

# PROBLEM-BASED LEARNING (PBL): MAKING AN IMPACT IN EDUCATION

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**ABSTRACT:** Problem-based learning (PBL) is an educational reform that is now becoming a household word in higher education, particularly in medical schools. Many medical schools have implemented a full problem-based learning curriculum (PBLC) while some have included PBL into selected units of the course in an otherwise conventional curriculum (embedded PBL) and others run their tutorials in a PBL manner within a modified conventional curriculum (hybrid curriculum). Yet there are others who claim that small components of PBL in a conventional curriculum are not PBL at all. Thus amateurs in the subject matter find difficulty in evaluating the logistics and outcome of these variations. This article focuses on the general characteristics of PBL and how this learning method can help enhance independent learning and critical thinking, whether in a full, embedded or hybrid curriculum. The extent of PBL to be included and which of the three types is to be adopted depends on the objective of the undergraduate medical course as determined by the faculty, resources available, limitations, feedback on the existing curriculum and various other factors. (*JUMMEC 1999; 2: 94-98*)

**KEYWORDS:** Problem-based Learning (PBL); Embedded PBL; Hybrid PBL; New Integrated Curriculum (NIC).

## Introduction

Medical education has evolved mainly through the need to produce trained doctors in the scene of a rapidly developing science and technology, and rapid changes in the disease spectrum. The future doctors will be exposed to massive information and will be applying skills unforeseen at present. In order to cope with the information overload, educational institutions strive to educate doctors capable of adapting to change, new ideas and development, and possessing the attitude of continuing medical education throughout their professional life. The problem-based learning approach has been advocated by many educationists as one of the processes that can help accomplish this task. The Problem-Based Learning Curriculum (PBLC) in medical education was first implemented in the McMaster University School of Medicine, Ontario, Canada in 1969. Since then various medical institutions have implemented the PBL curriculum. These include Harvard University, University of New Mexico, University of Southern Illinois and Michigan State University in USA, University of Sherbrooke in Canada, and University of Newcastle in Australia. There are however many institutions that include PBL as complementary components in

certain aspects of the course or parts of their course (1,2).

Recently, universities in our region such as National University of Singapore, University of Hong Kong and Universiti Malaysia Sarawak (UNIMAS), started a similar concept in medical education. Universiti Sains Malaysia (USM) introduced PBL from the second year onwards, in an integrated curriculum (3) while Universiti Kebangsaan (UKM) introduced small PBL components into an otherwise conventional medical curriculum (4). In the 1<sup>st</sup> Asia Pacific Conference on PBL held in Hong Kong in December 1999, more than 230 participants worldwide met to present their papers on various aspects of PBL in a variety of courses. Although most papers referred to the medical course, others included pharmacy, nursing, economics and business studies, education and science. The Medical Faculty of the University of Malaya is taking several steps in the process of introducing PBL style tutorials or components into the New Integrated Curriculum (NIC) that was first implemented in 1998.

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## The new integrated curriculum (NIC)

The undergraduate medical programme at the Faculty of Medicine, University of Malaya, Kuala Lumpur, enrolled its first batch of students in 1963. Since then several reviews and improvements have been carried out on the medical curriculum (5, 6). The most recent curriculum planning was done based on the twelve reforms of the Edinburgh Declaration, reiterated at the World Summit on Medical Education held in Edinburgh in 1993 (7). These include relevant educational settings, a curriculum based on healthcare needs, emphasis on disease prevention and health promotion, lifelong active learning, competency-based learning, teachers trained as educators, integration of science with clinical practice, multi-professional training and continuing medical education. Therefore the NIC was planned with the additional objectives of producing graduates with better attitude, communication and leadership skills, and to develop interest in continuing education and medical research (6).

The NIC is made up of three major strands that span through a 5-year programme. The strand on the Scientific Basis of Medicine forms the core knowledge, with the additional strands of Personal and Professional Development (PPD), and Doctor, Patient, Health and Society (DPHS) introduced to achieve the additional objectives. Phase I takes up just over a year, Phase II consists of 1.5 years and Phase III is covered in 2.5 years. The lectures in the Phase I and Phase II programmes were synchronized within most systems in the scientific basis strand. The PPD strand is made up of a week of nursing practice, 2 weeks of electives, and lectures or seminars in the Attitude, Character and Ethics (ACE) programme and the Management programme. The DPHS strand consists of some core lectures and a Community and Family Case Studies (CFCS) programme, where a patient is allocated to two students to be followed through the 5 years. More patient-oriented and other self-directed learning packages were introduced as a complementary strategy to promote active learning, and the mode of assessment modified. The also course contains some problem-based learning (PBL) components. The cases selected for the PBL tutorial component in the present Phase II attempts to integrate aspects of all the three strands in patient care. The consideration for the inclusion of PBL was more focused on the first and second year of the programme as it was considered more didactic than the clinical years.

## What is problem-based learning (PBL)?

This is a difficult phrase to define as it has been claimed that there are variations of PBL. However after going through various publications (1, 8, 9, 10) and personal communications (11, 12, 13), in general the most fundamental concept for PBL is any learning environment that drives the student to learn new knowledge and skills,

working in small groups. During the process of trying to understand and seeking possible solutions to the problem or case given, the students acquire (a) integrated factual knowledge in context, unconstrained by subject divisions, (b) skills in self-directed learning, clinical reasoning and teamwork, and (c) self motivation. In the context of medical education PBL is a learning process where various **patient-centred problems are used as a starting point** for the students **to learn how to acquire knowledge in the basic and clinical sciences** in an **integrated manner** along with **reasoning skills**, clinical or otherwise. During this process, with the guidance from their tutors and resource persons the students gradually become **independent learners**. The learning process is considered as more student-centered and self-directed.

The PBL approach is in contrast to the more familiar "case approach" widely used in most conventional curriculum, where the problem or patient's case is used as a means to integrate previously learned knowledge obtained mainly through structured lectures. Thus this mode of learning is not considered as PBL by some (10, 14). In instances where PBL is incorporated as part of or is complementary to an otherwise conventional curriculum a selected part or topic in the medical curriculum could be organized so that the students learn through the PBL process. This type of curriculum has been referred to as an embedded PBL curriculum. Examples of PBL environment may include research projects that compel the students to learn new knowledge instead of mere integration of previously learned knowledge. Such environment does exist in the NIC, specifically the electives (15) and Community and Family Case Studies (CFCS), although in the latter programme the learning objectives are made known and not fully decided by the groups of students involved (16).

In a PBLC such as the one conducted in McMaster, Harvard and Calgary the students will learn only using the activities mentioned earlier. The factual knowledge is not obtained through exhaustive lectures. Small group tutorials and independent study constitute the main activity while laboratory work and formal clinical skill sessions are kept to a minimum. Lectures are a novelty, being very general in presentation and used only for the students to identify their own learning issues individually and as a group (11, 12). Lectures and demonstrations are considered as optional enrichments for students. The learning process is totally integrative in nature with no subject divisions such as Anatomy, Physiology or Biochemistry or identification of clinical or pre-clinical knowledge.

## The PBL learning process

The PBL learning process includes the following features (17, 18):

1. *The trigger:* The students encounter the patient-problems (ie. the triggers) first before they learn the basic science or clinical concepts, and not after. The problems, given to the students one at a time in small groups, are designed accordingly; either to focus on a certain organ system or to be more general to allow free enquiry. Whichever is the case the design of the problems must ensure that there are overlaps in coverage so that the different groups of students will eventually acquire the basic knowledge expected at the end of each course.

2. *Brainstorming:* Using the problem given, the students will initially rely on their previous knowledge that is relevant, and from there identify their learning needs and objectives for the given problem as a group. They then decide on how to acquire knowledge on the issues raised. Members of the group will decide on how to distribute their workload and responsibilities, the time required to gather the information and the number of meetings required. During this process they learn to

- work as a team,
- be responsible for the group's achievement,
- recognize contributions from other members of the team.

Ideally the tutorial groups should consist of no more than six students.

3. *Discussion and hypothesis generation:* After the students have gathered their information from various sources, they meet to discuss and share what they have learnt, hypothesize on the issues raised, and evaluate their progress.

The tutor's role in these sessions is only to monitor progress and interaction (11, 19, 20). The tutor may intervene if there are personality conflicts to be resolved, the discussion is losing direction or becoming a deadlock. This should be done appropriately without dominating the group. An ideal tutor should get to know the students in the group, create an environment that is friendly and non-threatening, foster cooperation rather than competition, give constructive verbal feedback, and listen, observe and act when required.

### **Small group session, time and schedules**

It has been stressed that in PBLC more unscheduled time is required compared to the conventional medical course (11, 13, 18, 20). This time is required for:-

- the small groups of students and their tutors to work out their own educational plan
- the students to organize meetings to work out the given problem
- the students to work out their own self study plans

These activities, organized in the unscheduled time, are important since each group takes varying length of time and number of meetings (with or without their tutor) to achieve maximal learning from each problem given. The problems are also of varying complexity and the number of learning issues raised varies. Each learning issue also requires a certain amount of time to comprehend. Weekly meetings are arranged between the students and their tutors. This is to provide an avenue for the students to talk about the course, problems they have encountered, suggestions for changes in the course, and comments on learning resources and learning methods.

In this case several guidelines were suggested to facilitate learning. It was recommended that the staff involved provide an overview or helpful way of handling difficult concepts or facts. Secondly, new or important facts or concepts could be presented in lectures, including those that may have future significance for medicine.

### **Advantages of PBLC compared with conventional curriculum**

The advantages of the PBLC approach are mostly related to the process of learning itself.

1. *Posing a problem before the students learn the facts motivate them to learn because the knowledge to be acquired is considered relevant (17,18).*

It could also be argued, as in the case of the NIC at UM, that presenting clinical scenarios (cases of patients) by clinicians at the beginning of the various systems lectures could show relevance to what is to be learnt. Feedback from students of NIC and the previous curriculum agrees with this assumption. The difference with PBLC however is that with the scheduling of extensive lectures students become passive learners, especially the less motivated ones. In fact, surveys done in 1994, 1996 and 1998 indicated that they would prefer to have the clinical scenarios presented after the systems lectures. Exposing and training the students to some PBL process may modify this attitude. However, it has been noted, at Queen's University in Ontario, Canada, that even mature students tend to readjust and become passive learners when extensive lectures are scheduled after PBL tutorials (21).

2. *Active learning in the context of the need to understand and solve a problem tends to store integrated knowledge with better understanding rather than rote learning. Students develop and use the scientific and medical reasoning process as they learn (14).*

In the NIC, problems are also given for the students to solve. However in this case, since the students have already acquired some knowledge prior to the given

problem, solving it is mainly an activity that promotes greater understanding and integration of the subject matter. The case used can be extended into a PBL if it requires the student to seek new knowledge to solve or understand some aspects of the problem. To promote active learning, the students need to identify their own learning objectives and this can be promoted by excluding questions that induce rote learning. This shift was noted during the Phase II integrated or multi-disciplinary PBL tutorials that were started in December 1999 at the Faculty of Medicine, University of Malaya.

### **Where does NIC stand?**

As mentioned earlier, within the realms of the Phase I and Phase II, the NIC does contain some aspects that allow students to progressively meet some of the objectives of PBL through various activities, although they may not be considered as pure PBL. These include:-

- (1) elective projects, where students in groups of four (in Phase I) or two (in Phase II) undertake a project under the supervision of a faculty member;
- (2) CFCS, where pairs of students learn through interacting with the patient, his/her family and the community associated with the patient.
- (3) selected patient/paper cases in Phase I, although the focus of the problems tend to be more subject-based, where the students need to acquire new knowledge in the said subject independently so as to understand or solve the problem.
- (4) integrated or multi-disciplinary PBL tutorials in Phase II, which will also be introduced in Phase I in the near future.

### **Areas of concern on the implementation issues for teachers changing to a problem-based learning concept**

Tony Dixon (13) mentioned that changing from something familiar to another that is relatively new is unsettling. This is especially so for teachers who had been raised with the traditional concepts in education, where the teaching is didactic and mostly teacher-centred. To accept PBL one has to undergo three paradigm shifts, that is, a change in the understanding of education, a change in the understanding of subject content and a change in the understanding of the system/arrangement that promotes education. Most common issues raised towards PBL are:

*1. Teachers question the non-uniformity of knowledge acquired between groups.*

A common concern amongst teachers is that in PBLC the different groups of students will not acquire uniform information. In the old paradigm, the teacher giv-

ing the lecture is the main source of information. With that is the belief that since the same content of knowledge is transmitted to all the students thus all will have acquired the same information. However if one could read each of the students' minds one would then discover that this perception is not true since the amount the students "absorb" depends on their previous knowledge, attentiveness in class, interest in the subject matter and various other factors.

*2. Subject specialists worry about depth*

Another common concern is that the students may not have a solid foundation in PBLC and that the information acquired by students is in bits and pieces, not according to subject's priority sequence. In the old paradigm, who decides when and how much should be given? Is it the curriculum committee, the various departments or the individual lecturers? When it comes to implementation a variation of the three is in play. How then does a student cope with the information overload from each of the specialized disciplines, especially in this new era of information and technology?

The new paradigm consists of a holistic approach, promotion of understanding and interaction with the environment, and the ability to adapt and change as they learn. Learning in context promotes integration of subject matter, and any conflict that may arise promotes learning. Learning in context also allows selection of knowledge to be learnt and thus reduces rote learning. Communication, teamwork and early interaction with patients promote the element of care. In all these the teacher facilitates and helps the students through discovery learning.

*3. Facilitators feel inadequate when materials to be dealt with are outside their subject specialty.*

This is a valid apprehension and one that has to be overcome not only through training workshops but also by facilitating the students through the PBL tutorials, and learning with and from them. Learning is best done through experience, both for the students and the facilitators.

Prepared tutors' guides may help the tutor to gauge whether the group has identified most of the learning objectives suggested for the learning package. Self and group evaluation which is carried out at the end of every group meeting may help to reduce this apprehension.

*4. Teachers felt that Asian students do not have the confidence to discuss in a PBL format.*

During a PBL regional workshop held in the Faculty of Medicine, University of Malaya, in November 1999, the Phase II students were asked to volunteer for the PBL tutorials training session. It was observed that the students present were able to carry out independent group

discussions. During the group feedback, in their respective tutorial groups, a number of students were quite direct in informing the "tutors" of the unnecessary interruptions they had during the tutorial. It was noticed that once the students see that their opinions are valued they tend to be more vocal and would contribute to the development of the programme. Feedback from the workshop questionnaires indicated that the teachers were apprehensive about their students' ability to handle self-directed learning in PBL and so were the students.

## Conclusion

PBL is a process or arrangement that is taking an important role in medical schools and various other courses in our region. The reasons for this are many and some have been mentioned earlier. Some institutions will continue to use the pure model or PBL while others will make various modifications to suit their resources and limitations.

## Future challenges in the curriculum change

Several strategies have to be considered to meet future challenges. Problem-based learning requires a high degree of faculty commitment and collaboration. As mentioned earlier, how much PBL could be included depends on the objectives of the medical course. At present PBL components can be developed to hybridize with the system-based lectures within the NIC. Learning packages for PBL have to be prepared by academic staff and some form of recognition has to be awarded for their time and effort. Therefore remuneration system has to be reviewed. PBL will cause disorientation to the teachers and to the less motivated students, thus initial training is necessary. Both the student and teacher need to understand the PBL process to ensure success of implementation. Needless to say the method of assessment will have to be improved in various aspects including the criteria that determine the pass or fail mark and the type of questions asked. Questions that require encyclopaedic answers will defeat the purpose of PBL and will influence the way the students learn.

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