

# **An Introduction to Problem-Based Learning**

## **in the Faculty of Health Sciences at McMaster University**

### **LEARNING OUTCOMES:**

**At the end of this module, you will be able to**

1. Describe Problem-based learning and its core principles
2. Discuss the process of the PBL approach and the role of the tutor
3. Be able to identify and manage group processes in PBL
4. Discuss methods of assessment in PBL

### **Part 1. History and Context of Problem-based Learning at McMaster University**

Problem-based Learning (PBL) started at McMaster University with the founding of its medical school with Dr. John Evans as its first Dean in 1965. The founders had a vision of a radically different medical school experience that moves away from passive, “monotonous lectures” on separate basic and clinical science topics to a more integrated approach. They conceptualized a way of student-centred learning that actively engages students in a self directed manner. They reasoned that such a method would allow students to acquire lifelong self directed learning skills in problem solving, information retrieval, critical appraisal, and self assessment, thereby building the capacity to deal with ongoing advances in medical knowledge and treatment. This approach reflects the “real clinical world” and is thought to be more motivating and enjoyable.

PBL as defined by the founders at McMaster University was described as

Learning that results from the **process** of working toward the understanding or resolution of a problem. The problem is encountered *first* in the learning process and serves as a focus or stimulus for the application of problem solving or reasoning skills, as well as for the search for or study of information or knowledge needed to understand the mechanisms responsible for the problem and how it might be resolved” (Barrows & Tamblyn, 1980).

Others have expanded on the original definition. Wood (2003) states:

In...PBL, students use triggers from the problem case...to define their own learning objectives. Subsequently they do independent, self-directed study before returning to the

group to discuss and refine their acquired knowledge. Thus PBL is not about problem solving per se, but rather uses appropriate problems to increase knowledge and understanding”

Maudsley (1999) summarizes the principles of PBL as the following:

- Central is the “problem” that serves as the trigger for learning (“problem-first learning”)
- Knowledge is built upon, acquired, synthesized and appraised from the process of working through the problem
- Involves both self-directed learning and collaborative small group work
- Student-centred with tutor as facilitator of learning rather than information provider

The classic McMaster PBL approach includes the following components:

- Developing of learning objectives based on the problem or case
- Identifying educational resources, seeking assessing and synthesising information
- Bringing back synthesized information to the problem at the next tutorial
- Discussing the findings
- Tutors act as facilitators for group processes and discussion
- Self, peer and tutor-based assessment

The success of the PBL approach at the McMaster medical school influenced its spread to the other schools and programs in Faculty of Health Sciences, including the newer programs such as the Midwifery Education Program (est.2003) and the Physician Assistants’ Educational Program (est. 2008). PBL is used in small group settings in both the Physiotherapy (PT est. 1973) and Occupational Therapy (est. 1978) curricula. PT and OT Schools from across Canada, USA and international jurisdictions have sought out PBL expertise from McMaster School of Rehabilitation Science (SRS).

Since mid 1970s the McMaster Nursing program has applied the PBL methodology to 60% of its curricula within nursing courses. The School of Nursing has also been recognized as an expert in PBL, conducting consultations across the world ( eg. Australia, Asia, Denmark, Germany, South Africa, United Kingdom). The nursing curriculum has evolved to include Person based learning using a Problem Based Learning approach (PBL/PBL). Narratives are used in the curriculum as the stimulus for student learning using the PBL process to guide discussion & understanding of relevant information. The PBL approach is used in both small & large groups throughout the four years of the nursing program.

Following McMaster’s leadership, PBL has also been adopted by many other universities and medical schools in the world as a standard method of instruction. At McMaster University, PBL continues to evolve in different schools and contexts in response to challenges of changing needs, student demographics, faculty and resources. What remains core to PBL are:

- The problem or case serving as the stimulus for learning as students generate learning objectives, search and critically appraise the information
- Students engage in self-directed learning, starting with own pre-existing knowledge and experiences, broadening and deepening it from working collaboratively in a group setting
- Student-centred learning process facilitated by a tutor in order to enable learners to achieve learning objectives

## **Part 2 Becoming a PBL tutor: the Cognitive Basis for PBL and Facilitating Small Group Learning**

### *The Cognitive Basis for PBL*

The “problem” or “case” is the central starting point for Problem Based Learning. The steps of the PBL tutorial process are:

- Identifying the problem (group work)
- Exploring pre-existing knowledge (group work)
- Generating hypotheses and possible mechanisms (group work)
- Identifying learning issues and objectives (group work)
- Self study and research based on the above (individual and group work)
- Re-evaluation and application of new knowledge to the problem (group work)
- Assessment and reflection on learning (group work)

The goals of PBL are:

- To foster clinical reasoning
- To enhance acquisition, retention and use of knowledge in clinical contexts
- To promote self-directed learning
- To increase motivation for learning

The cognitive basis for the benefits of PBL as a teaching approach is based on the following (Norman, 1992):

- Activation of prior knowledge facilitates subsequent processing of new information – helped by group discussion
- Elaboration of knowledge at the time of learning enhances subsequent retrieval – helped by discussion or application to a case.
- Matching context facilitates recall – concepts integrated in a relevant case
- Studying concepts while attempting to solve a problem is an optimal strategy for spontaneous transfer of the concept to new problems – so long as corrective feedback is provided

Learning in PBL is facilitated by the tutorial group process, the problem/case and the tutor.

### *The Tutorial Group Process*

There is strong evidence from the literature that small groups facilitate learning both from a cognitive and social perspective. Having to communicate and explain ideas and theories to others reinforce concepts and cognitive elaboration. From a constructivist perspective, the social benefits include friendship, increased motivation from peer support and peer pressure, and increased engagement and collaborative teamwork skills. Typically, group sizes of 6 to 8 are preferred for balancing the learning needs of the individual and the group, however research has not been conclusive on the optimal group size.

Group formation undergoes a number of phases as described by Bruce Tuckman in 1965:

Forming-→Storming→Norming→Performing

The “Forming” phase is characterised by:

- High dependence on tutor for guidance and direction
- No group aims – other than provided by tutor
- Individual roles and responsibilities unclear
- Group members may test tolerance of the tutor or the “system”
- The tutor directs everything in the group

The “Storming” phase is characterized by:

- Individual rather than group decision making
- Competition amongst group members
- Lack of focus in group activities lack focus and cohesion
- The need for tutor to coaching the students through this phase

The “Norming” phase is characterized by :

- The development of consensus in the group
- Roles and responsibilities become clear and are accepted by the students
- Commitment and unity amongst the students are strong
- The tutor can facilitate and enable small group activities

In the Performing phase:

- The group is now “strategically” aware
- The group knows what it is doing – and why
- The group has a high degree of autonomy
- The group can handle disagreements
- The tutor can facilitate group – but in a less directive fashion

In 1975, Tuckman added a fifth phase: Adjourning.

- Adjourning is the break-up of the group
- Group has achieved something – individuals are moving on
- Close bonding in the group may cause some to feel insecure or threatened by changing to another group
- The tutor can anticipate feelings of vulnerability and explain that these feelings are natural

### *The Problem*

The central role of the tutorial problem or case is to engage the student but it also creates situational interest, which encourages self-directed learning, another hallmark of PBL. Self-directed study increases as students mature in PBL. There is evidence that PBL students take more personal responsibility for their learning.

### *The Role of the Tutor*

The PBL tutor DOES the following:

- Climate setting-creating a safe environment conducive for self directed learning
- Preparation: Understands the objectives, goals of the problems and tutorial
- Manages group dynamics, time and process
- Facilitates student learning with effective questioning and constructive feedback
- Helps group clarify learning needs, objectives, keep on track
- Helps students evaluate and summarize learning activities and outcomes after self study

The PBL tutor does NOT:

- Lecture or dominate the discussion
- Dictate pace
- Allows learners to go too far off-track
- Act as a passive bystander
- Give students the “answer”
- Avoid addressing conflicts, issues in group processes

The PBL tutor can facilitate learning through the use of the following teaching techniques:

**Scaffolding:** defined as a temporary help or support for learners to enable them achieve something that they couldn't do on their own.

**Feedback:** Immediate feedback more useful if learners are incorrect in their answers/formulation/ hypotheses or if learners are not confident in their responses

**Socratic questioning:** Questions used to probe understanding

**Analogous transfer:** Recognition of the general principles learned in the context of one problem as being useful in solving problems from a second, conceptually similar domain

**To facilitate analogous transfer:**

- Mentors (Tutors) should make explicit mention of similarities between problems from different domains
- Students should be given tasks that stimulate searching for the deeper structures of novel problems
- Tutors should provide immediate feedback to learners on their explanations and guide them in recognising analogies.
- Tutors should provide multiple examples to help students build on abstract scheme by generalising from examples

**Cognitive Congruence:** Refers to the tutor's ability to express him/herself in the language of the learners using the concepts learners also use

**Social Congruence:** Refers to the tutor's ability to communicate informally and empathically with learners

*Efficacy of PBL compared with "traditional" curricula*

There is mixed evidence as to whether knowledge acquisition improved in PBL compared with more traditional methods of teaching (Hartling et al, 2010). Most studies showing little or no difference (Vernon & Blake,1993, Albanese & Mitchell, 1993; Colliver 2000; , Newman 2003; ) and others showing better long term retention (Norman & Schmidt 1992) and practice skills with PBL (Dochy 2003). Conclusions from studies hampered by lack of methodological rigour

Koh et al.'s (2008) meta analysis suggests improved competencies in communication skills, appreciation for legal, ethical and cultural aspects of care, self directed learning, and coping with uncertainty. Studies support PBL as more enjoyable and engaging for students, and promoting enhanced self-directed learning

*Facilitating a tutorial group:*

For a video on a PBL tutorial session, please click on the following link:

<http://fhse.d.mcmaster.ca/PFD/tutorialMacSupers>

## **Part 3: Managing group processes and assessment in PBL**

### *Transitioning from information provider to facilitator: your first day as tutor*

A number of challenges are associated with PBL tutoring compared with more traditional forms of teaching. New PBL tutors need to make the transition from the concept of the teacher as “information provider” to that of teacher as “facilitator”. Originally, Early PBL advocated non-content experts as preferred tutors as it was thought that they would be less directive, less information provider, and provide more support for self-directed, student-centred knowledge discovery). However, currently, it is held that some content knowledge is useful, particularly with new students, to facilitate learning, prevent misconceptions and to keep the discussion on track (Neville, 1999). The PBL tutor also needs to be aware of normal small group processes and be able to manage them effectively. Finally, they need to be aware of the different aspects of formative and summative assessment in PBL.

In managing group processes, the first tutorial group meeting is crucial for setting the tone and direction. It is important for tutors to

1. Be Prepared
  - Know the course curriculum, learning objectives, and outcomes and overall curriculum
  - Be clear on group tasks and goals
  - Be explicit on your roles as facilitator of learning
2. Establish a safe, respectful environment
  - Orientation and introduction of group members,
  - Along with the students, establish group roles, norms and expectations
3. Anticipate and manage group processes and conflicts
  - Help group navigate and work out conflicts through the storming/norming phase
  - Protect group members from being scapegoated
  - Facilitate group trust and cohesion by successful management of conflict
4. Give descriptive, explicit feedback and support
5. Know when to act and when to step back

### *Challenging group processes*

There are a number of common challenges to tutorial group processes:

- The “Quiet” Group Member
- The “Dominating” Group Member
- The Group that keeps “Storming”

We will be further discussing the management of these challenges during the PBL workshop but it is useful to refer to: Walsh, A. (2005). *The Tutor in Problem Based Learning: a novice’s guide*. Program for Faculty Development, FHS, McMaster University for some suggestions.

A general approach to managing group process difficulties include: carefully listening to the perspectives of all group members, clarifying issues in the group in order to understand the underlying causes and focusing on facilitating group solutions. The emphasis is on open group conversations about issues and conflicts although on occasion, there may be a need to speak privately to a student. However, the tutor must avoid any situations involving collusion. Decisions and progress need to be monitored, and followed up on an ongoing basis. Tutors are also encouraged to seek advice and support from experienced peer faculty facilitators, unit planners, course/program coordinator, and other resources.

For some examples on how to deal with common tutorial process challenges, see the following videolink: <http://fhscd.mcmaster.ca/PFD/tutorialMcBloopers>

### *Assessment and feedback in PBL*

Assessment can be classified as formative or summative. Formative assessment is used for learning purposes. Used as feedback, formative assessment is essential for the development of expertise. Summative assessment is used to make decisions on promotion, based on specific criteria. Formative assessment/feedback is recommended on a regular basis after each tutorial session and consists of self, peer, and group assessment. These assessments can be used to assess and address group processes, student contributions, communication skills and professional behaviour. However, the ability of tutors to assess knowledge based on PBL alone is limited, therefore additional ways of assessing knowledge are needed. Summative assessment should be based on program’s objectives and expected learning outcomes and competencies. Each school has its specific process and forms for formative and summative assessments.

Effective feedback is characterised by the following:

- A culture of respectful dialogue amongst learners and tutor
- Elicits learner self-assessment of performance and understanding of expectations
- Linked to learning objectives and to actual observable learning outcomes and behaviours
- Specific, focused at what is changeable
- Non-judgemental, descriptive, framed as positively as possible
- Well timed, close to the event
- Specific recommendations for achieving desired performance
  - Adapted from Ende, 1983 and Walsh, 2005

### **SUMMARY**

- Since its inception in the 1960's at McMaster University, PBL has been adopted by other schools in FHS and worldwide
- PBL is characterised by: the problem or case serving as the stimulus for learning, student centred, self-directed and small group learning in a dynamic process that is facilitated by the tutor
- PBL as a teaching method has both cognitive and social effects
- Small group learning entails a number of processes and steps
- The PBL tutor has a very important role to play in supporting the learning process in PBL at both the individual student and the group level
- Strategies and resources exists to help tutors navigate challenging group processes
- Assessment and feedback are essential for learning

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