Investigations
in university teaching and learning vol. 3(2) summer 2006 ISSN 1740-5106

Problem-based Learning Principles & Application to Practice: an example from a practitioner-orientated course

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Keywords: *problem-based learning,*

Introduction

Highly motivated, well-read learners are advantageous in any classroom, from undergraduate programmes to taught doctorate settings, and these dual attributes have encouraged and inspired increasing numbers of HE tutors to introduce modifications on what has become known as PBL (problem-based learning), incorporating this element into their courses (Stevenson, 2005). Whatever its title - it is diversely known as PBL, EBL (enquiry-based learning), and PSL (problem-solving learning) - the criteria underpinning this student-centred approach to learning and teaching require learners to reflect equally upon their skills of enquiry and knowledge accrued, although some precise distinctions have been made (*ibid*, 2005). It is a philosophy of learning that enables students to see the relevance of the learning they need to achieve targets and succeed.

EBL as opposed to PBL is characterized by the student's setting her/his own path to learning, as far as is practically possible. This is different to the problem-based approach where it is more usual for the tutor to set the problem for the students to consider (Price 2003). Palmer states "Enquiry-based learning, as opposed to problem-based learning, empowers students to take charge of their own learning and gives them more freedom to research into topics of personal interest in a way which suits their own learning style" (2002, p.2).

PBL is an educational method that uses problems as the starting point for student learning (Barrows, 1980, cited in Bligh, 1995). It originated from the medical school at McMaster University in Ontario, Canada in 1969, where it was an "energizing, but controversial innovation" (Hamilton, 2005), and an entirely new approach to medical education. Much of the research and writing on PBL today is still focused on that specific discipline. In due course PBL spread to Europe the Middle and Far East, and Australia, (Walton and Mathews, 1989), and has begun to take root in the UK.

As Hinett (2002, pp3-4) states, traditional programmes of learning are front-loaded with content knowledge of the discipline. They only assess students when tutors consider they have an appropriate understanding of the issues involved. This approach is reversed in PBL, where the starting point is a problem for which relevant knowledge and a solution is sought, and the students engage in communication with a variety of agents. In this method the learning is often experiential, and to structure their knowledge and understand their progress students must review their learning journey, i.e. what knowledge/information they have, and what they still need, to solve the problem.

Thus problem-based learning can be found in any learning environment where the problem drives the learning. Using this approach requires that tutors change their role from being the source of knowledge to being the facilitator of the acquisition of knowledge. Thus learning becomes student-centred rather than tutor-centred. Some tutors who, by definition, are expert in their subject may have a tendency to dominate lectures, seminars and tutorials, leaving little room for student initiative, and leading to loss of motivation and perhaps, interest. Thus the tutor needs to gain expertise as a facilitator of learning, as well as having some mere expertise in the topic of study. Posing the problem before the learning is believed by advocates of PBL to be a motivating factor for students, as they understand why they are learning the new knowledge. Learning in the context of the need to solve a specific problem also appears to store more knowledge in memory patterns that facilitate later recall to enable further problem-solving (McMaster Medical School, p. 2). It is believed to assist with co-operative learning as students work together on any tasks, to solve problems, discuss ideas, or compare ideas about a concept.

PBL strategy

Hamilton (2005) sees the original model of PBL as arising from the recognition that the "hypothetico-deductive process" was the key to learning. Walton and Mathews (1989, cited in Newman and Flemming, 2002, p.2) had clarified this further, in arguing that PBL is a general educational strategy, rather than merely a teaching approach, and highlighting three areas of differentiation between PBL and traditional subject-centred programmes, i.e.

1. Curricula organization: around problems rather than disciplines, integrated with an emphasis on cognitive skills in addition to knowledge.
2. Learning environment: use of small groups, tutorials, active learning, student-centred, independent study, utilizing relevant problems.
3. Outcomes: focus on the development of skills, motivation, transferable abilities for life-long learning.

The typical process in PBL is summarized by Boud (1988, cited in Miller et al, 1998) as follows:

- "The problem is encountered first in the learning sequence, before any preparation or study has occurred.
- The problem situation is presented to the student in the same way it would be presented in reality.
- The student works with the problem in a manner which permits his (sic) ability to reason and apply knowledge to be challenged and evaluated, appropriate to his level of learning.
- Need areas of learning are identified in the process of work with the problem used as a guide to individualized study.
- The skills and knowledge acquired by this study are applied back to the problem, to evaluate the effectiveness of the learning and to reinforce the learning.
- The learning that has occurred in the work with the problem and in individualized study is summarized and integrated into the student's existing knowledge and skill." (p. 129)

Schmidt (1983, cited in Newman and Flemming, 2002) also describes seven similar steps, in greater detail.

Thus in PBL, students learn by seeking solutions to problems. Whilst engaged in this they often work in small groups, breaking the problem down into its constituent parts, whilst identifying relationships and connections en route. Individual, independent learning and attendance at time-tabled activities follow, with students searching for answers to questions they have uncovered and raised by themselves during the analysis of material. Not only that but as Jarvis (2002) highlights, students also control the pace and work out solutions to the problem within their groups, which is very different from traditional teaching methods, and other "watered down" (p. 129) variations where disciplines are taught didactically *prior* to the problem being discussed, and then problem-solving undertaken by the students. Jarvis sees this version of problem-based learning as being a form of practice-based education

The students may use the new knowledge to resolve or work with the problem more effectively. Cook and Goreham (2002) believe this can be achieved via the following strategies:

- "Explaining it through informed action
- Choosing alternatives
- Making decisions based on learning
- Identifying further problems and questions" (p.5)

There follows a consideration of what is known now, compared with what was known at the start of the process. Solutions and/or action plans are shared with

group members, they are questioned and choices justified. The learning theorists Eraut (1994) and Schon (1983) propose that for experts to use new knowledge, they have to relate this newly acquired information to their existing knowledge, and this is best done via the means of discussion. It must be mentally rehearsed by talking through the purpose of the information, and explanation, before it becomes usable. Cook and Goreham (2002) state, "This is precisely what EBL sets out to do, and what passive learning does not do well" (p.6), and this valuable active learning is likewise a feature of PBL.

Benefits of PBL

Various claims are made for the effectiveness of PBL in the areas of knowledge, understanding, thinking, communication, teamwork and satisfaction. Major systematic reviews of PBL research are summarized by Newman and Flemming (2002), who note that the different studies were difficult to interpret due to methodological limitations. A review by Vernon and Blake found that "results generally support the superiority of the PBL approach over more traditional academic methods" (1993, cited in *ibid*., p. 4). Similarly, Albanese and Mitchell concluded that PBL was more nurturing and enjoyable and found that PBL graduates performed as well, if not better than others, although they acknowledged potentially vital gaps in their cognitive underpinning knowledge (1993, cited in *ibid*.). However Berkson's findings were unequivocal in that "the graduate of PBL is not distinguishable from his or her traditional counterpart", although the PBL experience may be both stressful for all concerned, and implementation costly (cited in *ibid*.).

On the positive side, PBL can allow the students to follow areas of research that they may never have had a chance to explore in a more conventionally delivered programme (Dahlgreen and Dahlgreen, 2002 cited in Palmer, 2002). One of the main advantages of using this learning approach is that the students should have greater time to discuss and develop critical understanding of theory and research. They will also have the opportunity to develop meta-cognitive skills and dispositions (Katz, 1999) within the problem-based, self-directed learning such as time-management skill-planning, prioritization and decision-making, ability to select the main ideas, elaboration and organization to foster understanding and recall. Other benefits may include increased skills of critical thinking, such as inductive and deductive reasoning, critical analysis, inference and evaluation, open-mindedness, truth-seeking and inquisitiveness ((Kumar, (1994), Kist et al. (1990), Mentkowski and Doherty (1984) and Johannsson cited in Woods 1996).

Results from research at the Harvard Medical School's PBL programme (Moore et al., 1994 cited in Bligh, 1995) found that students reflected more on their learning, memorized less than their peers, and preferred active learning. Their interpersonal skills, psychosocial knowledge and attitudes to patients (including levels of patient-

centredness and empathy) were better, and they felt more stimulated and challenged, leading to higher levels of student satisfaction with the programme overall. Students also had greater retention and recall of knowledge in the months ensuing. They also reported significantly greater autonomy, more innovation and involvement, and were more sure of themselves in handling uncertainty. Although the researchers acknowledged that students adapt to whichever learning environment in which they find themselves, the students on the traditional curriculum were more likely to use the key words "non-relevant, passive and boring" to describe their experience. In addition, Hoon–Eng Khoo et al (2000, cited in Jarvis, 2002, p. 130) found that students regard this approach to learning as fun. Their research skills showed considerable improvement, and the use of library resources increased. However the PBL students did report aspects of concern over what and how much to study, as well as some frustration and anxiety over some interpersonal aspects of tutorial work (Bligh, 1995).

The research of Norman and Schmidt (1992) from McMaster, found that students using PBL have a greater intrinsic interest in learning as well as having self-directed learning skills enhanced and subsequently retained, although, initially, the PBL method may reduce the amount the students learn. Leong, 2000 (cited in Jarvis, 2002, pg. 130), who actually practices PBL, expressed similar concern that, because the whole of an academic discipline may not be covered in depth, there is a lack of holistic understanding. While she is positive over the technique's emphasis on student-centred learning, she proposes a hybrid model of PBL that enables the teachers as facilitators to work with students and utilize their expertise in examining the problem. On the other hand, Newman and Flemming (2002, p. 5) contend that "it is not clear whether the constituent parts of PBL produce an incremental effect if implemented singularly (as in a Hybrid curriculum)".

In her work on student experiences of PBL, Savin-Baden (2000) refers to the students' personal stance as the way in which participants see themselves in relation to the learning context, and ascribe meaning to their experience within that context. She writes of their experience of fragmentation when core aspects of their values, attitudes and beliefs are threatened due to a conflict between their expectations and the initial encounter with PBL. She details how students come to realise that PBL offers them a learning experience where they are able to promote their own development and self-discovery, through the positive experience of self-validation and support from both staff and peer-group. Learning may be discovered as not just the receiving of information, but about taking responsibility for one's own learning, unique to each individual, and as a means of understanding oneself, and content and process in relation to the world around. They are also able to define their future selves in perceived roles. For Savin-Baden (2000) it is this domain of personal stance through which the PBL enables students to discover and give meaning to their "life-world" (p.72) the students are able, often for the first time, to engage effectively

with the knowledge being learned, through heightened awareness of the relationship between their prior experience and the subject matter.

Facilitating PBL

It is important for staff to understand the different kind of role involved in problem/enquiry driven learning. Cook and Goreham (2002) envision the facilitator's tasks as follows:

- Interacting at the metacognitive level
- Keeping the learning process moving sequentially
- Probing participants knowledge deeply
- Ensuring all participants are fully involved in the group process
- Educational diagnosis
- Modulating the challenge of the problem
- Managing interpersonal dynamics
- Role changes over time e.g. coaching, modelling, fading.

Regarding Milligan's concern (1999 cited in Palmer 2002) that the PBL method may result in some students gaining from the efforts of others within the group, the tutor should take steps to ensure that this does not happen by clearly indicating that tasks should be divided equally, preferably in writing, on a schedule of the task/problem-solving process. In addition, throughout the time-scale allocated for the task, tutor review times could be scheduled when interpersonal dynamics such as this area for potential conflict, can be discussed and resolved.

According to Cormack (1989, cited in Savin-Baden, 2003), conflict often emerges when one person wants what s/he cannot have. Savin-Baden (2003) sees team conflict as relating to power and personality issues, and writes of them in terms of stances and territories. She highlights the bullying, ridicule and criticism that can occur on some HE courses, and says it is more apparent in PBL groups because of the demands and the intensity. This can manifest itself as individuals being marginalized or dominated, with huge impact on the individual. She recommends students learning from the literature on conflict management, and tutors developing trigger resources and activities to enable students to engage with these difficult issues at the outset of the programme (pp71-2).

Duek (in Evenson and Hmelo, 2000) in research with an ethnic mix of students (i.e. asian, black, hispanic and white) discusses equity of student discourse in PBL, having observed and identified certain patterns. The more notable and consistent roles she identified speak for themselves and include:

- The Discussion Dominators
- The Hypercontributors
- The Referencer and the Silent Scribe

Beyond these she also observed patterns of behaviour frequently discerned across all group members, including "overtalking, withdrawing, participating peripherally and undertalking". She emphasizes the right for all participants of whatever gender, race or disability to have a voice. In her study students did not participate equally in the group discourse, nor did they ask equivalent numbers of questions: white males were the largest contributors. Tutor presence caused a decrease in the participation of white females. Duek suggests

> *"…students should be made aware of group dynamics and should be empowered to take responsibility for their own participation and contribution to the group. If we wish to create skilled problem solvers, then training the students in effective group participation [is] important… In this way, students could learn the value of positive interdependence and become increasingly metacognitive, self-directed learners…"* (pp. 104-5).

Bligh (1995) sees a recurring concern as being that PBL costs more in terms of staff time, yet, he argues, that its effect is not to increase teaching time but "rather to change how this time is spent" (p. 342) as tutors using this method focus more time on working with their students.

Assessment processes play a crucial role in the effectiveness of any curricula. Boud (1988 cited in Miller et al, 1998, p. 182) describes three fundamental components of assessment that have been emphasized in PBL. These are:

1. The importance of careful specification of learning objectives and criteria for assessment.
2. Assessment as a process rather than a measurement activity
3. Assessment is for the benefit of student learning

Lovie-Kitchin (in Schwartz et al. 2001) states that PBL is a serious attempt to match the context in which knowledge is learnt with the context in which it will be applied, whilst incorporating many generic skills students need to acquire. Thus "it is logical that the assessments in a PBL course should reflect these different goals" (p. 154).

Overall, the PBL literature highlights the psychosocial change that occurs amongst staff and students. Both teacher attitudes and the cooperative ambience throughout the PBL curriculum mean that participants find the learning environment more stimulating but also more humane. For any higher education programme seeking to foster student retention, and any educational process that promotes enjoyment while learning, without a consequent loss of the discipline's knowledge base and

associated skills, PBL must be worth consideration, if not as a whole curriculum conversion, then as a teaching and learning strategy within the delivery of the course content.

Applying PBL: an example

For tutors on the Early Childhood Studies Scheme [ECSS] at London Metropolitan University, working almost exclusively with mature women returners who are beginning part-time undergraduate study, the introduction of aspects of PBL into teaching and learning is not just about enhancing learner motivation and increasing reading thresholds. It may help achieve these, yet it could also provide learners with a foretaste of learning experiences they may come across throughout their life-long learning and in their future careers. As Clarke and Engel (1979, cited in Hamilton 2005 pg. 5.), found "Only the constant practice of formulating and answering searching questions is likely to create the habit of continuing education". As Stevenson (2005) endorses, learning by enquiry could enable ECSS participants to sample the kind of problem-based, collaborative activity that is so valued in professional life outside and beyond the University. In the same way, trainee nurses, teachers, architects, dentists and managers may all come to understand their field by engaging with problems which simulate those they will face at work (Stevenson, 2005).

This approach seemed particularly appropriate for the module "Early Years Provision: Principles and Practice" (YC 1005N). It was rather dense and heavy in content and in need of a good variety of teaching and learning strategies to keep the pace of delivery lively and hold student interest, particularly as it is usually held between 5.30-8.00pm after the mature students have had a full day in their work-setting. This module is at the Preliminary Certificate level of the B.A. in Early Childhood Studies. It was hoped that incorporating the PBL element would encourage successful learning, resulting in increased achievement, as well as aiding retention enabling these initial women returners to progress to higher levels of study, due to increased confidence and motivation. Hence, a problem was devised for a group to enquire about and report back to the class as a whole.

The aim was for students to experience a far wider range of topics whilst learning one strand of the module (Views of Childhood). Other aims are to foster independent and cooperative learning and research skills, which will be essential elements for successful progression, and to develop students' ability to write for a target audience and to make oral presentations to a group. As their validated assessment for this module is, in part, an oral presentation, and they have to undertake several of these types of assessments, at all three levels of the ECSS course, this will also provide support for those developing skills.

Initially, prior to starting the PBL task, students will engage in an explanation about the method utilized and an activity to clarify and enhance their view of themselves as problem-solvers with subsequent discussion. They will also undertake Belbin's (1981) team-role questionnaire, to illustrate how this can enhance the compatibility of team members. Savin-Baden (2003) agrees that students should be encouraged to explore their stance and role within the team or group and acknowledges the use of diagnostic tools such as Belbin's audit. She believes it is important for students to recognize both their interactional stance, and examine their pedagogical stance, to enable them to fully understand how they interact with others in the learning environment, as well as the relationships within their own team or group, in addition to the tutor-student relationships at both individual and team level.

After this initial guidance and training activity, students will then take part in PBL exercises. Working in small groups participants will:

- Apply her/his existing knowledge and experience in order to deal with the unfamiliar situation.
- Identify what s/he needs to learn by formulating questions:-
  a. for me as the tutor,
  b. for other group members,
  c. for her/himself to answer independently
- Share and apply the new questions

Appropriate tasks are allocated and the self-directed learning tasks divided into three parts:

1. issues-raising and prioritization;
2. self-study and
3. the use of the new knowledge (Branda, (1993) cited in Woods, 1996)

Four weeks later they will present their findings to the rest of the class. Here reflection and discussion help to elaborate the final presentation. The tutor, and whole class will listen to and comment on student findings. This activity has been designed to demonstrate effective student-student and student-lecturer feedback.

Possible improvements in the future might also include guidance and training in the practice of peer-assessment and in giving feedback. This could include further suggestions as to how possible disagreements between students/peer-assessors could be resolved successfully (Tierney et al 2003). Benbow and McMahon (cited in Schwartz et al. 2001, p. 125) suggest the importance of identifying the potential strengths of individuals within a PBL group so they can be used for the overall good of the group. Both issues will require further monitoring.

If student-led sessions are utilized as a method of formative assessment this will ensure that each individual involved works both independently and cooperatively whilst engaged in (a) preparing her/his own part of the presentation and (b) putting together the group presentation. This overcomes the difficulty of PBL, mentioned above, of the student benefiting from the work of others when the group is working towards a single solution. In addition the formative assessment of the session, by peers and tutor, encourages students autonomy and higher order thinking skills (Bostock 2001, and Brown, 1998, cited in Palmer, 2002).

As Tierney et al state (2003), PBL provides the opportunity for students to:

- Develop peer-assessment skills;
- Engage in teacher and peer dialogue around learning;
- Clarify what good performance is (goals, criteria and expected standards) and
- Ensure learning outcomes are attained.

Palmer (2002) states the process of synthesizing individual research into a coherent whole for a group presentation is a valuable learning experience. In engaging with the PBL exercise, ECSS practitioner-students will have the opportunity to benefit from other students' areas of expertise and problem investigation during collaboration, and to share their own.

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