice. Finally, a summary of the findings is provided at the end of each section.

The PBL Environment

In this section, the context in which adoption of PBL arose for both courses is described, the cultural suitability of Hong Kong students for PBL is examined, and the forms of academic leadership in both courses are compared. This background is important, as the students' perceptions of their experiences of PBL is grounded in the different environments of the two courses.

Academic Leadership

Academic leadership in both programs was the responsibility of the Heads of both courses, referred to as HOS for one full PBL degree course, which is titled BS, and HOD for the other full PBL degree course, which is titled BD. They worked in close association with a small group of senior academics, three in BS and five in BD.

These groups were responsible for decision making and providing overall direction for both courses. Both Heads mentioned that they had very supportive Deans of Faculty, who provided essential backup and support when required, and made funding available for resources. The responsibilities for both leadership groups were the same. They oversaw provision of initial development and ongoing implementation of the courses, all staffing matters, the curriculum and its evaluation, provision of resources, and orientation of students

Beginnings of PBL in BD and BS

The stimulus for adoption of both PBL programs was different, however, the rationales were the same. According to HOS, the conversion process to PBL in the BS was internally driven, "bottom-up and strategically planned" with a purpose of creating an environment that would foster deep learning among the student population. The prime movers were two senior lecturers in the program and they formed a nucleus with three other willing colleagues to provide the initial impetus for change. Adoption of PBL by the BD resulted from a comprehensive external review by a professional accrediting body. The HOD stated that, "there was a recommendation that the program should produce students who could think critically rather than depend on rote learning and memorization to learn professional knowledge and skills". The BD academic leaders decided to adopt an integrated curriculum, which meant a change of organisational structure from individual departments to an undergraduate and graduate arrangement. The BS also changed its structure from discrete subject-based areas to a single discipline mode.

Conversion to PBL in BS was staged over three academic years. In the first academic year, Year 1 students were instructed using PBL in an embedded unit within a traditional curriculum. In the following year, with the same cohort of students, a further trial using a hybrid PBL program was implemented. It was an expanded model with similar format as the embedded PBL unit. Following the success of the hybrid model, a full PBL curriculum was implemented at the same time for the first three years of the program. Students in Year 4 in the BS curriculum follow a different structure to the full PBL program. In addition to comprehensive clinical components, Year 4 BS students completed a thesis in some area related to their

practice in their discipline area. The HOS stated that PBL prepares students well for doing their thesis work.

There was a total of eighteen full-time academic staff involved in the BS program. Initial training was undertaken at McMaster University by two senior academics and they were responsible for training the remaining 16 staff. The HOS noted that implementation was monitored very carefully to ensure students and staff were neither compromised nor criticised for achieving different learning outcomes from those expected from a traditional lecture-based approach. The idea of adopting a PBL approach was well received by the academic staff. They were committed to adopting a PBL approach and subsequently became involved in the conversion process. In effect, all staff were adequately introduced, trained and supported during the change to PBL. Consequently, the conversion proved to be smooth and comprehensive. Funds were reallocated for development of PBL facilities and for training of staff.

Implementation of the BD program was different because it involved an immediate switch from a traditional approach to a full PBL program and phased in over three years. A specially selected task force of senior academics was formed to lead the PBL initiative. Selection of personnel, who volunteered to lead the conversion, was based on three criteria. The criteria ensured each member had come from a separate subject areas, was not a program director or former Head of Department, and had previously demonstrated he or she could work together in a collaborative fashion. According to HOS, this enabled, as best as possible, to put together a team whose members were intrinsically motivated, were relatively free of other duties and alternative agendas for planning of the curriculum, and for setting up systems to support the conversion to PBL. Funds were used to renovate classrooms and provide initial training of lecturers for introduction of whole-of-curriculum PBL for Year 1 students. A second round of funding was received for facilitator training and curriculum development that assisted in preparing for the course full curriculum transition to PBL two years later.

Training for conversion by BD to PBL for about 50 full-time academic staff was conducted on site by bringing in two different consultants on separate occasions.

They also relied on engaging part-time staff to work in their course and occasional staff from another cognate faculty that used a hybrid model of PBL. While these part-time staff had experience as facilitators in PBL, there was no check to see whether they had experienced any formal training. Similarly to the BD, the BS was supplemented with part-time staff from the professional field, and occasional academic staff from another faculty to provide specialist knowledge.

Hong Kong Chinese Culture

In the interview with the HOS, her response to the question "Can Asian students do PBL?" was very much in the affirmative. She indicated that generally they were probably better suited to working in a PBL environment than students from Western cultures, where PBL had originated. The HOS believed that there were nuances to the Hong Kong culture that supported and reinforced the learning process involved in PBL, particularly with respect to group work.

> I think there are some qualities about Asian students that make them ideally suited to PBL and better suited than Westerners. In particular, it is not just an issue of their being able to work in a group; it is also about responsibility to other members of your group and also support of other members of your group. I think that is something that is quite unique, well not unique, but it is quite characteristic of Asian students, and it is extremely congruent and helpful to PBL.

The HOS emphasized that the extent to which the BS students went in order to support each other arose from their cultural base.

> Their ability and propensity to engage in group work of this nature reflect part of the embedded cultural values and features of their social fabric. I don't think we could have anticipated their behaviour, particularly in terms of how much they support each other. The students just go beyond all original notions of PBL.

She illustrated with an example about the manner in which a typical group of BS students supported each other both in the learning process and with organization.

> One person gets the readings and will photocopy it for everyone else in the group. They also organise all the finances and administration for the group. When they have

to hand things in, if someone lives far away they email it to a colleague, the colleague hands it in. ... It is also in simple things, how they organise their learning in ways that have nothing to do with us – it's just these amazing systems that they organise to support each other and to make their learning more efficient, and that is something they do on their own. They are supported by the Department, but some of these things weren't initiated by us. Their notion of group work is just so completely consistent with my understanding of principles and values of PBL.

The HOD supported the assertions of the HOS about PBL being an appropriate educational environment for Hong Kong students. She stated that, "there was a natural tendency towards cooperative group behaviour and activities, which make them a natural fit to a PBL approach". She also stated that individual BD students were willing to collaborate on an equal basis and, with a supportive environment, were prepared to take responsibility for their own learning without relying on the academic staff to provide continual authoritative input. It is important to note that according to the HOD, BD students did generally become very actively engaged in the PBL process, particularly in years three and four.

The HOD was not as sure about Year 1 and Year 2 students' acceptance of PBL. She did believe that the program was very successful as students were able to cope with the PBL environment and performed well. However, as an afterthought, she added that if "you were to ask them what they thought of PBL, they would probably tell you they want lectures!" She explained by adding that many of them "sought factual information that could be more easily learned" without having to go through the PBL process, particularly in their early years of PBL. This point will be revisited again when data from the student interviews is reported.

The observations of HOD and HOS add support to the views of Stokes (2001) when, following her experiences in a PBL environment with Hong Kong students, she concluded that they were well suited to a PBL educational environment. However, the reported experiences of the HOD and HOS are in contrast to the findings of Walker et al. (1996), who concluded that Hong Kong students were not suited to a PBL environment. There were considerable differences in the PBL environment to which Walker et al experienced using PBL, which may have account for some differences. The students in Walker et al.'s study were part-time adult students with professional experience, the program was embedded within a full course and there

was little orientation to the PBL process for staff and students. In addition, Walker et al. were reporting their findings after one trial whereas both courses in this study have been in progress for 6 and 5 years each.

Comments by students reported later throughout this chapter support the notions of both the HOS and HOD that almost all students were clearly comfortable with learning and working in a PBL environment. Some comments from respondents indicating acceptance and comfort in a PBL environment included:

> In making comments and judgments during the tutorial discussions, I think usually about the whole group not the individual. I think maybe my group mates are quite good in fact. So usually the bad points we have made, we have discussed already ourselves, or the approach maybe not correct or something similar. Usually not done individually, individually is not good, so usually only about the performance of the whole group. ... Maybe there is some difference between Chinese and the Western people. Just we think it is not so good to tell direct to you/someone they are wrong, or you are not good in that point. {Year 2, BS, Male}

> I am very comfortable with the PBL method of communicating, questioning, challenging and speaking up when I have something to say. I can also feel confident at home, because I will try some approach similar to how I do the discussions occasionally with my family. My family are slowly trying this method themselves and they are now mostly comfortable with and accepting of the process. They think it is part of the modern world and we have to have the ability to function in it. I practice some intellect, some challenging, discussion and questioning of world related facts among my friends and they like this also. [Year 3, BS, Female}

> I like the PBL, for me I think there is great merit in having the critical thinking and the discussions to achieve something more than my friends in other faculties. I like to work in the tutorial sessions as they are very active and I can challenge my group mates. This is very different to Hong Kong culture, asking the tutors to speak on some things and answer my questions. This way is invigorating for me and more natural. {Year 4, BS, Male}

Only a small proportion indicated they were not comfortable. The group that were not comfortable with PBL in general, came predominantly from years 1 and 2 in the BD program. They highlighted two points; that of maturity or readiness for PBL and using English as the language of instruction.

I think being one in PBL in Hong Kong is quite difficult, more difficult than in other countries. First, because the university trains their students to learn as individuals. Second, as [my counterpart] said, many health science and BD students in other countries they already have a degree before they get into their courses or some experiences with other areas in the outside world, we often do not, come straight from secondary school. They have better ability to learn, and they are more mature. I say to the faculty, they should provide some time for us to advance to the real world. It is a very difficult step to advance us to PBL. It is a very different culture, different planet. {Year 2, BD, Female}

I have a bit of a problem with English and terms and technical terms [in particular]. Our expression is poor - we can't explain some things and sometimes we will not understand some things. When I am too scare[d], my group mates will help me. I know it doesn't all fit together sometimes and I miss out sometimes, but there is justice in this because in the PBL we are much free[er] and I am not so afraid to ask the tutor or my more experienced group mates. I have improvement. {Year 1, BD, Male}

These findings would appear to suggest that:

Proposition 1. Students from a Hong Kong, Confucian-Heritage Culture are well suited to a full PBL environment.

Resistance to Change

The HOD stated that there had been some resistance to change, however, as the change primarily had been the result of a recommendation arising from an external review by a professional association, there was general acceptance that it had occurred "whether people agreed with it or not." Furthermore, the Dean had made it clear to "dissenting academics that the change was not negotiable." She also mentioned PBL was now well established in the faculty culture with the exception of one staff member, who had agreed to being placed solely on research activities and no longer participated in the program.

In contrast, the BS was internally driven and a more democratic process for making decisions about adopting PBL was taken. The HOS explained that when introducing the notion of adopting PBL, the full-time staff had agreed to a 3-year trial period for PBL after which a vote would be taken on whether to continue it or not. At the end

of the period, the vote to continue with PBL was unanimous. The HOS felt that the approach encouraged inclusion for all academic staff in every aspect of the change process and curriculum development process, and that this aided greatly in its acceptance.

With regard to student acceptance, the HOS believed that there was some uncertainty and insecurity about the new style of learning amongst some of the students in their first year or two, similar to those concerns noted by Andrews and Jones (1996). However, as a facilitator she helped to alleviate those student anxieties. She stated that in her experience as a facilitator,

> I find this quite a lot with beginning students. It is a concern. They say, 'Oh, you know are we going deep enough?' or, 'Are we going broad enough?' And I guess my own standard response to the students is, 'That's my job as a tutor. It is to make sure you are covering the materials that you need to be covering in terms of both breadth and depth. And to some extent you have to have faith that your tutor is going to indicate if it is appropriate or if it isn't appropriate. And that's my job and if you are not hitting an issue in sufficient depth that's the faculty's staff's job to make sure you do.' Now I don't know to what extent every tutor in our program makes that explicit but I find that can put students a little bit more at ease, if that message comes across.

The HOS believed that by investing significant time and resources in a good student orientation program and "providing plenty of support during their early experiences" the students were better able to manage their learning and study demands. She also noted that as students gained more experience with self-directed learning their confidence levels rose. The HOD and some of the more experienced students in PBL supported this assertion. It will be discussed further under the PBL Outcomes section later in this chapter.

Resources

Attention to provision of physical and human resources was a feature of both programs and was highlighted by the Heads of both PBL courses. Both had received grants to establish and equip dedicated PBL rooms on their premises. These are a series of small rooms with seating for up to 10 students around a single table in each. Internet access was available in every room via a permanent computer attached to a

printer. There were also electronic whiteboards provided in each room so that students could make printouts of any notes they made on the boards during their tutorials. Photocopying facilities are located where they are readily accessible from all tutorial rooms. Students from both courses had ready access to a library, which was well stocked with appropriate and current literature. The HOD noted that students made good use of the library and had access to other libraries as well.

> The library is fantastic. It is stacked with books and with journals. Sometimes they [students] go to the [cognate faculty] library, but not very often, most of it is here. Students make a lot of use of the library, and the librarians are very helpful and aware of students needs for PBL.

Methods of provision of readings differed in both courses. The BD students were expected to source their own readings for the full duration of the course. These were to be found using the recommended list provided in the student guides. In the BS course, students were provided with copies of readings for their first year and were then gradually introduced into sourcing some of their own during the second year. During their final two years, they were expected to source their own without any guidance. The HOS explained that when the courses first started all students were expected to source their own readings for the full course. The result was that during the second tutorial, when students are required to engage in peer teaching and discussion, students tended to deliver a series of mini-lectures and there was little discussion. The BS academic staff attributed the lack of discussion to individual students having only learned the content of the topic they had researched. Therefore, their capacity to engage in meaningful discussion was very limited. Although developing research skills is identified as one of the priority skills that students on a PBL course develop, the BS staff decided to trial providing similar readings to all students in the initial stages of the course in order to promote discussion. The HOS claimed the strategy worked and it is now clear that students are able to engage in meaningful discussions and develop critical analysis skills. Over their last two years BS students develop their research skills by independently seeking and evaluating the sources of information to address their allocated learning issues and contribute to solving complex problems.

Academic staffing arrangements were similar in both courses, but participation roles differed. The HOS explained that all academic staff were engaged in the PBL course development, problem design and facilitating tutorials. These included all their full-time staff, part-time staff from a pool of professionals in the field, who had graduated from the course before it changed to PBL, and external academic staff who were engaged on an occasional basis from other cognate faculties for providing different areas of specialist knowledge. The BD program had most but not all of their academic staff involved in the course development. There were occasional lecturers used from a similar cognate faculty that also used PBL. Recently they had developed a pool of part-time staff from practicing professionals, similarly to BS, and engaged them on a rotational basis. The staff-student ratios for PBL tutorials were similar for both courses.

With regard to operations, both programs had a full-time executive officer whose sole role was to oversee all administrative matters involved with the programs. Each executive officer had access to clerical support and had been in their positions since the inception of the programs. Students freely accessed the administrators and were able to use any available facilities for out-of-class meetings and discussions.

Student Orientation to PBL

In both PBL courses, students are prepared for their new learning environments with structured orientation programs, which take place at the commencement of their first semester. Both are similar in that they expose students to the PBL process and to what is expected of them as participants. However, there are differences in their nature and the time allocated to each orientation program.

According to HOD, in the BD orientation program students are introduced to PBL using a lecture format. Students are free to ask questions and engage in any discussions that may arise as a result of those questions. A panel of staff and volunteer students are used in these sessions to describe examples of how a PBL session is conducted. In addition, a comprehensive student guide is provided to beginning students during the orientation session. This guide had been developed at the behest of the senior students to fill an identified need and had been available for

the last two years only. It provides a background to PBL and a detailed description of what students are supposed to do in PBL and their tutorials. The BD student guide also contains the course objectives for the full degree and a list of general learning goals for each semester, along with a general list of recommended readings for the year. Details of assessments, timelines for submission of assignments and dates for examinations are also covered in the guides. The HOD explained that students were coached through their first few PBL sessions where facilitators would take time to guide students and give immediate feedback about their efforts to clarify what was expected of them.

The PBL orientation program for students in the BS is much more comprehensive and lasts a week. It immerses students in the PBL environment with a 'hands on' introduction to the instructional format and process. Students in the BS observe a PBL session and then experience a practice session themselves to help their adjustment to a very different learning environment. The HOS believed allocating a substantial block of time to orientation was particularly important for staging a successful PBL program. She also commented that, as the students were new to university learning environments, "they thought that this is the way of university education and were quite accepting of it [PBL]." Students are also introduced to their facilitators during the orientation week. In an interview, the HOS stated that:

> We actually have a full week of orientation to PBL and it covers a range of things.
> One is a talk – 'What is PBL, what does it involve?' Students also do a mock video
> problem with their 'to be' tutor [facilitator], so that the actual tutor that they are going
> to be working with throughout the year works with them. Although it is not a full
> problem, it doesn't take the full week bit it is a kind of accelerated problem.

The BS students also receive a course guide (also given to all facilitators) and afterwards they take responsibility for finding answers to any queries they may have. The HOS explained:

> The student guide actually has quite a lot of information about the field, the process of
> PBL, the goals, deadlines for tutors, deadlines for students, assessments and so on.
> That is, the information is common to all. It is my perspective that they have had that
> information given to them - it's freely available - but if students feel that they are not
> sure, then maybe that isn't my responsibility to make sure they go and look it up.

Both HOD and HOS indicated their orientation programs adequately prepared students for their PBL courses, although both mentioned they had been refined over a period of time. It is clear that BS generally provides a more comprehensive program and models a student-centered learning approach of PBL with students fully engaged in the training process. When compared to BS, the BD orientation really is presented in a much more traditional format. In both instances, students are familiarised with the PBL process, which should enable them to be confident with the new learning and teaching context, its academic requirements and the expected outcomes attributed to the PBL curriculum. The orientation programs of both courses supports the recommendations by Creedy and Hand (1994) and Walker et al. (1996) that students be well prepared for a very different learning environment. It enables students from a very traditional culture to realize that active participation, challenging others' opinions, questioning the concepts put forward and engaging in critical debate is not only acceptable, but a necessary requisite for learning. The more comprehensive program offered by BS when compared to BD has consequences for students early experiences in PBL and accounts for differences in students' perceptions of PBL. This will be discussed more fully later in the PBL Process section of this chapter.

Professional Development for Academic Staff

Although both PBL courses provide professional development for their academic staff, there are considerable differences in their nature and extent. The BS professional development program is permanently built into their system with all new facilitators entering the program receiving similar orientation and training since inception of the BS course. The HOS described how all the new staff received a two-day orientation and training program. The program involves familiarisation with the PBL process through discussion about the theoretical underpinnings of PBL and by observing expert facilitators conducting actual PBL sessions with students. The new staff are also instructed in techniques of facilitation before facilitating a PBL session and receiving feedback from experienced PBL facilitators about their performance.

In addition, BS staff members are required to regularly engage in ongoing continuing professional development (CPD) activities. These involve in-service workshops

twice per semester and two peer observations of PBL facilitation per year. The workshops are about current research and developments in PBL, usually lasting about two hours and form what HOS termed 'Advanced Tutor Training Program'. These workshops often included visiting experts and sharing sessions of experiences by in-house facilitators. In the first semester, peer observation is undertaken in a collegial manner with another member of staff providing feedback about a previously agreed set of issues. These areas are quite open-ended. Follow-up discussions are held between the two colleagues. In the second semester two senior members of senior staff observe all the tutors with a focus on particular criteria about which the staff being observed are aware. Discussions also follow these observations, with the facilitator's strengths and weaknesses being identified and any support required for improvement subsequently provided.

Initially the BD introductory training program was more ad hoc. There were seminars conducted by academics from a similar cognate faculty that had previously switched to a PBL format for part of its course. These were usually half-day sessions with discussions about PBL as a process. According to the HOD, most of the academic staff involved in facilitating had attended some type of training program. The academic staff involved with PBL in BD came from three sources. Most were from their own full-time staff, others were on an occasional basis from a similar cognate faculty that also used PBL, and more recently some came from a pool of practicing professionals in the discipline. According to the HOS, those who came from the cognate faculty were assumed to have undertaken training in facilitation while the practicing professionals underwent an intensive two-day training program. This program for the practicing professionals had been in operation for the last two years only. There had been little in the way of continuing professional development (CPD) with only two sessions over the previous five years, which the HOD described as master classes and were conducted by a visiting expert.

The recently developed two-day BD training program was carefully structured to immerse participants in the PBL process so they would experience it both as students solving a problem and as facilitators of students solving a problem. The steps used in the training program were determined by the HOD. First, participants were shown a video of a PBL session and discussions were held about the theoretical and philosophical underpinnings of PBL as well as the learning process and outcomes.

Second, participants were given a problem to solve for themselves, where they went through the processes involved in T1. The workshop presenters acted as facilitators modeling appropriate facilitation methods. A feedback and discussion session was then held. Third, the participants then facilitated groups of volunteer students as they went through the same process. Fourth, the participants spent the evening researching their learning issues for their problem, as did their students researching theirs. Fifth, the participants met the next day for T2 with the workshop presenters modeling different processes used for facilitating T2. Sixth, the participants then facilitated groups of students for T2. Seventh, and last, two feedback and discussion sessions were held, one with all participants and students, and another with the workshop presenters. This approach is somewhat similar to that reported by Creedy and Hand (1994), who used a PBL approach for introducing PBL to nurse educators, thus enabling the participants to experience the unique process first hand.

In-house quantitative research had been conducted on the effectiveness of this training program over a period of the last two years. The HOD stated that the results had shown a positive statistically significant difference for student evaluations of facilitator performance for those who had completed the training program when compared with those who had not, regardless of their previous PBL facilitation experience. The details of this study have not been published and its full details were not provided for reasons of confidentiality. It should be noted that these findings support those of Creedy and Hand (1994) who found initial training using a PBL approach improved facilitator performance. They stated that:

> On completion of the programme, varying degrees of change in existing instructional practices were evident. This change was found to result from engaging educators in reflection about practice, providing opportunities to implement the new [PBL] approaches on a trial basis, and providing feedback and support through the change process (p. 696).

These findings would appear to suggest that:
Proposition 2. A comprehensive training program for PBL facilitators increases their effectiveness.

Originally, the differences between the BS and BD in staff orientation programs were considerable. However, the recently implemented initial training program for part-time academic staff in BD has contributed somewhat to alleviating those differences. For academic staff in the BS, there is intensive and ongoing support, as well as monitoring of performance in a collegial manner. Relying on occasional staff provided by another faculty does present problematic issues for BD that become apparent when students' perceptions about their facilitators are examined later in this chapter. The HOD acknowledged using occasional staff from another Faculty had caused problems of quality and commitment. She stated that:

> Half the time they don't come to the briefing. They certainly aren't coming to the briefing I'm going to do this afternoon, which is start of the module. You might be lucky if one of them comes. They don't know really what to do and it's very different from their approach to PBL. Some of them react by just saying nothing and others tell me of not the nice experiences I think. But we know it's a problem, we know and it is very hard. I tried to address it by writing to their Head of department and by sending the results of the students' evaluation of the facilitators. It shows so clearly they are not up to standard. If these were my staff, I would say 'Hey come on, we have to do something about this!'

The HOD was clearly frustrated by the situation and was limited in steps available to her for managing the situation. She added that:

> … we could drop them and put our own people in, but we don't get resourced for that. So we just share them out among the years, make sure they don't get the same person [occasional lecturer] each time. But it's not always turning out because we don't always get the same people but we try to make sure they [students] only get them once.

Curriculum Design

When developing the BS, PBL curriculum the HOS claimed a "full PBL model" was adopted, which followed principles and procedures similar to those initially described by Barrows and Tamblyn (1980). It is, therefore, similar to the original PBL model developed used at McMaster University. The BS curriculum is designed so real-life problems are always the starting point for the instructional process. There are no separate subjects and the curriculum is organised around problems, which

become more complex as students progress through the full BS course. New knowledge is learned in a small group arrangement (6-8 students) with discussions conducted under guidance from a facilitator ensuring students learn in a self-directed manner. The BS timetable is arranged with two or more tutorial sessions conducted over a one or two week period, depending on the length and nature of the problem. Any skills sessions are always related to the topic being addressed by a problem and are learned in relation to that problem. Allowance is made in the timetabling for a resource session per problem where students can request an expert in a topic area to be available to answer their questions. The type of PBL used in the BS curriculum therefore fits Barrows' (1986) typology: that is, it is a problem-based and reiterative model, or closed-loop PBL.

The BD curriculum is also considered to be a full PBL model by HOD, although they had originally followed a hybrid model used by Harvard Medical School. In describing the evolution of PBL in her Faculty, the HOD stated that their model had "migrated from Medicine" but the PBL component has now been extended replacing all lectures. The current BD curriculum design closely resembles that of BS in its operational structure. However, the BD has more associated practical skills laboratory sessions because of the nature of its discipline. In BD laboratory sessions, students work on a complete case for study and research to develop related psychomotor skills. In both programs, it is the PBL process that is pivotal in students' learning of new content knowledge and for processing it. Both curricula were designed to provide that unique environment.

In both PBL courses, the curriculum documents contain a series of problems for each semester. These are arranged in a thematic, or systems, structure so that similar concepts are linked to form the whole discipline area. In the BS documents, there is a covering page consisting of a matrix containing a column listing all topics for each semester and a row for every problem. The matrix boxes are checked when a topic is addressed in a particular problem, which provides a very accessible overview of the content of the course. A set of outcome objectives are listed for the end of each semester so that the level of anticipated student development in terms of professional expectations is readily ascertained. The documents for BD were not viewed. The HOD explained that they were regarded as intellectual property and were not

available for public viewing. She did state that there were documents that listed the problems and contained broad objectives and assessment guidelines.

With regard to the provision of outcome objectives in BS curriculum, the HOS explained that the students do receive objectives but they are very general for each semester and not at specific problem level. It is more likely that the students used the problems and associated readings to determine the learning outcomes. The HOS explained that:

> For any given problem they are working on students are not provided with objectives to that problem. We do have set readings, however, they are not given the readings or told what the readings are until they have gone through the process of identifying their own learning issues for that problem.

The HOS also explained how students could also be unaware or oblivious of the existence of course objectives, despite having been provided with them in the student guides that are handed out at the beginning of the academic year. According to the HOS, she sensed that the objectives are used mainly as an administrative guide and as a checklist, a notion that supports the findings of Abrandt Dahlgren (2000) in her study about the impact of provision of course outcome objectives. In the BS program, the facilitators use the courses outcome objectives to review learning in conjunction with the actual learning outcomes. The HOS also explained how the objectives are integral parts of the curriculum as they guide problem design and student learning processes.

In BD course objectives are provided in a student guide at the beginning of a semester. The HOD did not know whether students used these objectives to help with their learning. However, she believed the objectives provided a useful guide for their curriculum design and as a guide for developing assessment items. These comments indicate that the overarching use of the curriculum as guide is similar for both programs, however, the BS documents are more detailed and are freely available.

Problem Design

Both PBL courses followed similar procedures when designing problems. In BD, a single specialist person in the subject area, termed the lead facilitator by the HOD, is responsible for designing a problem that deals with relevant knowledge and its application in line with the broad course objectives. Any problem is designed well in advance and passed on to a committee of colleagues, titled the PBL Task Group, for review and comments if required. Their deliberations are then passed back to the lead facilitator. Prior to presenting a problem to students, all of the facilitators involved meet to discuss the problem and the learning issues at which students are expected to arrive. Consensus about acceptable solutions to the problem is also reached. Immediately following completion of T2, all facilitators meet again to discuss the effectiveness of the problem with regard to stimulating students learning of the desired knowledge, and for promoting the learning process required at an appropriate level of reasoning and thinking expected of a professional at that stage of their education. Any recommended changes are reported to the lead facilitator to address before being passed on to the PBL Task Group for final review. The PBL Executive Officer files any suggested changes for use the following year.

In the BS there are only slight variations to that of the BD with the problem design process. In BS there is no single sub-group responsible for over-viewing the problems. Instead, all the facilitators review the problem as a group before it presented to the students and meet again afterwards for another review. The person responsible in the BS for writing and adjusting the problems is titled the case master. The responsibility as case master is rotated according to the area of specialist knowledge.

Assessment and Evaluation

Assessment and evaluation are integrated into the student learning process and ongoing curriculum review areas of the PBL environment in both courses. However, there are marked differences in their extent and application. Both Heads stated that their courses used end-of-semester written exams to assess student learning of the material covered in PBL tutorials. They also stated that the nature of the assessment

items is aligned with the student learning experiences and course objectives. The HOD did not provide many other details about their exam except to say it was the only piece of assessment that graded student learning from the PBL process. Student effort and contribution in the PBL tutorials was assessed on a pass/fail basis. There were other assessment items in BD directly linked to the laboratory sessions that were also graded.

The BS course used other methods for summative and formative assessment and provided more feedback opportunities for students than did the BD program. The HOS referred to this as process evaluation. She stated that,

> We do give them evaluation on all these so-called process evaluations that we do. We do that twice a semester, so mid-semester it is formative and at the end of semester it is summative. And in that process evaluation they are rated on three things. One is the reading forms, the second is their reflective journals and the third is their behaviour in the tutorial group and all three of those for statements or dimensions relating to critical thinking, and so forth.

The HOS also explained that when devising the assessment scheme they were cognizant of the collegial nature of a PBL environment for students and grading is developed so students can get a feel for their individual standard without having to be competitive.

> All of the grading scales are four point – they are sort of like satisfactory and satisfactory plus, or exceptional or something like that. For students to get, I mean not very many students get an exceptional, but when they do it's just incredibly satisfying to them. That being said within our overall assessment scheme for the whole curriculum process is on a pass/ fail basis, so they don't receive a grade for that. So you could say that that would be a de-motivator in terms of personal achievement. But I've not found that to be the case. I mean I think that our students are somewhat competitive. I don't like to use the word competitive because it has negative connotations, but I think that within a group, within any given group there is some healthy competition that keeps the students incredibly motivated and working extremely hard. I would say it is more a sense of responsibility to the group and commitment to the group is a strong sense that really is like a weight on their shoulders. That is, their own contribution contributes to the greater good of the group. And so they don't want to let the group down, you know.

In BS, the exam has evolved from its original format. The assessment items reflect the PBL learning process with problems presented in the same form as a PBL tutorial with students expected to follow the same process in solving them, except they now act as individuals. The original format was innovative with an open-book exam and students were able to access the library during the exam to search for resources. The HOS explained:

> We call it a PBL exam, so it's sort of a PBL model and that has also changed over the years. The first year we did an open book exam and the students hated it. We got the worst feedback on that than we've ever had on anything so we have modified it now and it's closed book. It is a three-hour exam; the students go in, they are given a problem then they have to generate learning issues, and then they have to choose two of those learning issues and explore them in depth and then write about them. But it is not an open book to my deep regret.

It has now changed to closed book as a consequence of student feedback. The students thought it was too easy for some to cheat and were stressed by the nature of the unstructured exam format. With respect to the exams, the HOS commented that:

> The students objected to open-book as they thought that people could be cutting and pasting; we allowed them to bring their computers/ laptops in if they wanted to. So they thought people could be cutting and pasting, that was one problem. We also had them going up to the library. That was 'zooy', in terms of competition for resources, although we tried to control that and get some systems for that. My own views are that life is an open book, so I like to have exams that are like that, but I don't think they felt as if was tapping their individual knowledge.

The BS course also had written assignments, which are more like traditional essays. They have several weeks to complete the assignments before submission and are allowed to use whatever resources they want. The HOS felt this arrangement compensated for the closed book exam being different to the PBL tutorial learning environment.

> So now we have both forms. We are quite keen to maintain those to have both sorts of summative assessment; something where you are in a room for a finite period of time as well as something where you have a longer period of time, that involves more written work.

The assessment regimen in BS, and to a lesser extent in BD, was aligned to the learning process, as advocated by Tang and Biggs (1996). Both courses had processes in place for evaluation as recommended by Boud and Feletti (1999) and Margetson (1995).

Evaluation in BS was of a holistic nature. There was formal student evaluation of facilitator performance conducted at the end of each semester, course evaluation by an external professional body once every three years and ongoing feedback about problem quality at the end of each problem. Students and facilitators had input into this feedback. There were no formal procedures for student evaluation of the course although the HOS explained that the reflective journals provided valuable insights into actual and potential problems. These insights were acted upon if believed necessary. She believed their system worked well. In reference to the student evaluation of facilitators' performance, she found them to be:

> Extremely valuable I would say. We have a rating scale of skills form and then open ended comments and usually I find the open-ended comments more valuable than the rating scale. I have had the opportunity to look at facilitators across year groups for several years. And they are high, they're pretty high, but if they are uniformly high then they just don't tell you a whole lot. Every now and then you find one tutor, you know in one year's group with lower ratings and that of course is of some concern. Interestingly we don't release that individual information to anyone but now since I'm Head of Department I see the names and not things I would necessarily have predicted, you know. But the qualitative comments that we get are personal and we find it extremely valuable. Sometimes it's confusing. You might get out of eight students one saying you talk too much and a second one saying you talk too seldom; we can't figure it out. But overall I find it very valuable. And I find the students to be amazingly honest – that's my own feeling.

The HOS also explained that the information was used tactfully to inform facilitators on how to improve their performance. She also stated that the one external evaluation of their course from their professional accreditation association in the United Kingdom was very positive.

In the BD course, there were similar formal evaluation procedures that differed slightly in practice. There were student evaluations of lecturer performance, which

were conducted at the end of each module (3 or 4 problems) – every 6 to 8 weeks. There were also regular feedback sessions by facilitators about problems at the end of each module. However, the HOD stated that attendance by lecturers from the cognate faculty at these feedback sessions was rare. Students had no input into these sessions, unlike the BS. In addition, there were meetings twice a semester with student representatives from each tutorial group and the HOD with discussions held about general issues relating to the course. This is a more formal arrangement than is the case in the BS course. The BD course had also been reviewed by a professional body from the United Kingdom and minor changes had been adopted as a result of recommendations made. The HOD did not provide details of those changes.

Summary Comments

Table 4.1 provides a summary of the similarities and differences between the environments for both courses. Generally, there are far more similarities than differences, which is to be expected as they are both full PBL courses. The main differences are in student orientation, professional development for academic staff, feedback opportunities for students to support their learning development and alignment of assessment to the learning experiences. The BS program paid much greater attention to these areas. Students' comments reported later in this chapter show that has clearly impacted on students' relative satisfaction with the two courses, and their development as they progress through their respective programs.

The PBL Process

At the time of this study, both the BD and BS courses had evolved to a stage that followed the framework of the original model for the PBL process as published by Barrows and Tamblyn (1980). The researcher established this by watching two videos provided by the HKCPBL that showed all the steps followed in both T1 and T2 with two first-year groups from both courses. By following those key steps of a PBL process, both courses can therefore be considered full PBL. Both courses easily satisfy criteria outlined by Ross (1999). Those criteria are that full PBL courses are neither problem-solving learning nor lecturer-guided, algorithmic approaches to problem solving. In addition, both BS and BD courses have captured the true spirit of

PBL as an educational paradigm detailed by Margetson (1998), and its principles of process and learning activities, as outlined by Schmidt (1993).

Table 4.1 Comparison of the PBL Environments in BD and BS

PBL Environment	PBL Course	
	BD	**BS**
Academic Leadership	Small group of senior academics.	Small group of senior academics.
Rationale for Adopting PBL	Recommended by an external review.	Internally motivated by a group of academic staff.
Hong Kong Chinese Culture	Well suited to a PBL environment.	Well suited to a PBL environment.
Resistance to Change	Some initially. Now accepted by all but one staff member. Students mostly accepting of PBL	Little initially. Staff unanimously voted to continue with PBL after a 3-year trial. Students very receptive to PBL
Resources	Very well equipped library and tutorial rooms. Staffed with full-time, part-time and occasional cognate-faculty academics	Very well equipped library and tutorial rooms. Staffed with full-time, part-time and occasional cognate-faculty academics
Student Orientation	Half-day program. Lecture plus panel discussion format. Supported by explanatory booklet.	One-week program. Guided but student-centred, immersion experience with feedback for students.
Professional Development	Initially minimal. For the last two years there is a compulsory 2-day, training program for part-time staff. No training for occasional staff from cognate faculty. Little CPD.	Extensive. Initial training of all staff involved. Systematic CPD.
Curriculum Design	Full PBL model with associated skills and simulation laboratory sessions.	Full PBL model with associated skills laboratory sessions.
Problem Design	Designed by topic specialist (lead facilitator). Reviewed by committee before facilitator briefing meeting	Designed by topic specialist (case master). Reviewed by all staff at facilitator briefing meeting.
Assessment	Written exam. PBL sessions are pass/fail	Written exam. Written assignment. PBL sessions are graded but in effect are pass/fail.
Evaluation	Formal student evaluation of facilitator performance at end of each 6 or 8 week module. Formal meetings between student representatives and HOD twice per semester. Only one external course evaluation.	Formal student evaluation of facilitator performance at end of each semester. Informal, ongoing student evaluation of course. External course evaluation every three years.

The PBL Tutorial

There are some differences between the BS and BD tutorials in the steps they follow but generally they follow the same overall sequence as outlined by Barrows and Tamblyn (1980). In BD, the process is for a small group of six to eight students led by a facilitator to be presented with a problem. One of the students will read out the problem and any words or terms they do not understand are clarified using their own knowledge or reference books, usually a dictionary of terms in their discipline. If necessary, as a last resort, the facilitator will provide information. The HOD explained the initial process of T1:

> In T1, they are led by facilitators and, as you know, we will give them a problem statement, straight off cold. We have somebody to read it to make sure they can pronounce the words if there are strange words in it. It may be technical or ever general words. They slip over words like solicitor and strange words you wouldn't expect them not to know.

Another student then assumes the role of clerk who makes notes on the whiteboard and also tends to oversee the running of the tutorial session with occasional support from the facilitator. The group then analyses the problem statement, first listing all of the facts. They are then required to brainstorm ideas about the problem taking into account the facts they have listed. Discussions take place at this stage about what they know in relation to the problem and identify gaps in their knowledge, which become the list of learning issues to be shared amongst the group for further research. Students then leave to conduct their research and return for peer teaching and discussion during T2, which is usually held two or three days later. The steps followed by BD students in T1, were described in detail by the HOD.

> They have already decided who will be the clerk. The clerk then just gets up and the board is ready to go with facts, ideas and learning issues. The clerk usually tends to lead from the white board to get them to generate ideas by extrapolating the facts. Then we just ask them to brainstorm and say what ideas come into their heads about the problem – not necessarily solving the problem because not all of them are problems that actually have to be solved.

The HOD elaborated on the nature of some of student and facilitator activity during T1 and the differences that can occur between expectations due to the increasing complexity of problems with year levels.

> And so ideas will be put forward, but the facilitators and the students themselves are supposed to ask why, so that the ideas are supported. A discussion then takes place to try to flesh out their current knowledge base about that idea, and then, if that is actually a learning issue the facilitator is obviously pushing it a bit harder to find the point where they don't know enough, when it can go up as a learning issue. [This is] particularly the case with senior years who have already done quite a few things and a lot of it is familiar but we want to take them to a different aspect of the subject for instance. Some good groups of students will do it themselves while others need more active facilitation.

It should be noted that she may be alluding to possible facilitator domination of group discussion when she was describing some facilitators' approach. She stated that some tutorials "can be quite intensively facilitator driven to get out what you want to get out of that. And I cool them [facilitators] down a bit."

This point is raised by students in BD and will be addressed further when discussing facilitation as part of the PBL process. The HOD had little to say about their T2 other than "the onus is on students to provide information in peer teaching and to engage in discussion. Facilitators should only play a guiding role here." She also mentioned that no time was normally set aside for feedback sessions for students, however, in their early stages of PBL some informal feedback should be provided during T1 and T2. This was the case with the video sample viewed by the researcher. However, BD students who were informants for this study were very critical about the lack of meaningful feedback from most facilitators.

There are a number of small differences in the tutorial process for both BD and BS, some of which were found by this study to impact a great deal on the student outcomes in terms of activity and learning processes. First, in BS one of the students also acts as a chairperson for the problem. This duty is rotated after each problem. In BD, it is less formal with the clerk and facilitator taking on this role. The BS students, therefore, get leadership experience in facilitating meetings. In BD, the clerk is too busy writing and trying to engage in the learning process to play a

significant role in leadership. Second, in BS the facts and ideas in T1 are discussed simultaneously to develop hypotheses for acceptance or rejection. This did not seem to make any difference in the discussions or learning. Third, the time for formative feedback is built into the end of each session for BS students. Fourth, readings are provided for the BS and reading sheets have to be completed and handed to facilitators at the beginning T2 for both first and second year students. Reading sheets are guides for students to summarise the readings, write down their thoughts about how the information relates to the learning issues and to list any questions they wish to raise. The HOS explained how the reading sheets were used as a way to ensure students studied the set readings and critically reflected upon their content. In effect, they are used to ensure that students arrive at T2 better prepared for discussion. The HOS explained:

> They have these assigned readings and after they do those readings they have to complete a reading form. It is submitted to the tutor, and comments are given on it and it's returned back to the students. It has three parts. The first part is a summary of the reading, which we try to encourage them to keep short but tends to be very long. One page is usually required but two or more is usual. The second part is that they have to explain how the reading related to the learning issues of the problem and that's the toughest and the most important part of the reading form. And the third part, which I also think is important, is they can raise any questions that they had about the reading. Sometimes these are quite mundane questions, 'I didn't understand this wording in line 42', and sometimes it is questions that people in our field have been struggling with for the last 30 years. I guess one of the purposes of having the reading forms is so that when students come to the second tutorial they can actually have a discussion. Rather than kind of going through the readings, you can safely assume that everyone has done the readings, thought about the readings, thought about how the reading relates to the problem and the learning issues. This allows us to get on with the most of the essential and meaningful parts of the discussion.

The BS students' comments supported the use of reading sheets, as they believed they felt more confident about having the necessary background information to better engage in the discussions. Their reaction was common from students in both Years 1 and 2. It was also supported by the senior students who had experienced their use prior to conducting their research and by the BS focus group. Some typical comments were:

Resources are really important. It is good to get some guidance, like a reference list every now and again. We also have the reading forms. This is very good as it gives us some guidance on how to find some things we need to answer the problems. {Year 3, BS, Male}

I think both staff and students like the reading forms and star authors. Star authors, that is if they are renowned professionals in the field and what they reckoned is popular. But of course we like, we also search for alternative textbooks or resources. It's always easy to start with some popular textbooks and use some skills we have learned from the reading forms. It has helped my learning. {Year 3, BS, Female}

We had some written forms in Years 1 and 2. We choose two references in each form and then write something on it and give to the tutor. I don't know why we should write this written form at first and I think it is not really useful. Now I can think it was useful when we were in year three. {Year 4, BS Focus Group, Female}

These findings would appear to suggest that:

Proposition 3. Provision of reading sheets focuses learning, assists students in their preparation for tutorials and promotes discussion.

Both informal and formal feedback sessions were greatly appreciated by BS students and they saw these as a necessary and integral part of their learning. The informal sessions consisted of peer evaluation for each student as well as input from the facilitator. In the video viewed by the researcher, this part of the PBL tutorial was conducted in a very constructive and collegial manner. The formal sessions were conducted twice a semester (mid and end) using written comments and a one-to-one session with the group facilitator. Students tended to value the informal oral sessions more than the formal written evaluation, although it was also well regarded. This is an area in which there was a clear difference in students in both courses as BD students felt it was a big weakness in their course.

Feedback from the facilitator was perceived by all BS students, from year one through four, as a significant element in their PBL. Formal evaluation was regarded

as an essential part of the process that facilitators used to guide student learning. All the BS students who were interviewed perceived the provision of feedback from the facilitators assisted them in their learning, not only of content materials but also as motivating them to have the confidence to learn in a process-oriented, PBL environment. A typical comment about the formal evaluation was:

> I think formal feedback from the tutor is also important. We have two evaluations from tutors, one in the middle of the semester, and one in the end. Usually in the middle one the tutor will tell you that, 'I think you can do better in the session', and then I knew that I can find out, ' Oh, OK, he expected me to do better - so in the coming sessions I will really do better'. So maybe it for me to encourage myself that's important and I will remember that there's something given by the tutor in my mind. Then in every session, for example, we have [been] asked to be the chairperson, I will try to do better and try my best to facilitate this discussion. {BS, Year 1, Male}

Students from BS did, however, prefer the more frequent informal feedback as it enabled them to respond more rapidly to addressing their weaknesses. For example:

> At the end of each session we spend ten minutes when each of us will talk about our own performance, the others' performance, about the whole session, about the readings that we got, about for everything, or maybe about the tutor too. And then the tutor gives us the feedback. Sometimes we get valuable feedback from the tutor. Yes, some tutors give us feedback on how we performed, but they usually won't tell about the difference of the whole group, because we've got to evaluate individually picking out points for further scrutiny and self-evaluation. {BS, Year 2, Female}

> ... the knowledge of the facilitator is important in your having guidance and for your own self-evaluation as well as that from the other students. {BS, Year 1, Female}

Use of formal evaluation forms on the other hand, were not regarded as being as helpful as the peer and facilitator evaluations carried out at the end of the tutorial sessions. Students felt that the forms were restrictive and did not allow them full expression.

> Evaluation forms are useful enough - quite helpful - but not very suitable. Because we just have certain box for the tutors, one category for average and then satisfactory. There are other comments I would like to make but I am not sure whether I should {BS, Year 1, Male}

I prefer having more frequent evaluations, because you won't really know your progress. When the tutors fill in the evaluation forms and that's after a long period of time so they may not be able to remember well the performance of that particular member.{BS, Year 2, Female}

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}

The BS focus group comments supported the notion that regular and thorough evaluation of learning along with the group and individual performances supported the students' learning. A comment that drew unanimous agreement from the six members was:

I like the tutors to tell me where I should improve. There are sometimes when you can't realise yourself, your weaknesses, and you need someone to tell you. I especially like tutors to tell me - maybe during the evaluation or perhaps writing the comments in the journals and so telling me where I need to improve in some areas. {Year 4, BS, Female}

Another comment followed:

Good facilitators know how they are able to evaluate the different students' performance and how good the quality is. Good facilitators also frequently let [the students] know what they are lacking and also what they are doing the best. {Year 3, BS , Female}

In contrast, the BD students felt quite insecure about what they were required to learn and whether they were "ever on the right track" as one student commented. There was a feeling of resentment amongst some students that they did not receive more guidance, particularly in their earlier years of PBL. Three typical comments were:

I've had no guidance at all. It is very frustrating, I don't know whether we are doing it right or not or even if we are learning the right things. {Year 1, BD, Male}

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

More guidance from our facilitators would help us a lot. {Year 2, BD, Female}

These comments confirm Engle's (1999) view that students need feedback to evaluate their performance and develop their learning processes. Given the positive and unanimous support for ongoing informal feedback by BS respondents and the highlighting of a lack of this feedback in the BD PBL process by the majority of BD respondents, there would seem to be a need for this to be included in PBL tutorials.

These findings would appear to suggest that:

Proposition 4. All PBL sessions should be structured to allow adequate time for informal feedback sessions on student developmental performance.

The Problem

Students from both courses generally perceived the problems as being an important part of the PBL process across all years and they were frequently mentioned during the interviews. Student responses in the interviews and focus groups demonstrated they had a deep understanding of the role of a problem in the learning process. This was particularly the case with BS students in the focus group and their depth of understanding can probably be linked to the BS students' ongoing engagement in contributing to the evaluation of the problems in their PBL curriculum programs.

The group has to be actively in the discussion. Through the discussion I think new ideas have to be created and also sometimes new learning issues. The problem has to expose these aspects. This is very important. The problem starts the process and provides us with some ideas about associated learning issues in our discussions. {Year 4, BD, Female}

Respondents from both courses highlighted the need for a balance between complexity and simplicity when problems are designed. They believed that the problem needed to be complex enough to stimulate interest and learning, without requiring excessive time and work overloading individual research. They also indicated that a well-designed problem contains enough information to promote interest and discussion while challenging participants to deduce learning issues. They also alluded to the need for the problem to be grounded in the prior knowledge base, thereby helping to motivate students' learning.

Some examples were:

> I think a problem should be drafted very carefully so that it can draw out some issues, but not so obvious. I mean for example, if it is about a patient who has brain damage it, it should throw back to the relevant learning issues. {Year 3, BD, Female}

> If the problem gives too much detail the interest will be lost. And probably if too complex will just do the same; interest will be lost if we just have difficulty searching for information. {Year 2, BS, Female}

> The problem should not give too much detail on everything, so it simulates our interest. The problem needs to leave some gaps for us to fill in – what I mean is gaps in the content or knowledge we need to acquire to be able to fill those gaps after the two sessions of the discussion, and after consideration of the formal [evaluation of the problem]. {Year 4, BS Focus Group, Female}

> If the topic [of the problem] is worth debate everyone will say lots of things and the section will be more interesting and beneficial. If the topic is quite straight forward, or like each one is giving a lecture on the topic she or he is responsible for, then it would be boring. I think most of us will prefer to study ourselves, that's true to use the PBL. Otherwise, it is just like a lecture. {Year 4, BS, Male}

> I think the problem statements should encourage brainstorming. It is not just fooling about with some fact that we don't know. For example, we are the BD students and so many basic science things we may not come across, and in the session we are discussing those we don't know. It is difficult to discuss those things we do not know and it will loose my interest in that field. But with some problems we know a little bit about that and we can in a logical way, think about that, and deeper, which is quite interesting how we will learn it. {Year 2, BD, Male}

Outcomes of working through the problems depend on the problem itself. When problems are clearly constructed, we know what the learning issues are and we discover something we don't know and then we try to learn it. {Year 3, BD Focus Group, Female}

It was clear that students, particularly in their first two years, believed sufficient background knowledge was required for them to be able to engage in meaningful learning. Too little background knowledge would result in superficial learning and de-motivation. Some comments were:

Background knowledge is an influencing factor and our background will influence how we see the problem and it will influence our approach to the problem. If we face the problems with little or no background knowledge, maybe then we will just discuss it at a very surface level. When they have more knowledge then we can think more about what is related to the problem or something more about that problem. {Year 2, BS, Female}

Background knowledge and our associated depth of knowledge effects how much we can learn. It will also affect our efficiency in our discussions and in our generation of learning issues. For example, when I have the first encounter with a new topic I will not be familiar with everything and when I am in this position the problem seems to be 'neutralised' when new to everybody. We can't think of the direction to learn. Our satisfaction in what we can learn or our learning will also be affected. (Year 1, BD. Male).

As we progress, for example when some problems are related and we are able to learn part 'a' and part 'b' of the same issues when two consecutive problems are like part 'a' and part 'b' of the same issues. With part 'b' we can learn better because we have new background knowledge. {Year 1, BS, Female}

Another student pointed out that not all materials to be learned are suitable to be presented for learning from problems. This particularly related to information of a technical nature, which the student believed would be more appropriate to be learned in a more didactic environment.

I think PBL's not suitable for all kinds of topics. And I don't like it because, how to say, because some topics are difficult to just search information and then discuss among ourselves. Some topics are really very, very difficult. About the acoustics [problems] again for example, [where] there's some chart and then frequency [values

given to us]. It's very difficult for us just to read it by ourselves and then discuss among ourselves. I think those [types of problems] are not suitable for PBL and those problems are difficult. Difficult time [for us] and I think if [we are to learn some important knowledge from such problems,] if we must learn some topics using PBL we should change, - but it's quite complicated. I think it should move to the skills labs. {Year 4, BS, Male}

Another student commented how he believed that problems did serve the purpose of learning by elaboration.

But in the opposite lane, problems can give us enough facts in order to generate the ideas that people can discuss more effectively in order to generate more learning issues. {Year 4, BD, Male}

There were comments that indicated problems should be constructed to challenge them and not be simplistic, as that would inhibit their development as independent problem solvers.

If a problem is too straightforward it guides us in the search for solving problems. I think it is critical that we are discovering learning issues for ourselves. If it's straightforward then we don't really have to discuss any issues and just learn the facts. That is not so good. {Year 3, BD, Male}

It will constrain our thinking and discourage us from searching wider for further knowledge. {Year 3, BS, Male}

It will mean sometimes we are more secure if the direction of learning is narrower, but surely it will constrain our learning and further exploration. {Year 4, BD, Female}.

A large number of students commented that the problem should promote holistic learning. This occurs as part of a realistic problem and not as separate pieces of theoretical knowledge that may not be directly linked to their future profession.

I prefer problems that mimic what I'll get as a real BD professional. If problems are just like clinical situations it promotes discussion and a deeper learning takes place. If it is just theoretically based subject matter then no real learning happens. {Year 4, BD, Male}

Our discipline-oriented problems are better than those from other areas as ours are more interesting and we can generate more ideas. {Year 2, BD, Female}

A well-designed problem helps to train us to solve real-life problems holistically, not just bits by bits, subject by subject, but through viewing the patient as a whole. {Year 3, BS, Male}

Students from both courses identified realistic problems as an aid to learning as they linked theory to practice. For example:

The PBL problem, the case we end up with, it resembles a real situation. This case will describe a male aged what and what, and then he's got what problem, so we need make an assessment and find some kind of treatment to help him. It's like a real case and it help us to analyse the case, find many features we need to. We also need to bear these in mind and then go and search information. Not all information fits though and then we make the selection. I think the whole process is, helps us to think and our thinking that we will need when we are in the real world, yes. {Year 4, BS, Female}

Having solved problems in tutorials helps me to understand the things we find in clinicals better. I can now see how the theory fits together in some practice situations. {Year 3, BS, Female}

It is so much more meaningful than school where we just get is one way, one way teacher, students repeat, always one way and the examination system is to recite things. PBL is good because it helps me to make some links, the knowledge to the real situation. It makes me think about what I should do and how I should do it. {Year 3, BD, Male}

Having students participate in the problem review process, which was a regular activity in the BS program, assisted facilitators to identify any changes to make the problem more realistic and manageable. Including the users in the problem content and design has the capacity to bring out constructive elements required for students to learn the discipline content.

Usually in tutorial two, when we have finished that problem, we discuss with them [the tutors] about whether the problem is good, if anything needs to be improved. We'll put in suggestions to be formatively used next year to improve practice. Like [some] people will be caring about this and we will actually get some comments on it. Usually people will help you participate in that because we really have our experience

in going through these problems and we think these experiences can help improve the problems. {Year 4, BS, Male}

This highlighted a difference between the processes of both courses, as BD students did not get this opportunity. A BD Year 4 student illustrated this aspect when he commented:

> We have little input into improving our PBL. It is only through our student reps. Sometimes, I think we could suggest improvements to some of the problems, but no one asks and we haven't really got an opportunity.

In summary, the students generally understood the importance of problems and their role in the learning process. The students indicated the problems needed to be carefully constructed, so as to take into account their prior knowledge and the knowledge to be learned. They use them as a means of linking theory to practice and enabling learning to take place in a stimulating and holistic manner. All these points satisfy the rationale for adopting PBL as outlined in the literature by Barrows (1988 & 1986) and Schmidt (1995). They also highlight the importance of problems in the PBL process as outlined by Gijselaers and Schmidt (2000), Andrews and Jones (1996), Margetson (1998) and Boud and Feletti (1999).

These findings would appear to suggest that:

Proposition 5. Students understand the role and the importance of the problem in the PBL process.

The Facilitator

Students in both courses had very clear views of the role of their facilitators and regarded them as playing an important part in the PBL process. It was also clear that there were differences in the attributes of the facilitators with many students in BD being very critical about the quality of some facilitators who came from different faculty areas. Students generally believed the best facilitators came from their own

respective faculties, had extensive clinical experience and possessed appropriate facilitation skills. They also highlighted a need for a facilitator to provide meaningful and constant feedback, particularly in their early years. The last point has already been examined under the tutorial process.

Facilitator as a Guide

All students in the BS and BD programs perceived the role of the facilitator as one of a knowledgeable guide and a person who could, if necessary, provide information to keep the instructional process moving and the group working productively. The PBL facilitator's role as a guide meant ensuring students discussed relevant content and conceptual items, kept discussions focused and provided information only when needed. Too much intervention was believed to hinder productive discussion.

Students in both programs appreciated a facilitator who was able to competently guide, rather than overtly direct their learning process. Some comments were:

> One of the tutors we got 'actively initiates' and helps to guides our discussion and this also helps us then to formulate the discussions. We therefore think we are the best group. {Year 4, BS, Female}

> A good tutor is not directive [but] will act responsibly and encourage the group. A good tutor assists us by actively intervening when they need to. {Year 3, BD, Male}

> A tutor can guide a group and sometimes smooth the way in the discussion of the topics. For example, the student may be making a mess because it's new to the student. I think the tutor can help in doing the organisation or help us to go to a conclusion. {Year 2, BS, Female}

Students indicated that they liked their facilitators not to intervene for much of the time but wanted them to do so if they strayed too far away from the appropriate direction. The experienced PBL students commented that they were able to conduct the tutorial themselves, albeit with some facilitator input if they had not reached sufficient depth in their discussions or were missing crucial items they needed to learn.

The good tutors, they will assist us when we are wandering in the discussions and if some students are talking about empty content. [He/ she does this] by asking us some questions to bring us back to the right point. {Year 4, BD, Female}

Most of the time the tutor can just sit there and do not have too much intervention, but [this] will be good, you know. But if we are stuck, in some areas then this will change slightly, in that they should ask some questions, sort of [act] like a guide, help us to come up to the answer. It will be good. {Year 4, BD, Female}

After four years we really facilitate our own sessions. I think we don't need a facilitator most of the time. [On a few occasions] with some problems that are complicated, it's helpful to have some direction about whether we have covered everything. {Year 4, BD Focus Group, Male}

With less experienced students, they indicated they appreciated more help from the facilitator as their existing knowledge about some subject materials was scant and their skills for learning in a PBL environment were underdeveloped. The support students expected from their facilitator included provision of factual information so they could continue with the discussion using fresh ideas or new information. Sometimes they wanted some hints about where they needed to go so they could find out for themselves. Provision of some information was most important when the students did not have enough prior knowledge to support a discussion. They did not want to waste time on discussing unnecessary items not related to the problem. However, students preferred not to have the facilitator play too large a part in the discussions as the students perceived it was their job to ensure they first discussed the topic and problem issues to the best of their ability. Typical comments included:

The tutor usually sits there and monitors how our discussion is going. If we have some wrong idea he may tell us if it is a wrong idea. That should be this and this, and he/she directs each of us in the right direction. We need that. {Year 1, BS, Male}

If we are discussing something that is not related to the topic, or if the discussion is too far away then she will stop us and bring it back. And maybe if there is anything wrong she will actually tell us. Another experience; when we think that we have finished the discussion and we didn't do some things, she will say, 'Oh, you didn't bring up the issue, that's of importance' and she will help us and we will continue with the discussion until we are satisfied we have covered that issue. But usually during the

discussion she will usually come in at the finish and assist us to come to the correct conclusions – not interfere. {Year 2, BS, Female}

Then there is a good tutor. Because maybe there is something we cannot understand just by reading the materials, maybe we may misunderstand or it may be misleading the idea of the reading so if there is a good tutor he or she may direct us to a right direction. And also a good tutor can help us to think of one issue more deeply. And [a good tutor will also] guide us how to think. So a good tutor can guide us towards our right direction. {Year 1, BD, Male}

It is also worth noting that two students mentioned they appreciated facilitators who allowed them time to think and only intervene when it becomes apparent that students have lost their way.

We have some sessions where all the students will all be very quiet … or something and then he [the facilitator] will see that we are thinking. But [when he sees we] do not have any answers then he will help us on something. … [The tutor,] he does not tell us everything – [he /she] will just tell us enough to get the discussion going. {Year 2, BS, Female}

Usually she will wait until we ask her. Most of our tutors let the students guide themselves. That gives us time to think. But sometimes we got stuck in some concepts and tutors have to intervene. {Year 2, BS, Female}

Some students commented that good facilitators were able to promote harmony.

I remember when we first started PBL; there were some group members who remained silent most of the time. Our tutor suggested to some of us we could encourage these shy group members to join in. That helped all of us and we were able to have more productive discussions. {Year 4, BD Focus Group, Male}

In one group, there were two boys, always talking – competing with each other. Our tutor suggested to them to give us a chance to [speak up] and give some contributions. I think they were not aware they were making the sessions difficult for the other group members before this. {Year 2, BS, Female}

We like our tutors to also play an important role in PBL sessions. They sometimes give us questions when we are quiet, and cannot make any discussion. The one tutor

we really liked would become involved in those stalemates and make some jokes. I think we can then be more relaxed, I think that some things are too far away from us, and the tutors can help with this. {Year 1, BD, Male}

Facilitators as Prompts for Deeper Learning

Students were unanimous in their views that they liked their facilitators to contribute to their learning by challenging them to engage in higher levels of thinking. They believed good facilitators model the process students should adopt, particularly in their early years. Some examples of their comments were:

If the facilitator can assess us and question us, model these things - this would be better. Later it is our responsibility to ask each other such questions, but I think being given a model, to us is very important. I [also] think a good facilitator should ask us meaningful questions. {Year 1, BD, Female}

My facilitator always encourages us to think and not to speak at a superficial level. She will ask you to challenge yourself - of what you have learned. What you have learned may be wrong or not enough, and she asks you, and encourage you to critically, rethink what you have learned. That is the first thing. The second thing she taught me is learn how to listen to others. Listen to others if you think there is a problem, just ask them to share with us. {Year 2, BD, Male}

The facilitator should let the group make the decisions, then he or she may remind us when we are just lost in some part by asking some questions like, 'Is that all?' or something, and then stimulate the ideas. I think it is better for the facilitator to be asking in order to let people think more. Yes, I think something like, 'Why do you think so?' or 'What do you think about this point? I think this can help people to think more about difficult things. {Year 1, BS, Male}

The tutors may encourage us to think of some more questions about the actual clinical practice, about the problems. For example our tutors may ask, 'How can you explain this term or other terms to parents because they are not actually familiar with this or they don't understand?' In this way the tutor will lead us to think more deeply about the actual case. {Year 2, BS Focus Group, Female}

A good facilitator will help us to think critically. Even for those who are not as clear, our tutors are well educated, they can lead us to think more critically. This helps us with our academic pursuits. {Year 3, BS Focus Group, Female}

Facilitators as Content Experts

The more experienced PBL respondents believed that facilitators with expertise in the same field as the problem focus were better able to guide them than those who did not have content expertise. Students who were less experienced particularly valued facilitators who had expertise in their discipline area and problem content. Some comments included:

> I think a good tutor is very important in the PBL group. I think if the tutor has experience, I mean clinical experience; he or she can really contribute on some issues that we can't solve. Because especially on clinical experience or how to deal with some clinical issues before we have some placement, we really don't know which is the best solution or how can we go through some procedure. If the tutor has some experience then she can give us some suggestion or give out her own opinion on that, then we cannot just stop at that point. And also if the tutor can stimulate our thinking by asking the group questions, it really can make the quality of our discussion better. If the tutor can ask very challenging questions and then it will change our discussion level to a better one. {Year 3, BS, Female}

> The senior tutors will have their own area of expertise. If the problem is something like they are familiar with, they can usually have some stimulating questions and they will be able to facilitate in that discussion. But if they are not really familiar with the topic, they can hardly ask some questions and they even don't know about that problem [or some of the] issues. So there's no one that we can come to who will say, look here, look for the usual of knowledge, knowledge 'a' or knowledge 'b' for example. {Year 4, BD, Male}.

> Sometimes we have a facilitator that specializes in one field only. For example we will have a BD technician as a facilitator and that means they will only have the knowledge about the technical things and procedures. {Year 2, BD Focus Group, Male}

> A good facilitator will guide you and not let you discuss about the wrong thing for too long before guiding you to the right thing ... and that's why we like ... [tutors from our own faculty area] because they are so much better because they know when you are wrong or right. You find in some tutorials, some people are trying to explain to someone from another department, explaining to them in [our discipline] terms, what we've put out, and then it's a waste of time ... because people from [our faculty area] can tell. He or she [from BD] would know. {Year 1, BD, Male}

The facilitators from the BD are best, because at least they know what they are doing and at least they guide you so much better in the right direction. … Sometimes we get people from pharmacology or something and they will teach you a lot of clinical sciences for the problem and focus on the pharmacology. Pharmacology people just focus on the pharmacology and the work on the rest of the problem is left out. … For this, when we come to the exams we will not know many of the things we need to know from this problem. This is very – it's difficult for us. {Year 3, BD, Female}

Quality of Facilitators

Generally, students' comments indicated there was a big difference between the quality of facilitators in BS, who were mostly held in high regard, and many in the BD, who were generally regarded as sub-standard. The BS focus group students commented that most of their facilitators across the years had been skillful and supportive.

I've had a lot of tutors and they were all good. Some of them were very good, very helpful and helped us to learn the [discipline] knowledge and … skills. They helped us to learn these things and there is much improvement for us. … They ask questions and guide us when necessary. {Year 4, BS Female}

The BS students made only two adverse comments about facilitators. They were:

My tutor is irresponsible because she does not pay attention to what we are saying during our discussions. {Year 4, BS Female}

The tutor shows a lack of responsibility when he does not attend our discussions. {Year 3, BD Male}

These were moderate complaints compared to the number and level of complaints made by BD respondents. The complaints were almost exclusively directed at the occasional academic staff from the BD cognate faculty. These were complaints about the facilitators' inability or unwillingness to engage in appropriate PBL facilitation methods. This confirmed the HOD concerns. Some comments were:

The tutor that I don't like or respect will stand, present some notes from the computer and leave. {Year 4, BS Female}

> Yes, we have some facilitators come from other campus areas. These lecturers come from other departments, not from this department, so we are given a psychology lecture about critical thinking! This lecture was titled "Crime and Punishment". And it is not in PBL, but we get it as problem-based learning. I got lectures for crime and punishment! {Year 2, BS Female}

> Many of them can be fired. You ask why I say this; this is because they cannot help us. They waste our time in the tutorial - often three hours on each tutorial. ... Sometimes they keep totally silent in the tutorial. That is he can leave, it is not important for the tutorial. Another, he dominates the PBL. He is really so called teaching us, but I think it is just giving some data, some information, what we can find in the books. But he is not teaching us how to think critically and logically. And I think he can also leave because we can find it in the books. {Year 2, BD, Male}

> Sometimes the facilitator leaves early. The session from 2 to 5, the facilitator leaves at 3.30 and doesn't come back at all. Not good! Fickle, yes, very, very upsetting – when he leaves he says, carry on, carry on. {Year 3, BD, Female}

The students, who made the last two comments, were extremely despondent and their body language indicated a look of hopelessness. This demonstrated how the behaviour of the facilitators could have a negative impact on students' confidence, their perceptions of the worthiness of their course, and their perceptions of PBL as a method of instruction.

In summary, both BD and BS students had very similar ideas about the importance and roles of the facilitators in the PBL process. Facilitators who acted as guides, intervening only when necessary to promote continuity of the learning process, challenging to encourage higher levels of thinking, and displaying competence of content knowledge were seen as important by students. These attributes fit Murray and Savin-Baden's (2000) description of well-prepared and capable facilitators.

There was, however, a clear difference in views about the quality of facilitators, with BD students being highly critical of those who came from cognate faculty areas. The reasons for this are most likely that these BD facilitators did not receive any training and did not attend briefing sessions as the HOD pointed out. This confirms the findings of Creedy and Hand (1994) with regard to improving the quality of facilitation through initial training and CPD. The thorough introductory, training and

continuing professional development programs outlined by the HOS for BS staff and as recently introduced for part-time staff in the BD, are essential for development and maintenance of facilitator expertise.

These findings would appear to suggest that:

Proposition 6. All academic staff participating in PBL should receive intensive initial training and regular ongoing support for CPD.

The Group

As pointed out by Geerligs (1995), the small group learning environment, with its associated processes is the "cornerstone of Problem-based Learning" (p. 269). This small group environment is complex and seen by students as being very important in the PBL process. Comments about group dynamics by students in this study can be placed in three broad categories: group dynamics, group discussion and cooperative learning. In each of these categories there are behaviours identified by the students as being necessary to engage in productive and meaningful learning. Generally, there was little difference between the students' views of BS and BD courses and their experiences of working in groups.

<u>Group Dynamics</u>

All respondents indicated that with experience, they became more adept at working together to accept individual differences in behaviour. Typical comments were:

> Now in Year 4, I think everyone is more used to the PBL. In PBL mode of learning, when we approach year two and then year three and also now, our class is more close to each other. We know each other more. ... I think now we are more willing to express ourselves. In my experience I think that in year two and year three the group atmosphere [is better because] more group mates contribute in the discussion, more than in Year 1. In Year 1 everyone just didn't know what to do, and then the

discussion does not facilitate. But in year four, the group is regularly having discussions between us. {Year 4, BS, Female}

To have good products in the discussions, there has to be an adherence to a certain process. The discussions have to keep going. Because if there's silence, or if the group members don't feel like contributing or something, then its dead. {Year 3, BD Focus Group, Male}

It is a good way to train young students, look at them as individuals, like interpersonal relationships, because we are having that with the patients too. Maybe some of our patients will be very dominant, talk to us all of the time and while other may be very quiet. When you can't even talk, you can [however] take a person's phrase from his or her mouth. This is a good treatment, I think to accept others' opinions, for me, it is good. I think I accept more from others, instead of having them correcting me. I think it is quite difficult to change each person and others' character really. It is sometimes difficult to keep some of us quiet, particularly with my classmates, like you are faced with each other every day. It's sometimes not that easy, but you can get over it. Now we just learn to adjust. I think I learn that just myself. {Year 2, BD, Female}

Attitudes of group members were seen as being important for a group to function effectively. If some member tended to dominate, then problems arose. This was more of a problem in BD than BS. Some comments about problems caused by dominators were:

Some people they will be dominating in our group discussions, they ruin the whole thing. {Year 2, BD Male}

In one group we had one person who tried to – he kept dominating. Some people were rude to that person and kept answering him back, back and forth. This is not good, not very good. {Year 2, BD, Female}

Groups should not be dominated by one person! Some group mates are over-excited in educating others but changing the personality of some people is not easy. While it is the responsibility of the group, we cannot change this, no mechanisms. Some of us will choose to let the people who want to talk all the time do the work but often it will be superficial things. {Year 4, BD Focus Group, Male}

Students indicated they developed a range of strategies to deal with group functional issues. One student in BD also mentioned that they liked to deal with potential problems outside of the PBL group.

> If we have to deal with a problematic situation where someone may dominate all the time I think it would be more efficient if it's dealt with outside the session, better than in the tutorial session. ... Because it's just our, its just our session and maybe he or she may not be so dominant, and at this time it may be more easy to talk to the problem with her or him outside. {Year 3, BD, Male}.

An experienced BS student mentioned domination had only been a minor problem for her groups. Her comment was:

> I think I haven't met someone really dominating the discussions. But sometimes one or two would say a little more than the others then the tutor will remind, after the session that, 'Oh maybe you talk a bit too much this time.' Maybe you can give some opportunities to the others to express their opinions, or maybe you can invite them to join in the discussion by asking them questions rather than just throw out the ideas, directly. Yes, the chairperson will usually take responsibility for this. {Year 4, BS, Female}

Some students indicated that they had developed and used different approaches to address potential conflicts among the members of their groups and to resolve issues in a non-aggressive and socially acceptable manner suited to their culture. The only two males in Year 3, BS, decided how this worked for the females in their year. One explained:

> To be frank, the girls in our department they will exchange candies and sweets, chocolates and they will resolve their conflicts and nothing at all happens at all afterwards. But I'm not sure what happens in other groups in the department. Between the men – Yeah well, we are the only two in the year, only two of us in this year. So we have no other choices. Yeah. {Year 3, BS, Male}

When they had issues with each other they would:

> Go and have a beer, if we have arguments. We don't have fights like other people. Westerner. ... we just have to be friends there is nothing else for us to do but this. {Year 3, BS, Male}

An experienced BS student indicated group work and maintaining the group dynamic required effort. She stated:

> Working out how to work as a group. This is one of the most important things for our learning. That means having good discussion skills and being cooperative. {Year 4, BS Focus Group, Female}

These findings would appear to suggest that:

Proposition 7. Hong Kong students value the small group PBL learning environment and have developed strategies for maintaining harmony.

Group Discussion

The group discussions and the discussion process is an area that PBL students also value highly. All BS and BD students believed it contributed significantly to the effectiveness of the PBL process. Typical of these comments were:

> I remember one block of PBL is very good. ... I think the most important thing that made the group good was the members. The tutor and also the students in the group are motivated to express themselves ... and everyone will contribute and ask many questions. ... Also we raised our many learning issues, and so even a minor point can be raised in the session. So in that semester of PBL, I found it ran very smooth[ly] and we all learned a lot and the atmosphere is very good.. And we/I think that group is very good. {Year 4, BS, Female}

> I mean if a group is going to be working well together, and having some good relationships, and the group mates are going to feel free to make their comments, then the group mates will be free to discuss or challenge each other – naturally. We have to. When this happens, it creates a better atmosphere. It creates what, better platforms for learning. {Year 2, BD, Male}

> To have a really good discussion, it means everyone in the group contributes. This is the most important thing. ... A good atmosphere is created when there is contribution from all group members in discussions and there [are] attempts to challenge others'

ideas and give rationales. It is when everyone is stimulated and each person will try to participate that the atmosphere will be very good and the group dynamic active. This does not mean I will always be saying some things or always be active, but I will be part of the group discussion in some way. {Year 2, BS, Female}

The discussion process is very important in order to make things go. [However,] I am always trying to contribute to the discussions, not shy to say anything in the discussion part, so this helps the discussions to continue among group members. {Year 4, BD, Male}

It's like because everybody has equal share of discussion, I don't know why, because in some groups ... someone is just, is dominating and somebody is always quiet and then in our group we notice everybody is just chattering when they have an idea. So I think we could put participation as an important factor. {Year 2, BS, Female}

I prefer my group-mates to do their own research to find what additional information there is, ... not all the same. This contributes much to the discussions, some additional research, some different experiences and some other knowledge. If the group members share these data in the discussions, our hypothesis generation and discussion products will be very high. {Year 4, BS Focus Group, Female}

These comments support the assertions made by Schmidt (1993) that engaging students in discussion of problems as members of teams from the onset, forms the foundations for human learning, comprehension, and construction of semantic networks.

Conversely, a lack of contribution to discussions by individuals is regarded as an inhibiting factor to developing and maintaining a good learning environment. For example:

Yeah, if I'm unfortunately been parked with some students that are not motivated and or shy, or lazy. It is a problems [sic]. And then you can't learn anything. {Year 4, BD, Female}

It will affect our results, usually if we have only got one to two those people participating, then it will certainly not be so good. Because if you got seven to eight people in this group, the one may not be so able to effect the whole group so much, but when you got half of the group that are very quiet, then it is problematic. ... But in the end they will come to a conclusion themselves and take it as their responsibility.

Fortunately we have not got that situation often, only a few, on a few occasions before. {Year 2, BS Focus Group, Female}

Cooperative Learning

A willingness to share information was seen to be an important feature of group dynamics by all students. For example:

I think for a group to run smoothly there needs to be certain kinds of students. ... They should be good at contributing politely to the discussion. They will be supplying lots of information to the group and some of them asking for clarifications of others. {Year 4, BS, Male}

I would be very happy if the group mates are having similar styles as me. If all the group mates in the group are difficult and not contributing too much, then I would feel much pressure, not so free to express my opinion in the group. {Year 4, BS, Female}

I think I was quite active in the discussions, but not contributing additional information frequently, but rather I raise questions about the others' points or I will ask for clarification or something like that. {Year 3, BS, Female}

Our group has some outgoing people. What I mean is they speak their mind, with a certain amount of tact of course. You know it's like bringing up questions and willing to talk about it. In this way we will all share. This is very good because the group will have many interactions. {Year 2, BD, Female}

What our group mates do to help in our PBL is they share information. They will prepare well before the discussion and then they will be asking challenging questions and having many interactions. {Year 2, BD Focus Group, Female}

Good group members will share their knowledge because they may have different experiences in the past, different clinical experience, or they find different things when they research or research different things and then we can benefit too. So you can find much to share among the group. {Year 3, BS Focus Group, Male}

One BS student informant noted that the capacity for sharing carried over outside the PBL tutorials.

Well actually in year four ... it is our clinical year and the students, we actually are creating some group discussions among us. ... It is happening more and more. ... The

discussion is mainly to share some assessment protocols for our clinic ... and also to discuss among ourselves some things we did not have [some knowledge of] before. {Year 4, BS, Male}

The BS students' comments indicated they were quite comfortable with active collaboration and it benefited their learning.

I think some of the group mates will share everything with each other because during the discussion the atmosphere is very effective for learning. I think it is very promising because maybe if we all share with someone it helps us all to learn. {Year 2, BS, Female}

On the other hand, those groups that had members who would not share were seen to be unproductive and undesirable.

Group mates cannot be selfish. If they are fairly selfish, he or she may find something very important, or useful material, or reading, but if he or she does not share it with each other, just keeps it for himself or herself and will not make a copy for each group mate, that is no good. I do not think a selfish person is a good group mate in a group. There will not be much learning. {Year 3, BS, Female}

There are some factors that make for PBL to run not so smoothly, factors like attitudes of some of the group mates who are not wanting to share what they have. Yes, this is because they want to compete, have some more things, so they don't share all the information with us. {Year 3, BD, Female}

Among the BS and BD informants, the group members' ability to remain open minded was a key to maintaining good group relationships and a positive learning environment. The BD focus group informants were more cognizant of the potential for difficult situations to arise and the possibility of deterioration of the group dynamic and its effect on their learning.

I think we get a good atmosphere. This is important. I think if the group members have good interaction, if there are some raising points and are others adding something on it, then the team spirit is good. This is when we can be free about our ideas and the products will be very good. {Year 3, BS Focus Group, Female}

I think the group mates should remain open minded - not always. Each person has to feel free to be able to comment, free to be able to discuss or challenge. It creates a better atmosphere. Maybe the faculty could teach us some things on this to help us when we first start the PBL. {Year 2, BD Focus Group, Male}

These findings would appear to suggest that:

Proposition 8. Contribution to discussions and sharing of information is critical to an effectively functioning PBL group.

The comments made by BS and BD respondents supported Geerligs (1995) theory that unless the group dynamic is good, the quality of the discussions deteriorates. Any disagreements or disruptive behaviour needs to be dealt with as soon as it arises, even if it takes time. Developing and maintaining a structured environment where group involvement, active participation and interaction can be nurtured, supports group productivity as advocated by Mpofu et al. (1998). Table 4.2 shows a summary of the students' perceptions of the PBL process.

Summary Comments

The overall processes used by both groups were mostly similar for conducting their PBL tutorials. The differences involved the extra support for learning provided by BS by way of constant feedback, provision of readings in the early stages, use of reading sheets also in early stages, comprehensive initial training and regular on-going CPD for all facilitators, and generally a more inclusive involvement of students in their learning process. Students from both BS and BD understand the role and importance of the problems, value good facilitators and learn to function well in groups. They particularly appreciate the value of discussion in their learning process.

Table 4.2 Comparison of the PBL Process in BD and BS

PBL Process	PBL Course	
	BD	**BS**
PBL Tutorial	Now follow full PBL model originally described by Barrows and Tamblyn (1980). Students conduct own tutorial with scribe and facilitator guiding the process. Feedback session at the end of each tutorial is optional. Students responsible for finding own readings and information. Formal evaluation by students at the end of each module (6-8 weeks). A 'master class' by a senior academic that summarises key information identified by academics.	Use full PBL model originally described by Barrows and Tamblyn (1980). Students conduct own tutorial with a student chairperson and scribe guiding the process under the care of facilitator. Time built in for feedback sessions at the end of each tutorial. Readings provided in Year 1 and gradually phased out through Year 2. Reading sheets to guide learning provided in Year 1. Summary session for consolidating knowledge learned at the end of each problem. Ongoing informal student feedback fed to academic leaders. Resource sessions available upon request. A 'master class' from experts addressing students needs and providing some state-of-art topics.
The Problem	Students cognizant of the roles and importance of the problem in the learning process.	Students cognizant of the roles and importance of the problem in the learning process.
Facilitation	Students believe facilitators should guide the learning process and help create a harmonious learning environment. Students believe facilitators should intervene to prompt for deeper learning and if necessary occasionally provide factual information. Students believed content experts made better facilitators. Students were very negative about many of the occasional academics from a cognate faculty.	Students believe facilitators should guide the learning process and help create a harmonious learning environment. Students believe facilitators should intervene to prompt for deeper learning and if necessary occasionally provide factual information. Students were positive about their facilitators.
The Group	Students have learned to work together. Students value discussion highly as a learning process. Students believe sharing underpins successful functioning of a group.	Students have learned to work together. Students value discussion highly as a learning process. Students believe sharing underpins successful functioning of a group.

PBL Outcomes

Cognition

The cognitive outcomes for students in both courses appear to have been quite profound. Comments from the student respondents provide strong evidence that the rationales behind both courses – promotion of deeper and more meaningful learning – were being achieved. The results of this study showed students had to change their learning styles from passive to active learners; that they engaged mainly in the higher levels of cognitive activity, that is critical analysis and integration of data during the learning process; and evaluated situations at both a conceptual and operational level. They all reported engagement in critical thinking and many implied they used metacognition by reflecting on their thinking processes. The reports of metacognition were more widespread in BS where activities to promote it were built into the framework of the BS, PBL tutorial process. Students also mentioned they needed some time to engaging in thinking and that mainly accounted for some periods of silence during their tutorials. Evidence supporting Schmidt's (1993) six principles of cognition in PBL were provided by the student informants.

Learning Styles

It is clear that all the respondent students in this study experienced learning difficulties when they first encountered PBL. They had been used to a didactic teaching environment where they were passive learners who memorized information for passing exams. The new expectations about taking responsibility for their own learning were quite foreign to them and most mentioned having to learn to adapt their learning styles in order to cope. Two comments that encapsulate most students' responses were:

> In first year we learn materials that are about basis sciences and some very basic
> clinical things, so actually everything is new and in the beginning I don't really like
> PBL because I've been taught by teachers for quite a long [time], quite a number of
> years, and then suddenly we have to find out all the materials for ourselves. I was
> panicking in the first year actually. After about two years, there were a lot of good

things coming out of PBL and now I love it, or something like that. {Year 4, BD, Female}

In the first year of PBL, I managed to change my learning style from one dependent on textbooks and teacher directed learning to one, which utilised problems and vague directions for engaging in a specified learning process. {Year 2, BS, Female}

In Hong Kong, when we study in secondary school we got all the textbooks and the teacher gave us the lectures. And then we just study all the information in the books and then go to exams. Then when we come to the university and as we faced change we were just confused, very confused. No lecture and then, what we have is a problem, with a case and then we don't know how to start with that. ... I think I start to like it after year one. {Year 3, BS, Female}

The difficulties with new style required for learning in a PBL environment dissipated relatively quickly for the BS students, whereas it took at least two years for most of the BD students to become comfortable with the PBL approach. It was clear that many of the BD students struggled with their early attempts at PBL. Some typical comments were:

In secondary school we were given information. Later on in the PBL in university studying I felt I was in a vacuum. Although I had a lot of thoughts but I don't know where I find the lock to open the door, open the door for me to go to another room to find more knowledge. Find wisdom. I have this problem; I don't know how or where I can find the lock. I think there are many classmates who have the same problem as me. If facilitator cannot guide us, give some guidelines; if the facilitator is not expected to push us through, where we should go. But at least she should give guideline and help [show] us the way where we can open the door. {Year 2, BD, Male}

I would really have liked some guidance with what resources to select, there was just so much to cover that it never ends. After two years I am now better able to source and select materials, but it took so much time in the beginning that I didn't have time for anything else. Many of my friends found the same thing. {Year 3, BD, Female}

The change in learning culture between private secondary school and PBL in university is likened to being caught in a vacuum. The transition from one learning style to the other was an almost insurmountable problem as I searched to find a way of learning, because I wanted to learn in the new PBL system. If I as a student cannot

adapt to, or learn how to learn in a specified learning approach like PBL, then even the guidance by the facilitator cannot assist me with my learning. {Year 1, BD, Female}

I would expect a facilitator to guide me under such circumstances, not show me what I have to learn, but facilitate me to learn how to learn in a new and unfamiliar system. If I am unable to adapt to the method of learning in PBL, then the facilitation of learning provided by the facilitator, group interaction and dynamic interactive contributions would amount to nothing. (Year 1, BD, Male}

Many other BD respondents also believed they needed more support, but managed to develop their own skills over time. Some typical comments by BD respondents were:

I will not take the initiative most of the time. I would like, have liked more guidance in my early years. But I think in year three I feel a definite improvement. {Year 3, BD, Female}

Unfamiliarity with PBL prevented me from showing initiative and contributing to the learning process. I found it very difficult to find information and I really did not know where I was going or how to improve. It took a long time for me to learn this new system. {Year 4, BD, Female}

To begin with I hated PBL. There was little guidance and I really did not know where to go. Now after three years I am really glad I've done PBL as I am much more confident and independent in my learning and thinking. It would have been a lot easier though with more support in the early stages. {Year 4, BD, Female}

The need for more support in the early stages of PBL was a clear theme that ran through many of the BD students' comments. It appears apparent that there is a problem with the BD approach in the early stages of PBL as not one of the BS respondents from any group commented on it. This is an important finding of this study. There were a number of probable causes that accounted for the differences. These were differences in preparation of the students for PBL, standards of facilitation and provision of resources. These points will be revisited in more detail throughout this section.

Some respondents indicated they were not able to accept PBL as a preferred learning style. These were predominantly from BD and it mainly related to the way in which they organized their learning. For some others it was the importance they placed on

learning of content so they would have the necessary knowledge to practice, which they valued over the learning of thinking as a process. These concerns were mainly for the BD students in their early years of PBL and less as they gained experience in PBL. Only one BS student mentioned he was uncomfortable with PBL in his early stages, however, he had eventually adapted to it with experience.

> I was concerned that I would miss out on learning the things I was required to when I first began PBL, because I was not familiar with this way of learning or how I was going to learn what I needed to know when I graduated into the workforce. {Year 2, BD, Male}

> PBL assists me to learn and remember what I have learned but learning is not organised [or] structured into organised learning patterns as if it were according to a list for example. I get a lot of joy from learning when the content knowledge I should learn is listed in a logical format. When the content knowledge I have to learn has not been organised into a logical order or there are no learning protocols then I don't know how to organise it in my own mind. {Year 2, BD, Female}

> If the learning of factual knowledge is not organised in some logical system for me then I find it difficult to place that knowledge in my final cognitive knowledge structure. {Year 2, BD, Male}

> I can learn a lot of new points and things in PBL sessions and often I am able to relate what I have learned earlier to the problem despite the concerns I had earlier about linking points I learned in PBL to work in hospitals and the rest of the curriculum. {Year, BD Focus Group, Male}

> Personally, I did not like the PBL style of learning much because on one hand we do not know how deep and how far we should read or search for information. The department's policy regarding allocation for PBL discussion performance assessment in overall assessment and lack of guidelines regardless of the great deal of freedom to choose what to learn make it difficult for me. Now I am more comfortable in PBL I can cope. {Year 3, BS, Male}

Despite the initial difficulties, most respondents indicated they appreciate the value of the different approach to learning required in PBL. The main reasons they gave indicated it aided their deeper understanding of their discipline. Respondents from the BS, in particular, were quite enthusiastic.

I think it is quite good actually. I don't like spoon-feeding methods in learning or teaching, so actively learning, and then revising and adding information to what you have learned is actually quite interesting. Rather than having piles and piles of books and if I got notes given by some others, then I will just read and then forget. If we have the information that we find out and we understand it by ourselves, then we can add information to what we have learned. {Year 4, BS, Female}

I love PBL. At school we were taught to memorise and I didn't really learn to think. With PBL, I have a much broader range of understanding and I think a lot about what I am learning. {Year 1, BS, Male}

An important point to arise in this section is the need for support for students to achieve the desired learning outcomes by changing their learning style. Most in BD indicated they would prefer more guidance in their early years. This was not mentioned by any of the BS respondents, who were given a lot of support by the BS program with a more lengthy orientation program, well-trained facilitators, and constant feedback at the end of each PBL tutorial.

These findings would appear to suggest that:

Proposition 9. Hong Kong students can successfully adapt their learning styles to PBL environment.

Proposition 10. Hong Kong students adapt their learning style quickly if there is ongoing support from facilitators and group members in the initial stages of their PBL program.

Proposition 11. Students appreciate the value of deeper and more meaningful learning experiences provided by the PBL environment, provided that appropriate ongoing support is available.

Critical Thinking and Metacognition

Critical Thinking

One of the prominent features to arise from the interviews and focus groups was that all students, both BD and BS, believed that they had quickly developed critical

thinking skills as a result of their learning through the PBL process. Their comments revealed a growing sophistication in the appreciation of the nature of critical thinking and its consequences for their learning development over their four years. This finding adds support to those of White et al. (1999) who noted that critical thinking was the most frequently reported outcome for students in PBL. Some typical comments from all years of both courses were:

> Critical thinking you can write a long essay on. Let me try to answer. In primary school, secondary school, or maybe in the old curriculum in the university, we're trying to 'eat' a lot of data. You are not asked to develop your analysing or integrating ability; that means it is most possible that you did not get any knowledge but just data. With PBL, I think we have to understand knowledge, whereas under the other ways of teaching it's impossible for us to develop wisdom. And I regard wisdom as one of the ultimate goals of university. And the critical thinking is an essential tool, helping us to develop from eating data, to gaining knowledge and wisdom. {Year 4, BS, Female}

> I guess I think for university a student should not just be a copy machine. Sometimes we may have maybe a joint research project and it requires us to think critically about what we are seeing and hearing. If we don't have any special thinking, then I think that we are just follow our usual tradition. We take the orders from the boss and then we go 'la, la, la, la'. We do not think for ourselves. PBL makes me think. {Year 3, BS, Female}

> When I engage in critical thinking I do not accept all that other group members present. I really have to think, question myself to see if I agree with information being presented, whether it is really true and make decisions about the information constructs presented. {Year 3, BD Focus Group, Female}

> Critical thinking! I remember one of the points in the evaluation form is to challenge, challenge others presentation or information or something. Yeah, and if we just accept all what the others present we won't have critical thinking. We have to really think; 'Mm, do I agree with that? Is it really true, and what about if the case is this, this, this!' {Year 2, BS, Male}

> In PBL, we have to ensure we understand the information we encounter by thinking critically about the information at hand, through challenging that information and making inferences. {Year 2, BD, Female}

At first I did not have critical thinking. I just accepted what people said. I was afraid to say otherwise. I had to think what to say without thinking whether it's critical or not. I think I am now more able to think critically. {Year 1, BS, Female}

To begin with I was too shy to say much about others' comments. Now I am beginning to question some of the things they say, as sometimes it is different to what I think it should be. {Year 1, BD, Male}

Inherent for engaging in critical thinking is a need for close attention to details of any discussion. It was clear that the nature of the PBL tutorial process with its small groups engendered recognition by both BD and BS students for that need. Some respondents' comments were:

In PBL, to make inferences during a period of engaging in the critical thinking I have to concentrate hard on the process involved by attending to what others' say, noticing any points that seem strange, thinking quickly, challenging that point, then giving a reason for challenging that point. {Year 4, BS, Female}

I think both critical thinking and doing the inference you have to be very concentrate on, in the process, yeah. If I'm not attending to what the others say, I wouldn't notice if there is anything strange that I have to challenge. In order to have critical thinking I have to concentrate and then think very quickly, and then give the reason why I challenge the point. {Year 3, BD, Female}

When we are in the PBL tutorials we have to use the accepted process. The PBL process makes me concentrate hard on what is being said, think critically, make inferences, comment or challenge others' points and give reasons for points offered. {Year 2, BS, Male}

Metacognition

Metacognition is based on the process of reflection and deliberations by an individual about problems and their own and others' thinking processes as outlined by Barrows (1988). It was clear from comments that some respondents had developed a habit of monitoring their own thinking processes. This was particularly the case in BS. It was less common in BD where it was mostly the more experienced students who indicated they engaged in reflective activity.

I think because we have joined in the discussions in PBL we have developed a very critical mind. This is because everyone has got their own idea after we have to read our materials, then sometimes you can't just accept what the other people have said and when you first feel yourself. Just something is totally wrong, you have to really think, on which area, or which points that the discussion is wrong. You just can't think, 'Oh you are wrong', you have to give effort and keep on leading to it. Also when the whole group has difficulty or is just stuck, you have to really concentrate on that's what we have said, break the things down and if only lecturing you have only to grab it, not any special thing. It's not a very, not an easy thing to evaluate or think critically, but if and when you have discussions, you have to do it in order to make the discussion. {Year 3, BS Focus Group, Female}

I think it's also good because it streamlines our learning skills, because we have more independence, and depend on what we are and what we want to learn. And because with lectures you just need to photocopy the notes. In a lecture situation you just attend the lecture and then understand what all the lecturers said. But in PBL you can define what you are, what you want to know and then you can define how you get the answers and also have the discussion. More independent. {Year 4, BD, Male}

I think in the PBL I get used to having discussions so I think I can keep a check of my learning. So now every time when I am talking something I am thinking about my thoughts as I discuss with my group. I'm thinking about this learning process. Yes! {Year 1, BS, Male}

When we have solved the problems as much as possible through discussions with other group members, have critically examined all our issues bit by bit and then integrated them and feel as if we have learned something. We all have times when we are satisfied with that session, but most of the time we'll come up with more questions to ask. {Year 1, BS, Female}

The thinking processes described by those students fit the notions espoused by Margetson (1998) and Barrows (1988) that thinking in a PBL environment elicits metacognitive processes.

There is a probable reason as to why BS students quickly move into meta-cognitive processes. This is that they are required to review what they have learned at the end of each tutorial session and again at the end of each problem. There is no formal arrangement for this to happen in BD. In addition, BS students were required to develop individual and group mind-maps and concept maps as a means of

summarizing and consolidating information. These also allowed them to monitor their learning at the end of each problem. Students in BS were able to use the mind-maps and concept maps as graphical organizers to gain an overview of where all the knowledge they learned fitted together in the context of the problem, and in relation to that learned in previous problems. It also enabled them to examine and reflect on their thinking processes while solving problems, which is metacognition. They saw this as being a superior method of leaning to that provided by a traditional lecture environment.

> We use our mind-maps to wrap up the problem, to summarize all the knowledge we have gained, get a more complete picture of something; where you've been and what you've learned. Yes, I think I made connections, uphill connections, as we have to draw relationships between them [the pieces of knowledge] and I think about how I got there. {Year 4, BS, Female}

> My friends [non PBL] are very amazed with my mind-maps, my complicated mind-maps. I think when we have to create mind-maps we have to think through all the other little things. I think about what I have learned and how it all fits together. It has been revealing to me as I can easily see what I have been thinking about and how those thoughts are associated. If instead, we had a lecture for example, we can just jot down what the lecturer said and will go out and not have engaged in any thinking. {Year 2, BS Focus Group, Female}

> My concept maps do stimulate my thinking process and my mind because after we complete them we don't have to memorize everything. We can go back later and revise the books. Also we can have the concept map in front of us and having this in front of us, most of the time we can think and talk to other points, so no extra time is needed to memorize. {Year 1, BS, Male}

An important finding in this section was although most students reported quickly developing critical thinking skills, the slower rate of development of metacognition in BD students could be attributed to activities included in the BS, PBL process where time was devoted to encouraging oral reflection based on feedback and evaluation discussion as well as supporting student activities of developing mind-maps and concept maps.

These findings would appear to suggest that:

Proposition 12. Students engaged in a full PBL process quickly develop critical thinking skills.

Proposition 13. In order to quickly develop metacognitive processes, students need supportive activities that engage them in metacognitive processes.

Levels of Learning

One of the attributes of PBL is that it enables higher levels of learning to take place. If Bloom's taxonomy is taken as a classification guide, then this will include analysis and synthesis of knowledge, as well as evaluation, which is regarded in Bloom's system as the highest level of learning (Thorpe, 2004). Recall of information is at the lowest level of learning. It is worth pointing out that respondents rarely mentioned recall or memorization of facts as being part of their PBL environment. Students, in the BS particularly and in the BD to a lesser extent, refer to integration (synthesis) and analysis as part of their learning process. Frequently, but less often, they referred to evaluation as a summative part of their problem-solving process. There was a clear difference between the BS and BD respondents in this regard, as BD students felt they did not begin to develop these skills until their third and particularly their fourth year. The BS students felt they were able to engage in discussions and engage in higher levels of thinking almost from the beginning of their course.

The students' ability to analyse information has already been established from their comments reported under critical thinking. Some comments that specifically referred to integration of knowledge were:

> Unlike in a traditional education system where students are required to memorize a lot of data that is not a product of your own thinking. In PBL, there is an expectation that the students develop analytical skills, the ability to integrate what we have learned from the problem with our existing knowledge, interact, share and learn from others, manage our own learning and time, as well as determine pertinent learning issues. {Year 4, BD, Female}

> Let me try to, divide it [the PBL process] into many parts. The first thing is what you can read in the books. The second thing is the knowledge you can memorise. And the

third thing is the knowledge that you can manage from what you have read. And fourth, the knowledge that you know how to integrate with your past experience, with the problem you have encountered. And last, the knowledge how to interact with others, share with others and learned form others. How to manage your issues. Yeah there's a list there, what I can think of. In PBL we do the lot. {Year 4, BSFG, Male}

Specific comments about evaluative thinking, which is at the highest level of Bloom's categories, were less common. Three examples were:

I think this PBL style helps to prepare us, has helped to teach us, with our talking [communications] and to evaluate what the others and the other authors have written in the books. For example, when we are in the primary school or secondary school, we just take everything from our teachers, take everything every time, we are silent and memorize it. But for PBL we have to evaluate, 'Oh is it this, or is it this other'. Talking about things, something like that, because we don't really agree with the other kinds of things being said or the other people's ideas. {Year 3, BD, Male}

We have a different attitude now and have learned to think critically because not only is it the evaluation of books by myself, or what I've learned from PBL, but what I learn from others during the discussion, how the others perform, the tutors' performance, or because it makes me evaluate everything when something goes wrong. {Year 2, BS, Female}

Well I always try to challenge others. So some of my friends at this point only I think, "So what about another situation do you still agree on that?" I would challenge on that. That's good. {Year 1, BS, Female}

It was common for BD students to remark that they grapple with developing evaluative thinking. This they attributed to a lack of opportunity. A typical comment was:

Quite a lot of our facilitators, they come from our discipline area and sometimes they would be rushing us to some conclusions. Some of them, they have little respect for our comments and opinions I think. Often they would expect us to give some answers. I enjoyed our facilitators who give us time for thinking - let us evaluate what we say in our own words. We can be more confident about ourselves. All of my friends, they are of similar mind. {Year 4, BD Focus Group, Female}

These findings would appear to suggest that:

Proposition 14. A supportive, full PBL environment enables rapid development of higher-level thinking.

Time for Thinking

During the focus group discussion with BS, a point was raised about silence during PBL tutorials (it did not arise with the BD focus group). The students were commenting that the reason for silence is not necessarily because they are not overtly participating, but are engaged in thinking about the points being discussed. Another also commented that thinking is not confined to the timetabled tutorial sessions and is often done while outside their scheduled classes. These respondents were comfortable with breaks for reflection during the tutorials and one mentioned that this aspect of learning was never part of their evaluation of the PBL process for learning. These comments supported the findings of (Geerligs, 1995) when he reported silences being used by students for thinking and they were an acceptable part of the discussion and learning process during PBL. The comments were:

> During the PBL session sometimes we will not have any discussion for some time. It can be because we are either having a bad day or it is because we are using these moments for thinking thoughts. {Year 4, BS Focus Group, Female}

> Of course we also do thinking on our own where, outside the classes when we read the readings, we are preparing things for discussion. But still in the discussion we also stop for a while when we come to some sort of problem that we can't work out, mentally work out safely. But this is acceptable. {Year 4, BS Focus Group, Male}

> We can't talk and talk non-stop. No way right. We need to, we all need to stop for a while and rethink things to talk about, to reflect, and to conceptualise. {Year 3, BS Focus Group, Male}

> We are comfortable stopping talking among our group members for a while. During the discussions as well when we come to some problem we can't work out, it allows us to mentally work it out safely. It is typical for us to think about our problems for a while but we seldom evaluate this aspect in PBL. {Year 2, BS Focus Group, Female}

These findings would appear to suggest that:

Proposition 15. Students may require time to cognitively process information before contributing to the discussions.

Schmidt's Principles of Cognition

In Chapter 2, Schmidt's (1993) notion of six principles of learning that can be facilitated in PBL was reviewed. Some of these principles were confirmed by comments from students in this study. Their thoughts, as revealed by those comments, are understandably not as complex or sophisticated as Schmidt's. Nevertheless, their views do add some weight to the points Schmidt makes and it is worth reporting these.

First Principle

"The prior knowledge people have regarding a subject is the most important determinant of the nature and amount of new information that can be processed." (Schmidt, 1993, p. 424)

> By discussing, it facilitates our learning case by case. After one case the knowledge we gain will not be enough for just handling our patients, because for the PBL, ... it's so discreet, because it is not concentrated on one topic alone. Well one problem it may cause confusion, so many fields but they are not totally related ... but there is also some kinds of other things. So maybe it's not concentrated enough, for one case, but then the next case, then [we find] we are discussing something back to the previous case and then we slowly get some more understandings. Some things become more clear. {Year 2, BD Focus Group, Male}

> I think PBL's not suitable for all kinds of topics. ... For example, again about the acoustics, there's some chart and then frequency, - it's very difficult for us just to read it by ourselves and then discuss among ourselves. ... Most of the students in th[ese] sections cannot understand how to put these things together because there in not enough informations for us to do more. Too much missing - not enough information for us to solve these problems. {Year 4, BS, Female}

> Yes, what we are learning now, it really does start to integrate. I think they [the curriculum designers] extract a lot of what we're learning now, they rely on a lot of

things you learn in year one, but no one remembers, 'really'. So I have to go study it again. When we do study it again I guess it's better. But we feel we have missed so much before. {Year 2, BD, Female}

Second Principle

"The availability of relevant prior knowledge is a necessary, yet not sufficient, condition for understanding and remembering new information. Prior knowledge also needs to be activated by cues in the context of which the information is being studied." (Schmidt, 1993, p. 424)

> Remembering is easy in a short time, but in a long time, ha, ha.... I think that knowledge is a list, it gives us a lot of joy in a logical order. But in PBL there's no protocol and don't know where to put what we have learned in the final place. Sometimes I cannot link it. {Year 3, BD, Female}

> In PBL, if it is not clear but the discussions are productive, then we will build and build our knowledge and we can pick up new ideas and information. When this happens we can put our ideas forward, people can ask the facilitator and get some comment ... so we mostly we do something like connecting to earlier ideas - we are learning different things and topics because the topic is new to us, so this is the interest for me. {Year 4, BS, Female}

> I think we can learn something from PBL sessions and sometimes we can relate what we have learned the problems we encounter now. Just in the hospitals, the PBL curriculum, it's not as bad as some of my classmates said. I learned a lot of new points and I can make connections to what I have learned in the PBL sessions. Yes, PBL does help me to manage things like that. {Year3, BD Focus Group, Female}

Third Principle

"Knowledge is structured. The way in which it is structured in memory makes it more or less accessible for use." (Schmidt, 1993, p. 424)

> If the tutor has wide knowledge and experience in the clinical field, he/she will give us some examples of his/her own experience. This can show us some realities - help us to make some links. {Year 4, BS Focus Group, Female}

> And I think we have learned other methods of thinking, from each other like critical analysis. Maybe she will look at the problem in one aspect and the other looks at it in

another aspect and we learn to look at something, different aspects, and then have different aspect of thinking. This way we can have good changes, some further understandings. {Year 4, BS, Male}

If there was [sic] some problems that would come together, then I would find things a bit easier to connect and remember the facts. I remember that I studied the anatomy of heart in module one, I think in the September, but after that I came across the heart disease in module three in March, I found I had forgotten the things, the anatomy of the heart really. Now I needed to know/ remember what the regular heartbeat was, so then I need to revise it. When I will get something, some knowledge for this point and for this situation where I was studying the nasopharyngeal tract in this problem for example, it is fine, but the next week I would go to study the liver and the next week I would go to study the heart and then I feel it is so inconvenient. No structure to place my references and some concepts, no simple track. {Year 1, BD, Female}

Fourth Principle

"Storing information into memory and retrieving it can be greatly improved when, during learning, elaboration on the material takes place." (Schmidt, 1993, p. 426)

During the discussion there may be some disagreement between the members, so one important thing is when we go to work in the future we may come to these problems where during the conversation or discussion. I think during the discussion, if that student got some information that conflict with mine and we need to learn, to help us compare or justify the information more. So we've really learned to negotiate with others and challenge each other. I think not only challenge each other, but also challenging some of the materials that we have read. {Year 4, BS, Male}

In year three, as I explained, we had some excellent group discussions. We shared a lot during those discussions, the discussion in that semester, our experiences, relating them to the problems, generated good discussion questions, had very active discussions where everyone was free to ask questions and give comments. Because everyone contributed good ideas we were able to agree on many concepts, I remember we learned so much in that time. {Year 4, BS, Female}

For me year two becomes more practical about the problem, with emphasis on the patient's management and how we treat the patients, and what the [practitioners] attitude toward the patients might be. In year two there's more practical things, but for the year one, maybe it is more theoretical things and not so easy to grasp what we

need to learn. The discussions we had in year one helped me, although I remember things for the year two. {Year 2, BD, Male}

Fifth Principle

"The ability to activate knowledge is the long term memory and to make it available for use depends on contextual cues." (Schmidt, 1993, p. 426)

And I think, maybe the positive side of thinking is that we are trained, like given like a statement, then we are looking and have to find the clues, things like ideas, some details, and then things spring from it. It's really hard thinking. I don't realise it at first, but later when I go to other particular case I would have an insight, this helps me I think. The positive side is that it teaches me how to dig things up from, like some sentences or case I've [encountered]. I think that's the best thing in PBL, and the best for me as a practitioner. The best thing of PBL is we will face a case, a patient in front of us and we have to dig up [relevant] information, like from the cases we've already solved. {Year 2, BD, Female}

When we first start the problems in T1 many of the problems are not clear. Then we start to get some understanding and generate some learning issues. Even if we are not clear about where we should go we will still be learning many thing. If our group mates make many contributions, add some things they have discovered by themselves, then the discussions will show us many new things. I find this way is hard work but at the same time very interesting. I think it is a good way to learn and remember some things. {Year 4, BD Focus Group, Female}

In one clinical experience situations where I think this thing's amazing [I can do this]. Then I remember from the PBL. It is during the clinic we faced some children with language delay or some special case that we haven't see before and then the clinic group discussed it. Yeah, we all try to and found a way to help the child. I think that comes from PBL. {Year 4, BS, Female}

Sixth Principle

"To be motivated to learn, prolongs the amount of study time (or processing time, to put it in cognitive psychology terms) and, hence, improves achievement." (Schmidt, 1993, p. 426)

The PBL process consists of two sessions. In the first session we just brainstorm, hear about group members prior experiences and throw out ideas. The second PBL session

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is motivating because you have prepared by reading some things and you are eager to engage in the interview process to explore how much information has been generated. {Year 4, BD, Female}

I am very similar, like after maybe T2 and we have all gone through the books, the journals and things, we can use the thinking, the logic that really applies with the case. After books and journals, the knowledge you get you can apply it. Yeah, and I think that's the logic, the parts that you can think, how to apply it to the real case. Yes, in that it stimulates thinking. {Year 2, BD, Female}

I think the motivation it really depends on the students themselves whether they are self-motivated then there will be something they 'know' better. For those who want to learn it is true, they will be very motivated, but for those who are lazy, I think they will not make proper use. But those who are not motivated to learn, then it may have a negative effect on them. Yes, intrinsic motivation. I'm motivated if I have a real case in front of us. It's quite motivating, something like theoretical, but something we can be physically involved in, then it provide us with the motivation, some of the problems we really want to solve. Like maybe you have a vision with that model, then I really got the motivation to solve it. ... The motivation to continue more on your own, to look up more on your own, to learn more on your own [and] learn forever. ... Yes, you have certain plan, it's quite intrinsic and it really depends on the individual's learning. {Year 2, BD Focus Group, Female}

These findings would appear to suggest that:

Proposition 16. Schmidt's (1993) concept of six principles of cognitive activity applies to Hong Kong students engaged in PBL.

Affective Learning

The affective domain of learning under Blooms Taxonomy refers to attitudinal features of learning (Anderson & Krathwhol, 2001). This may be to do with liking or disliking a learning environment and its processes; it may be to do with a person's motivation to learn; or it may be to do with changes in self-confidence about a person's ability to perform. Students who participated in this study reported positive

changes in all three of these areas of the affective domain as a consequence of their learning in a PBL environment.

Attitude

The HOS had indicated that she believed BS students loved PBL. This was borne out by some of the BS students' comments.

> My feelings towards PBL [is that it] is not as boring as lectures, and I'm interested, but still need some more control on for example, organisation of the content of the problems. {Year 4, BS, Female}

> I think PBL is different for all of us people are not bored now, what we do now in PBL sessions is more discussion, more action. I think this is different. In PBL if it is not clear, then you can build and build the contents and we can pick up new ideas and information. {Year 3, BS, Female}

> At first I did not enjoy PBL. Now we can put our ideas forward, people can ask the facilitator and get some comment. In PBL we mostly we do something else like we are learning different things and topics. This side of PBL is very good. {Year 4, BS, Female}

The enthusiasm of BD students was not as widespread, particularly in their first three years. Typical comments were:

> The necessity to argue and share the experience of learning in PBL is very motivating. When everyone [in the PBL group] is keen and has an attitude reflecting an expectation to learn I find it very motivating. In earlier years, when we were not so sure, it wasn't as motivating. {Year 4, BD, Male}

> The transition to PBL was very difficult and painful for me after having been trained to learn in a didactic secondary school system because we were given no directives about what we should study. {Year 3, BD, Male}

These findings would appear to suggest that:

Proposition 17. Students in a well-supported, full PBL program develop very positive attitudes towards their learning. Conversely, unless it is appropriately supported, they will develop a negative attitude.

Motivation

The HOS mentioned that their students went well beyond expectations with their motivation to learn. This supports the findings of studies by Schmidt and Moust (2002) and White et al (1999), and assertions made by Johnston (1999), Alavi and Cooke (1995), Engle (1999), Dolmans et al (1995) and Barrows (1986).

This was borne out by the following comments by respondents.

> I was in a great group. It was just one of those times when it was just fantastic but they were all kind of, probably not all individually but they became a very high flying group and we felt the pressure. You know and it was more pressured and yet we also thought it was really exciting we knew that we were doing better work than any of us was capable of by ourselves, so it was very exciting that PBL motivates us to learn. {Year 4, BS, Female}

There are other comments referring to motivation already reported in support of Schmidt's sixth Principle of Cognition.

These findings would appear to suggest that:
Proposition 18. An appropriately executed full PBL course is a powerful tool in motivating students to learn.

Confidence

Students from both BS and BD indicated they had gained a lot in their confidence in dealing with other people and with novel situations. They stated that they now felt comfortable with challenging each other, something that was quite foreign to their

culture. They had developed skills to do this in a non-confrontational and socially acceptable manner. In other words they became diplomatically adept. Others mentioned that after their PBL experiences they were no longer afraid of new situations because they had learned to cope.

Challenging Others

> Learning in PBL has helped me in that I always try to challenge others, to some of my friends at this point only. So in PBL I would challenge like this, 'So what about another situation do you still agree on that?' And I think that's good as it has helped me a lot with my confidence – I would never have done that before. {Year 1, BS, Female}

> My classmate is wonderful because during the discussions she asks questions that appear to be very naive, but are very thought provoking. She will ask why, if the subject is too expansive, or if someone says something which seems authoritative or representative of some schools of thinking she will simply ask 'Why?' or 'Why should you think that?' or 'What's the reason?' Her method of questioning is very solicitous and facilitates our discussion processes so easily using these kinds of questions. To start with she was quiet but now is always questioning us. {Year 3, BS Focus Group, Male}

> Originally, I was very shy and lacked confidence. I had to work so hard on my English as well. Now I am happy with PBL and will questions others if I am not sure what they are saying is right. My parents don't like PBL because now I ask them, "Why?" {Year 3, BS, Female}

Coping With New Situations

> I'm never going to be intimidated by a new situation again. This is because I know that I can find the knowledge I need, no matter what it is I know that I can get the knowledge that I need. {Year 3, BS, Female}

> I know that when I have to I can easily find out what I need to know. For example, when I was on work experience with students from another university that doesn't have PBL they were worried about a situation that had arisen. I thought I will arrange a meeting with our supervisor at work to discuss the problem. They [the other students] were very concerned about the meeting. I wasn't, and we were able to resolve the problem once that supervisor understood our concerns. {Year 4, BD, Male}

These findings would appear to suggest that:

Proposition 19. A full PBL environment enables students to develop confidence in their ability to diplomatically challenge others' opinions and to cope with novel situations.

Generic Outcomes

Students reported developing a number of generic skills. These arose mostly from opportunities available to them from learning as part of a group and the responsibilities they had as a group member.

Leadership

The BS tutorial designates a student as leader on a rotational basis for each problem. This begins from the first problem the encounter. This opportunity is not formally provided in BD where it is left to the scribe and the facilitator. The scribes have little opportunity to act as leaders in BD tutorials as they are busy making notes. In BS, there is a scribe as well as the leader. This probably explains why there were few comments about development of leadership skills by BD informants. For example, two BD respondents indicated that:

> No, we really don't have a [group] leader but there is, what we have is just the representative. The representative just is just responsible for some administrative work during the tutorial sessions, not really the leader. {Year 2, BD Focus Group, Male}

> We are not like our fellow students in the [cognate] faculty. In the BD, we do not fight because we all want to speak. They appoint a leader or chair to make sure each person takes only 10 minutes for their individual presentations. We are not like that, so we don't need anybody to do this, take the same role.

In contrast, BS students regarded the role of chairperson as beneficial for acquiring leadership skills as well as being character building. Some comments were:

I think one practice in our PBL is quite good. In every section we find a student to be a chairman and a student to be the secretary. This role is shared among us all, equal participation, and everybody gets a bit of experience. {Year 4, BS, Female}

There are a few benefits, one is that section can go more smoothly and then everyone got a chance to practice their leadership skills. Yes, that's important too and very good because it helps us to gain experience in a leadership role and acquire leadership skills. Chairing the PBL session, this helps us with refining our leadership skills. {Year 4, BS, Male}

We mostly have a leader or we got a leader for each PBL session. The leader will try to point out, or question those who are much quieter and try to bring these students back. The chairperson will ask them, 'Have you any ideas prepared, please join in, have you a good idea', or something like that. ... Often if one of the students is not joining others in the discussion, so the chairman may try to invite that person to contribute. The chairperson tries to get them to discuss equally and continues to encourage participation. {Year 2, BS Focus Group, Female}

Yes there is equal contribution and sharing among the group, but the chairperson has his or her duties to make sure everyone can contribute. Being the chairman/ person, this part of PBL is very – fulfilment for me, yes. Not so much for some others, but it is part of the PBL, so it OK for them too. {Year 3, BS, Male}

These findings would appear to suggest that:

Proposition 20. When a PBL group has a designated student chairperson for the session, opportunities are available for them to develop leadership skills.

Teamwork

The small-group learning environment promoted the development of interpersonal skills and a collaborative approach to learning. This was evident in both courses. Comments supporting this finding have been already reported under group processes.

Communication

Some students mentioned how the PBL process had enhanced their communication skills in English. They were more confident with their ability to use English although some indicated it initially proved to be a difficult and stressful learning experience. Three of their comments were:

> I think because we use English as the language of education, the language of instruction as well as use English in discussions and we have all improved. We need to know the terms, the uses, or the topic of the things in English if we want to pass successfully. {Year 1, BD, Male}

> I think because we have to always communicate with English in discussion it has helped me a lot. I heard from my other secondary school classmates, he or she does not need to use English in discussion and then she always said that his, her English is retarding because there is no chance for her to use English. Yes, she's in a different university - and a traditional course. {Year 2, BS, Female}

> There were three things I think I can say I had difficulty with communicating in English. One, using English to express my ideas, two, what I think I fear most is reading in English, and then three, to contribute to the discussion in English. I worked very hard on my English and I think it is now much improved. {Year 2, BS, Female}

These findings would appear to suggest that:

Proposition 21. Use of English during PBL tutorials assist Hong Kong students develop their English oral communication and reading skills.

Time Management

Four students made specific reference to improving their time management skills. This was forced upon them by having to take responsibility for their own learning. Their comments were:

> Sometimes I didn't have enough time and I don't even look at one page of the notes. And I don't have preparation for tutorial two. Yeah. That was a problem when I first

started as I was used to traditional teaching. Now I have to make best use of my time because in PBL, I can't afford to get behind. {Year 2, BD, Male}

PBL requires individual students to manage their free time in order to learn more when we engage in self-directed learning. {Year 3, BD, Female}

Students in skills labs, as with lectures in Hong Kong, will often opt to miss lectures, opting to read or look at books, or get others' notes, especially if they are familiar with the subject area and because there is just one examination at the end [of the semester]. In PBL we can't do that. We have to learn to organise our time between the sessions because it is so packed [full]. {Year 4, BD, Male}

I've really learned to organise my time. Before, it was easy to sit in the back of the classroom, just take notes for exams and do a couple of assignments. In PBL, there is nowhere to hide and we all depend on each other. So I've really had to work on improving my systems for study and research. {Year 4, BS, Female}

These findings would appear to suggest that:

Proposition 22. Students exposed to a full PBL regime develop and refine time-management skills.

Self-directed Learning

One of the espoused features of PBL is that it develops independent learning skills that equip a graduate with desirable attributes as an employee (Murray and Savin-Baden, 2000). Comments from some of the respondents confirm that they did develop into competent self-directed learners. This applied to both BD and BS courses. Some typical comments were:

I think I'm more well equipped now for the way to search information, by myself. In our career we won't have teachers to teach us. If I didn't experience the PBL I think I won't know how to learn by myself. I would rely on the others to tell me how to do and what to do. {Year 4, BS, Female}

My experience in PBL has benefited me because I have gained the skills necessary to learn independently and not have to rely on others to tell me how and what to do. {Year 4, BD, Female}

In clinical situations when I encounter something I do not know I am able to observe the situation myself and find out what I need to know by myself because through PBL I have learned to be independent and self directing in my learning. {Year 3, BS, Male}

These findings would appear to suggest that:

Proposition 23. Students in full PBL courses develop sophisticated self-directed learning skills.

Summary Comments

The comments by respondents in this study indicated that a PBL environment does promote significant development of higher levels of cognitive activity as one of the outcomes in both courses. Many of the findings support the claims of authors and researchers in PBL. There were clearly increased levels of confidence to deal with new situations by students in both courses; greater motivation to learn (particularly by the BS students), and development of generic attributes that are helpful for their future professional lives. It is interesting to note, how, problem solving as a learning process and a learning outcome was not overtly mentioned by students. It was possibly overlooked because it was so obvious that it underpins the whole PBL educational experience. Table 4.3 provides a summary comparison of the PBL outcomes for both courses.

Concluding Comments

The analysis of data revealed that overall there were many similarities between the two courses, BD and BS. They both use a full PBL approach and operate in a similar environment. There are some differences in their approaches and, while these may seem minor, they do impact on students' perception of their learning experiences.

The students in the BS program are clearly more positive about their experiences overall, while the BD students' responses highlighted a need for some improvements. These recommendations will be addressed in the next, and final, chapter, which will also provide a summary of this study and its propositions, the conclusions reached and recommendations for improved practice along with suggestions for further research.

Table 4.3 Comparison of the PBL Outcomes in BD and BS

PBL Outcomes	*PBL Course*	
	BD	**BS**
Cognitive	Students had to adopt to a new learning style for a PBL environment.	Students had to adopt to a new learning style for a PBL environment.
	For many, difficulties with adjusting to the new learning style continued for two years or more. They believed more early and ongoing support would have helped.	For most, there was little difficulty with adjusting to the new learning style and by Year 2 were quite comfortable.
	Believed PBL aided deeper learning.	Believed PBL aided deeper learning.
	Students engaged in critical thinking and metacognition.	Students engaged in critical thinking and metacognition.
	Students engaged in analyses, synthesis and evaluation of knowledge.	Students engaged in analyses, synthesis and evaluation of knowledge.
	Students require and appreciate time to think.	Students require and appreciate time to think.
	Students' responses support Schmidt's notion six principles of cognition inherent in a PBL environment.	Students' responses support Schmidt's notion six principles of cognition inherent in a PBL environment.
Affective	Some students liked PBL.	Almost all students liked PBL.
	Students were motivated to learn.	Students were motivated to learn.
	Students developed self-confidence.	Students developed self-confidence.
	- they comfortably challenged each other and authoritative sources.	- they comfortably challenged each other and authoritative sources.
	- they were comfortable with new situations.	- they were comfortable with new situations.
Generic	No mention of leadership activities.	Developed leadership skills.
	Developed teamwork skills.	Developed teamwork skills.
	Developed communication skills.	Developed communication skills.
	Developed self-directed learning skills.	Developed self-directed learning skills.

CHAPTER 5: SUMMARY, CONCLUSIONS AND IMPLICATIONS

Overview

This final chapter synthesises the major finding from the study, critically examines the research design employed and draws conclusions relating specifically to the research questions. Implications of the findings of this study for PBL practitioners that were involved and for PBL practitioners in general are discussed. Finally, suggestions for further research are made.

Summary of the Research

Background to the Study

This study compares two full PBL courses in the Health Sciences in terms of relationships, similarities and differences. The research was set in a context of a dearth of empirical research about the appropriateness and effectiveness of PBL as an innovative approach to professional education, particularly in an Asian context. Since the introduction of PBL into medical education contexts in North America, and its subsequent adoption by other tertiary institutions in Europe and Australia along with its spread across a range of disciplines, much of the research has been based on an analysis of the concepts rather than on the nature and effects of actual practice. Furthermore, the research has been influenced by paradigms based on Western thinking and almost exclusively related to a Western setting.

More recently, there has been a proliferation of PBL into East Asian countries along with a diversification of PBL into different forms. Those forms are usually hybrid models of PBL that combine some of the basic tenets of the original PBL with more traditional teaching and learning methods. This mix occurs in varying degrees with doubts expressed about whether some forms purporting to be PBL are actually

fulfilling the original philosophy and educational process of PBL. The situation is further complicated by a lack of a universally agreed conceptual definition for PBL. There is, however, an operational definition for PBL that is referred to as full PBL.

It is in that context that this study was designed: that is, it looks at the effectiveness of two full PBL courses that have been recently introduced into a Hong Kong university using the perceptions of a purposive sample of students as the major source of evidence. Accordingly, the main research question in this study asked, "What are the relationships, similarities and differences between two different full PBL courses in the Health Sciences?" In answering that question, there were three specific aims to be addressed. They were: (1) "What are the components integral to a successful PBL system as identified by the literature?"; (2) "How do students perceive the appropriateness of these components with regard to affecting their learning experiences?"; and (3) "Is there enough evidence accumulated from students' perceptions to generate substantive theory that will influence future practice?"

The study focused on undergraduate students who were part of two professional bachelor degree programs in the health sciences. They were volunteer representatives from each of the four years of the programs that used PBL as an educational approach. The only extrinsic incentive they had to participate in interviews and focus groups was a certificate of appreciation offered by the HKCPBL. The academic leaders of the two programs were also interviewed.

A literature research revealed there was little research that focused on full PBL courses. A likely reason for this is that most PBL courses are in practice modified versions of PBL. There was, however, enough research available to identify some of the key elements of the PBL process in a full PBL environment, along with its likely outcomes.

The results of published studies showed that there are key steps to be followed in a PBL curriculum if outcomes of higher order cognitive activity and independent learning are to be achieved. Following the PBL process in a full PBL program enables an approach that empowers students with responsibility for their own

learning while contributing to a team effort. The studies also indicate that students on PBL courses remember what they have learned for a much longer period and are more motivated than those on traditional courses. They also learn generic skills of teamwork, self-directed learning, leadership and communication.

The literature revealed that a comparative study using qualitative methods is suited to the research question. At the outset an emergent design was used to suit the changing circumstances due to the unknown nature of the investigation. This approach laid the basis by which substantive theory could be later developed.

Procedure

A naturalistic technique was adopted for the fieldwork with the researcher engaging in preliminary informal conversations with academics experienced with PBL and observing videos of students engaging in PBL tutorials. These preliminary activities proved to be valuable. The casual conversations gave an insight into the views of academics and observing the PBL tutorial provided a better understanding of the PBL process in both full PBL programs.

Interviews were conducted with two academic leaders of the two full PBL programs, both before and after interviewing the student participants. The academic leaders provided a large amount of data about the programs and the processes followed in implementing PBL. The also gave a variety of possible outcomes for students in their respective PBL programs.

A purposive sample of 32 students was interviewed in 16 pairs. In addition, another 12 students were interviewed in two focus groups with one member of each focus group having also participated in the initial interviews. Use of a standard protocol of open-ended questions followed by probing questions enabled different views to be explored and ambiguities to be addressed.

Transcriptions of interviews were followed by an analysis of the data whereby a constant comparative method was used. Initially manual methods were used to develop notional categories, followed the commercial software program, QRS

NU*DIST, to refine them. Three PBL experts then reviewed samples of the analyses in order to check for the appropriateness of the categories developed from the data.

The results were reported as propositions based on the different categories of perceptions of the participants in the study. Initially, these categories were formed from data collected by the student interviews and triangulated with data collected from the two focus group discussions and interviews with the two academic leaders. The results were then discussed in light of previous research findings.

Reflections on the Research Design

Use of an emergent research design based on a naturalistic paradigm proved to be appropriate for this study. An initial technique of informal discussions enabled the researcher to gain valuable insights into the context of the study and into the perspectives of academic staff about their PBL experiences and expectations. Interviews and focus group sessions all yielded rich and relevant data. Semi-structured interviews proved to be effective tools to discover details of participants' perceptions. However, the prolific amount of data they yielded proved to be almost unwieldy and very time consuming to analyse.

At all stages of the study, formal and informal input was sought from PBL practitioners and researchers. Because English was a second language for all but two of the respondents, constant checking for clarity of data and its interpretation was needed. This also proved to be very time consuming. However, it is to be expected, as there is no alternative in the unique context of this research.

By having informants from each of the years using PBL and from both programs allowed diversity of views to be collected in a representative manner. The focus group discussions enabled preliminary assertions to be tested and modified. A final check against the data provided by the academic leaders added another dimension to testing the rigour of the propositions.

Limitations

There were a number of limitations that impacted on the findings of this study. These mainly related to cultural issues and to a lesser extent the research process. First, there was a cultural tendency to secrecy and not sharing of resources – curriculum documents, for example, generally were not accessible.

Second, there was the potential for Hong Kong students' cultural tendency to not criticize, pose challenging questions or question any perceived authority figure to affect their responses. However, it appeared to the researcher the respondents were mostly eager to contribute and were sincere in their responses.

Third, language is a limitation. English is a second or third language for the students' and in this case the interviewer's first language is English. Some of the meanings or interpretations of questions and / or answers may have been altered, confused or confounded. This raises the question about "how accurately does the data represent the phenomenon?" (Merriam and Simpson 1995, p. 142).

Fourth, data collection strategies employed less structured, open-ended questionnaires and required a massive amount time for coding and developing categories especially where "variations in response means more work in the analysis and identification of categories" (Merriam and Simpson 1995, p. 145).

Fifth, suitable venues for interviews were scarce due to lack of space and loud noise made audio taping of interviews difficult.

Sixth, the qualitative nature of the study limits its generalisability of its findings, when compared to the advantages of a quasi-experimental study in producing empirical evidence.

Seventh, an in-depth analysis of some of the data is limited in this study because sufficient time and resources were beyond the scope of this study.

Eighth, the students' perceptions represent a non-probability sample and, therefore, the validity of the data may be compromised as in many cases data represents an approximation of the phenomenon (Merriam and Simpson 1995, p. 142).

Ninth, and finally, this study is not able to measure the attitudes and perceptions of students for the purposes of evaluation; instead, it conducted an exploration of students' perceptions in order to lay the foundations for further studies in the field by providing a framework for future investigations.

Cultural issues had potential implications to restrict the outcomes of this study. However, the only apparent impact was due to some limitations in the students' use of English. It is likely that if the interviews were conducted in Cantonese, the findings may have been more culturally nuanced. The researcher was careful to allow sufficient time for responses and checked them for meaning, thereby minimising potential limitations. There was also the potential impact of the researcher as an outsider.

With regard to the research process there were limitations that were inherent in the unique context of the study. Given the circumstances, the methodology used was the only possible means of conducting the study.

Conclusions

This study attempted to answer the research question using the personal perspectives of students and academic leaders to establish similarities, differences and relationships between two full PBL courses. First, it showed that there were many similarities between the two courses. They had similar organisational structures for managing their programs, with procedures established for developing, maintaining and evaluating their curricula. Both had generally similar processes for designing and reviewing problems, and had systems in place for professional development of academic staff and orientation of students to a PBL education environment. Thus the frameworks for the learning environments were generally similar. The PBL processes followed by both courses were mostly similar, with both courses using two separate tutorials, the first to generate learning issues out of problems drawn from

real-life, and a second for students to return and engage in peer teaching and discussion to arrive at possible solutions. The outcomes for students in both courses were broadly similar, with the PBL approach eliciting higher levels of cognition, motivating students to actively engage in the learning process and enabling development of a range of desirable generic skills. Those generic skills included leadership, communication, teamwork, and self-directed learning, and research.

Second, this study also showed there were some differences between the ways these programs were executed. With regard to preparation of students for a completely different learning experience, the BS provided a more comprehensive program. In addition, preparation and ongoing support for academics to be PBL facilitators was more thorough in BS, although BD had recently established a similar preparatory program with evidence showing beneficial effects for students. The BS program was structured to provide more mechanisms to lend support for students, particularly in the first two years. The mechanisms included provision of readings, and constant informal and formal feedback. Formal assessment methods in BS were more comprehensive and overarching of the learning process. In BS, students were more actively engaged in an informal manner with evaluation of the problems and of the course.

Third, the findings of the study established distinct relationships between students' perceptions of their learning experiences and the PBL process as an educational environment. The findings also established that the differences between the manner in which PBL was implemented and supported in both programs could have a definitive impact on outcomes for students, particularly in relationship to their learning. All the relationships arising from similarities and differences in both these full PBL courses have implications for PBL practice and for further investigations by educational researchers.

The implications of this study can be grouped into three broad areas. There are implications for leadership of the two full PBL courses in this study, and for full PBL courses in general, whether they are in Hong Kong or elsewhere. There are also implications for educational researchers investigating the effectiveness and suitability of full PBL courses to elicit higher levels of thinking by students and for

students to develop valuable generic skills to better prepare them for their professional careers. As well, there were incidental findings that supported other research.

Implications

Implications for PBL Practitioners

An immediate implication for this study is that provision of additional support for students in their early years of the BD program is an important option for improving their learning experiences, Provision of a comprehensive, immersion style induction to the PBL process may significantly help students to better adapt. In addition, ongoing support by way of provision of common readings with a mechanism such as the reading sheets provided by BS would enable meaningful discussions between students particularly in the second tutorial session. It also has strong potential to provide a more secure learning environment for students, where they are more accepting of the new approach to learning.

Regular formative feedback to students appears to be a key to their learning development. Including them in evaluating their own learning process, as well as their evaluation of problems and courses engenders a collegial and collaborative culture.

The findings of this study strongly suggest that thorough preparation and support for academics engaged as facilitators for PBL tutorials is essential. Under-prepared or even unwilling facilitators frequently are detrimental to the PBL process and quickly leads to disenchantment by students.

This study has provided strong evidence that students from a Hong Kong culture are able to successfully adapt from their traditional learning environment to becoming self-directed learners immediately after leaving secondary school, provided that they have appropriate support.

Implications for Researchers

There are important implications for researchers, working in PBL, and probably more generally for those with an interest in innovative learning environments and the outcomes they elicit. Researchers have been working for some time trying to validate outcomes for PBL courses generally, and there is still very little published research about full PBL courses.

This study showed that this sample of students perceived themselves as engaging constantly in higher levels of cognitive activity. They were also motivated to learn in a PBL environment. It would be necessary to undertake much more rigorous research with individual students in order to determine exactly what their learning processes are and to what degree they were motivated by their experiences. Replication studies with other samples of students from full PBL courses may be needed to extend these findings. Additionally, this study showed that this sample of students perceived themselves as having developed desirable generic attributes that further prepared them for their future profession.

Research using students' perceptions into other forms of PBL, hybrid and embedded for example, would be interesting. They would provide a basis for comparing process and related outcomes of the types of PBL often cited in the literature under a blanket description as being PBL. The results would allow educators to make evidence-based decisions about which model of PBL to adopt. While PBL practitioners had relatively minor input into this study, it would also be valuable to use their perceptions of effectiveness of PBL.

Data collected in this study could be used to develop and pilot a generic learning environment instrument to quantify learning in full PBL courses. It would need to be further validated across different disciplines and cultures. Such an instrument would enable PBL facilitators to monitor domains of their learning environment and make appropriate adjustments to enhance areas of students' experiences.

Incidental Findings

There were some other findings in this study that, although being peripheral to the main thrust, are worth mentioning because some of them support the findings of other studies and some suggest new areas for research. The incidental findings that support other studies relate to the forms of cognitive activity and the levels of motivation that are induced in a full PBL environment. Comments by some students in this study lent support to Schmidt's (1993) theory about six principles of cognition involved in a PBL educational environment. Other comments by students also lent support to observations by Barrows (1986) and Engle (1999) about a PBL environment motivating students to learn.

Student comments also identified likely new areas of outcomes for PBL environments. These include: development of time management skills; increase of confidence levels for students; development of strategies to foster group harmony; and development of sophisticated self-directed learning skills.

Further Research

Two areas that could be further researched are the suitability of PBL as educational methodology in non-European cultures and a stimulant for self-directed learning. The findings from this study suggest that an appropriately structured and managed full PBL program can be successfully introduced and maintained in a Hong Kong culture with its traditional value and belief systems.

Amongst the generic outcomes of both courses was a strong belief held by students that they had developed self-directed learning skills. This is an important finding that has not been the focus of any specific published study, and should be a stimulus for further research. Three other generic outcomes worthy of further exploration include development of time-management skills, growth of self-confidence and identifying strategies to promote group harmony.

Final Comments

Merriam and Simpson (1995) noted that qualitative comparative studies have the potential to generate substantive theory. The process of identifying similarities and differences between courses and then identifying relationships to develop substantive theory, has been a significant outcome of this study. Techniques used by both full and PBL courses have further identified desirable cognitive, affective and generic attributes as being features, confirming some previous research. Most importantly, this study identified areas of the PBL environment and process that can be significantly enhanced by incorporating relatively minor changes and techniques. These changes can be easily transferable to other PBL courses.

There has been little published research that looks at students' perceptions of PBL courses and there has not been any that compared full PBL courses. This study has been able to identify a range of outcomes to be expected in full PBL courses. In doing so it has confirmed some of the findings of previous research. It has provided evidence of techniques to enhance practice and to improve outcomes. It has also established a sound basis for further research.

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APPENDICES

Appendix A

Comparison of Final Categories, Subcategories and Initial Categories

Final Categories	Final Subcategories	Initial Categories
PBL Environment	Academic Leadership Hong Kong Chinese Culture Resistance to Change Resources Student Orientation Professional Development Curriculum Design Problem Design Assessment and Evaluation	Resource Person Assessment Feedback Training
PBL Process	The PBL Tutorial The Problem The Facilitator The Group	Participation Discussion Interaction Learning Issues Objectives Facilitator Sharing
PBL Outcomes	Cognition Affective Generic	Learning Style Critical Thinking Reflection Holistic Learning Motivation Teamwork Time Management Confidence Leadership Communication Research Skills Decision Making

Note. Initial categories were developed from students' comments only. The final categories and subcategories also include comments by the two academic leaders.

Appendix B

How thematic ideas were reduced to the final category map using QRS NUD*IST 4 computer program

Q.S.R. NUD*IST Power version, revision 4.0. Licensee: David J Johnston.

PROJECT: MGJ PBLEnvProject Yr1,2,3,4 RefNo.271004, User Mignon G Johnston.

(1)	/LEARNING ENVIRONMENT/ACADEMIC
(2)	/PBL PROCESS
(2 1)	/PBL PROCESS/Participation
(2 2)	/PBL PROCESS/Discussion
(2 2 1)	/PBL PROCESS/Discussion/1 Interaction
(2 2 2)	/PBL PROCESS/Discussion/Challenging
(2 3)	/PBL PROCESS/Objectives
(2 3 1)	/PBL PROCESS/Objectives/L Issues
(2 3 2)	/PBL PROCESS/Objectives/L Process
(2 4)	/PBL PROCESS/S Assessment
(2 4 1)	/PBL PROCESS/S Assessment/Feedback
(2 4 2)	/PBL PROCESS/S Assessment/Management
(2 5)	/PBL PROCESS/Evaluation L
(2 6)	/PBL PROCESS/PROBLEMS
(2 7)	/PBL PROCESS/Resources
(2 7 1)	/PBL PROCESS/Resources/Material Resources
(2 7 2)	/PBL PROCESS/Resources/Human Resources
(2 7 3)	/PBL PROCESS/Resources/Time Resources
(3)	/FACILITATOR
(3 1)	/FACILITATOR/Role
(3 1 1)	/FACILITATOR/Expertise/Expert
(3 1 2)	/FACILITATOR/Expertise/Non Expert
(3 2)	/FACILITATOR/Guide
(3 2 1)	/FACILITATOR/Guide/Resource Person
(3 2 2)	/FACILITATOR/Guide/Learning Facilitator
(4)	/GROUP
(4 1)	/GROUP/Dynamics
(4 1 1)	/GROUP/Dynamics/Dominator
(4 1 2)	/GROUP/Dynamics/Pos Contributor
(4 1 3)	/GROUP/Dynamics/Neg Contributor
(4 1 4)	/GROUP/Dynamics/Conflict Resolution
(4 2)	/GROUP/Team

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(4 2 1)	/GROUP/Team/Member
(4 2 2)	/GROUP/Team/Teamwork
(4 2 3)	/GROUP/Team/Coop Learning
(4 2 4)	/GROUP/Team/Sharing
(4 3)	/GROUP/Individual/L Style Individual
(4 3 1)	/GROUP/Individual/Active Learning
(4 3 2)	/GROUP/Individual/Passive Learning
(5)	/COGNITIVE/Schmidt's 6 Principles
(5 1)	/COGNITIVE/Psychological
(5 1 1)	/COGNITIVE/Psychological/Critical Thinking
(5 1 2)	/COGNITIVE/Psychological/Reflection
(5 1 3)	/COGNITIVE/Psychological/Decision Making
(5 1 4)	/COGNITIVE/Psychological/Research Skills
(5 1 5)	/COGNITIVE/Generic/ SDL
(5 1 6)	/COGNITIVE/Generic/Communication
(5 1 7)	/COGNITIVE/Generic/Leadership
(5 1 8)	/COGNITIVE/Generic/Time Management
(5 2)	/COGNITIVE/Affective/Attitude
(5 2 1)	/COGNITIVE/Affective/ Motivation
(5 2 2)	/COGNITIVE/Affective/ Confidence
(5 3 1)	/COGNITIVE/Outcomes/Holistic L
(5 3 2)	/COGNITIVE/Outcomes/Integrated L
(5 3 3)	/COGNITIVE/Outcomes/Progressive L
(5 3 4)	/COGNITIVE/Outcomes/Cumulative L
(5 3 4 1)	/COGNITIVE/Outcomes/Cumulative L/Depth L
(5 3 4 2)	/COGNITIVE/Outcomes/Cumulative L/Meaningful L
(5 3 5)	/COGNITIVE/Outcomes/Experiential L
(5 3 6)	/COGNITIVE SKILLS/Outcomes/Self Evaluation
(5 3 7)	/COGNITIVE SKILLS/Outcomes/Professional Practice
(5 4)	/COGNITIVE/Psychomotor
(5 4 1)	/COGNITIVE/Psychomotor/Skills Labs
(D)	//Document Annotations
(F)	//Free Nodes
(F 1)	//Free Nodes/ISIv Introductions
(F 2)	//Free Nodes/L Env Info
(F 3)	//Free Nodes/Yrs PBL Experience
(I)	//Index Searches

Appendix C

Facsimile of consent form sent to students

STUDENT CONSENT FORM

Dear ... [Student]

You are invited by Associate Dean Academic, Faculty of ....[BD]..................../
Head of Department of ....[BS].................to participate in a research project titled:

Enhancing teaching and learning quality in problem-based learning

The research is part of an ethics committee approved interdisciplinary initiative and will be conducted by the Director, Hong Kong Centre for Problem-Based Learning and an appointed Research Assistant. This project also has the support and permission of the faculty leaders.

The aim of the research is to:

- o investigate student perceptions of their problem-based learning (PBL) experience
- o develop an instrument to evaluate the quality of learning in PBL programs
- o inform program administrators and academic educators and assist in enhancing learning in PBL environments

The specific objectives of the research are to:

- o identify and explore common and specific themes and categories that emerge from the data collected
- o identify any similarities and differences
- o compare students perceptions and experiences
- o analyse and clarify what is important to students in their respective programs

Participation in the research:

The invitation is made to Student Representatives from each year group (1-4) to participate in this research project. Student Representatives are requested to identify another male and another female member from your respective year groups to participate in the research project (Snowballing method). Student representatives are encouraged to participate, however, if you are unable to participate please identify other members of your year group (2

male and 2 female members in total), who are able to provide well-informed perceptions of their PBL program experiences.

Participation is entirely voluntary and you can refuse to participate or withdraw at any time.

Response to this invitation will indicate your consent to participate in the project. Once you have read and understood all of the information concerning the project, would you indicate your availability to participate by email to The Associate Dean Academic/ Head of Department in your faculty.

All data collected will be treated with strict confidentiality. Only the principal investigator and his/her research assistant will have access to the collected data. All data will be coded and no names will be used during the project, in any of the reports or documents intended for thesis work or publication.

Permission to audiotape will be sought from each participant at the commencement of all interviews, including any focus group meeting.

The data will be secured and stored in the Hong Kong Centre for Problem-Based Learning for a period of 5 years/ or as required, as outlined in university policy and university ethics committee guidelines.

Concerns of an ethical nature or complaints about the manner in which the project is conducted should be forwarded to the Executive Officer, Human Research Ethics Committee, Faculty of Education at the University of Hong Kong. Please contact The Director, Hong Kong Centre for Problem-Based Learning for additional information about this project.

Feedback about the reported findings, research outcomes and information generated will be given to any interested parties on request. We hope the project will provide valuable information that will assist in further understanding PBL in an Asian context and contribute to improving the quality of PBL for students in this university.

Yours sincerely,

[Associate Dean Academic/ Head of Department]   Page 2