Supporting Group Learning

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PBL: an introduction

A new educational method

“Problem-based learning (PBL) surfaced over 30 years ago as a reaction to the problems and shortcomings of conventional educational approaches.

Through experience and research in many different educational arenas it has evolved into what was a distinct educational method aimed at giving the learner effective skills in problem solving, self-directed learning as a life-time habit and teamwork, all while acquiring an integrated body of knowledge from many different subject areas or disciplines.

This integrated information, learned while working through a problem, is structured in the learner’s mind for later recall and application to future problems and tasks. One of the method’s strongest attributes is that it is an engaging and motivating way to learn as the learner works with problems that are challenging and perceived as relevant. The student realizes that the learning required to solve and understand the presented problems is useful and appropriate.”

Four keys to the method

“First, the problems are presented to the learner in the way they would present in the real world, as unresolved ill-structured problems, stimulating the generation of multiple hypotheses about cause and management.

These problem simulations are designed to allow free inquiry by the learners to gather more information in their attempt to achieve understanding and resolution, while practicing and perfecting problem-solving skills.

Second, the learners have to assume responsibility for their own learning, determine what it is they need to learn and find the appropriate resources for the information from the world about them (texts, libraries, online, experts). In addition, they have the responsibility to monitor and assess their own performance and that of their peers. Problem-based learning is a learner-centered learning method.

Third, to cause this to happen, the teacher’s role is that of a guide or facilitator of learning; commonly referred to in PBL as a tutor. As PBL teachers in secondary education put it, the tutor is a guide at the side of the learner instead of a sage on the stage at the front of the class. It is an adult–adult relationship with students aimed at growth and independence, not a parent–child relationship so common between teacher and student in traditional teacher-centered learning.

Fourth, the problems chosen are those most apt to be confronted by the learner in life and career.
The skills and activities required of the learners are those valued in the real world—making PBL an authentic learning process.”

Extracted from: Barrows, H. (2002). Is it Truly Possible to Have Such a Thing as dPBL? Distance Education, 23(1), 119 - 122.
The cognitive bases of PBL

The following is based on Schmidt’s (1983) classic discussion

There are three conditions that facilitate learning:

1. The role of prior learning.
   “[Learning] presupposes earlier knowledge that is used in understanding new information”

   PBL has the potential to activate prior relevant knowledge when problems are presented:
   (a) as a neutral description of an event of phenomena that need to be explained in terms of underlying processes,
   (b) that actually do lead to problem solving activities eg students asked to investigate water filtration will not be problem-solving in the same way as students who are told “Villagers in this province have little money, no drains, poor access to metropolitan centres and there are high levels of water-borne disease. What can be done?”
   (c) as concretely as possible
   (d) with a degree of complexity adapted to students’ prior knowledge.

2. Similarity between learning and practice situations
   “The closer the resemblance between the situation in which something is learned and the situation in which it is applied, the better the performance. This phenomenon is called encoding specificity.”

   PBL has the potential to encode specificity to the extent that problems have a close resemblance to problems that students will come across in later professional life. It may also be useful to choose problems that are:
   (a) frequently encountered in the chosen setting
   (b) urgent or life-threatening
   (c) potentially serious in their outcomes
   (d) often poorly handled by professionals

3. Elaboration of knowledge
   “Information is better understood, processed and retrieved if students have the opportunity to elaborate on that information.”

   PBL has the potential to prompt elaboration through use of:
   (a) posing and answering questions
   (b) discussing with other students
   (c) taking notes
   (d) teaching peers what they have first learned themselves
   (e) writing summaries
   (f) formulating and criticizing hypotheses about a given problem
The tutor’s role in the PBL process

**Guiding the learner**

“Initially, the tutor guides the students through meta-cognitive questioning to stimulate their problem solving, identification of what needs to be learned and from what resources, their critique of their study and resources, the application of new learning back to their problem work, their summarization of what has been learned and their self and peer evaluation...As the students gain comfort and experience with the method, the tutor withdraws, commenting only when scaffolding seems indicated.”

Source: Barrows, H. (2002). Is it Truly Possible to Have Such a Thing as dPBL? *Distance Education*, 23(1), 119 - 122.

**Intervening in the problem-solving process**

“The problem based learning tutor is not authoritarian. Barrows and Tamblyn believed that the tutor should have expertise in group facilitation (process expertise) rather than a subject area (content expertise). Ross disliked the tutorial label; he viewed problem based learning sessions more as professional strategy meetings than teaching sessions. In problem based learning, the tutor facilitates or activates the group to ensure that students progress satisfactorily through the problem. According to Margetson, the tutor does this by “questioning, probing, encouraging critical reflection, suggesting and challenging in helpful ways – but only where necessary.” Most new tutors in problem based learning are challenged by the “where necessary” (deciding when and how) part of intervention.

**Ways of Intervening**

From experience at McMaster University, Woods outlined two main, question based ways for tutors to intervene. These are, firstly,

- to ensure that students approach the problem appropriately

and, secondly

- by challenging students’ assumptions, to ensure that they reflect on and justify their assertions

A third type of intervention could be added to these:

- to close each session by enabling reflection on the dynamics of the group and what has been learned.

In addition to understanding the essence of problem based learning and work within small groups, therefore, the tutor must be skilled in facilitation, active listening, motivating learning, and critical reflection.”

Styles of PBL and the importance of scaffolding the PBL process

“Scaffolded inquiry and problem-based environments present learners with opportunities to engage in complex tasks that would otherwise be beyond their current abilities. Scaffolding makes the learning more tractable for students by changing complex and difficult tasks in ways that make these tasks accessible, manageable, and within student’s zone of proximal development...Quintana et al. (2004) conceived of scaffolding as a key element of cognitive apprenticeship, whereby students become increasingly accomplished problem-solvers given structure and guidance from mentors who scaffold students through coaching, task structuring, and hints, without explicitly giving students the final answers. An important feature of scaffolding is that it supports students’ learning of both how to do the task as well as why the task should be done that way.

Scaffolding not only guides learners through the complexities of the task, it may also problematize important aspects of students’ work in order to force them to engage with key disciplinary frameworks and strategies...Such scaffolds act by “rocking the boat” and stopping mindless progress through the task, thus redirecting students’ attention to important learning goals such as examining counter claims, articulating explanations and reflecting on progress. Scaffolding is often distributed in the learning environment, across the curriculum materials or educational software, the teachers or facilitators, and the learners themselves...Teachers play a significant role in scaffolding mindful and productive engagement with the task, tools, and peers. They guide students in the learning process, pushing them to think deeply, and model the kinds of questions that students need to be asking themselves, thus forming a cognitive apprenticeship.”


Over time, the many different contexts for the use of PBL have resulted in the development of number of different styles of PBL, in which learning can be facilitated in different ways. The following pages include some commonly used and methodologically and pedagogically sound scaffolds which will assist you to structure your facilitation of your PBL groups, both in-person or online.
"Triple jump" is a phrase that is often heard to describe a particular form of assessment associated with Problem Based Learning (see below), but in fact it can be applied to most structures used in PBL learning processes. It closely approximates the inductive method in science (Chalmers 1982) and as such prepares students for many different learning, working and thinking experiences in their later lives.

The three stages can be thought of like this:

First jump: Observation

PBL begins with a ‘problem in the world’ in the shape of a prompt provided by the instructor. This prompt should provide a context as close as possible to the future professional context. Since problems in the real world are usually messy and ill-defined this allows students to learn how a professional defines problems by selecting only the relevant information from the vast corpus of possible observations. Students take part in discussion around this prompt to decide what is and what is not is relevant, allowing them to draw on prior knowledge and to begin elaborating their knowledge in discussion with others.

Second jump: Proposing hypotheses

All observation is theory dependant behaviour and this jump aims to help students articulate the underlying assumptions that drew their attention to the observed facts. They do this by proposing possible explanations for what they have observed. Students frequently want to jump direct to this stage but it is important that hypotheses can be linked to particular observations and are not ‘free-floating’ and unmotivated. Once again prior knowledge and elaboration are important learning principles.

Third jump: Testing hypotheses

This jump comes in two stages. First students have to decide what needs to be known and how they will acquire that knowledge. Secondly, they must do some research, articulate their findings back to the group and help the group synthesise all contributions into a coherent learning.

3(a) Identifying learning issues

Having articulated some explanatory hypotheses for the observation students need to decide what they need to know in order to confirm or refute those hypotheses. That is, they need to decide what kind of evidence will count to answer their questions. Having done that, they then need to decide where they will look for the evidence and allocate research tasks among the group. Possible sources of information include scholarly literature, knowledgeable professionals in the field, raw data gathering and of course the Internet. Students should be encouraged to evaluate the likely worth of each one and what each will contribute to their understanding.

3(b) Building knowledge collaboratively

The actual research on the learning issues is usually done individually although large tasks may be shared among a subset of the group. Each individual has to report back to the group not only on what they have found out but also on how that information changes their collective understanding of the issue that was raised by the original prompt. It is very important that each report is synthesised in such a way that everyone knows how all the individual pieces fit together and what that means for everyone’s understanding of the whole.
Step 1: A trigger such as an authentic case study used. This may be in the form of a video documentary or piece of reportage from an actual event or situation, along with other primary source material, which together pose a range of professional issues and problems. Students are assessed on their ability to identify and evaluate issues and problems arising from the material presented.

Step 2: Students are then placed into groups where lists are consolidated and prioritised, with each group member negotiating a particular issue or problem to be individually investigated and reported upon. Students are assessed here on their ability to work collaboratively towards an agreed outcome (via a piece of work evaluating the group process and its effectiveness).

Step 3: Students have a defined period (such as a week) in which to employ their own research and investigative skills in pursuing their topic. Their results may be presented in a variety of formats, including literature reviews, reports and plans of action, or a colloquium may be facilitated where oral presentations are given. Students are primarily assessed on their ability to plan and manage a project, as well as the rigour and quality of their findings.
"In the first stage (problem definition), students were given a problem with a minimal amount of information. The students used the information to ask their tutors a series of questions to elicit more information that may or may not have been available. This enabled students to bring prior knowledge to bear on a novel problem and devise an educational plan to identify the items of information needed to solve that problem. They then went on to conduct an information search (stage two) for 2–3 h and returned for a third period (synthesis and feedback) with the information they had acquired, and a period of re-appraisal and synthesis followed. The students assessed their own performance, and the tutor gauged their abilities to ask questions, use prior knowledge, and seek and synthesize information within a limited time frame.

Phase 1 hypothesis generation Students are given limited data from an experimental study. Using the available information, the students frame 1–3 possible explanations for the data. The answers are handed in.

Phase 2 design of experimental tests Students are expected to choose one of their explanations and design a suitable test or tests to confirm or deny their expectations.

Phase 3 re-assessment Students are given [or seek] more information (usually the original paper on which the TRIPSE is based or a set of references) and asked to re-assess their original explanations/tests in view of the new information [or the outcomes of prior experimentation].

It is important to emphasize to the student that there is really no one correct answer, only sets of answers ranging in credibility. Although it is ideally suited for basic sciences, because it models the practice of modern science, the format can be quite easily adapted to clinical scenarios, as well. It is important to have a trial run of the procedure with the students so that they get some practice. This serves to dispel anxiety."

This outline of students’ activities describes suggested steps in the STEP process, the activities which students perform within these stages, the environment and conditions in which these stages are performed, and the representational tools which can aid in achieving the goals associated with each of the stages (e.g. the individual and group whiteboard templates).

According to the authors:
“The three-session design of the pbl activity does more than structure students through activities; it also ensures that students pay adequate attention to the preliminary and follow-up phases contained therein...

By placing students’ collaborative work between two other sessions of individual activities, we are able to ensure both adequate preparation prior to discussion and adequate reflection and follow-up by individuals after the collaboration has occurred. Session One, which precedes discussion, orients students to the kinds of “mindset” that pbl activities require, familiarizes them with the overall learning objectives and how each activity helps them meet those objectives, and engages them in thinking deeply about the problem before discussing it with their peers. Session Three, completed after the discussion, ensures adequate follow-up on what was learned individually, providing each student with the opportunity to articulate his or her own individual final solution to the problem...and then reflect back on how his or her initial ideas changed by investigating...concepts and discussing their importance...”


Alternative to this basic design, if a course requires a more group-based format throughout the process, the STEP framework may be easily adapted, for example as suggested below:
Step 1  Students view video case/given scenario (can be done online)

Step 2  Individuals conduct preliminary analysis of scenario and how it can be improved/problems resolved, prepare notes to bring to online group session

Step 3  Online group meeting to:
- Share and negotiate ideas
- Generate learning issues
- Conduct research
- Reason through ideas using evidence from research

Step 4  Individual composition of final solution
- Comparison to others’ ideas/priorities
- Reflection on products and processes (further scaffold needed here, for example the use of a representational tool for students to use)

Step 5  Group report (as per whiteboard in Figure 1) stating list of:
- possible solutions (what should be done)
- why implement each solution (using evidence from research), and:
- pros and cons of each solution

Derived from:
I. The structure of the teaching/learning sequences in problem-based learning

A) The first time the group meets:

1) Introductions and background of each member.

2) Establishing the climate and ground rules.

B) The first session with a new problem.

1) Establish learning objectives.

2) Evaluate and manage the problem, as far as possible, with the present knowledge and skills possessed by the group. The problem is taken on as an unknown without prior preparation.

   a) Develop an initial concept of the problem on the basis of information available at the outset.

   b) Generate multiple hypotheses as to the cause of the problem.

   c) Carry out an appropriate inquiry to attempt to establish the more likely cause.

   d) Analyze new data obtained through inquiry as it relates to the forming picture of the problem.

   e) Add the new data that is thought to be significant, particularly in light of the hypotheses obtained, to a growing problem synthesis.

   f) Continue this process, scanning for new information when stuck, creating new hypotheses as appropriate.

   g) Decide at an appropriate point, despite inadequate or confusing data, on the most logical cause (hypothesis) and the appropriate treatment for the problem using criteria such as prevalence, seriousness, and treatability.

3) As the above process is going on, learning issues should be identified and recorded whenever knowledge or skills to understand appropriately or deal effectively with the problem or aspects of the problem are found to be lacking in the group.
4. At the completion of the problem encounter, when the group has committed itself to the probable mechanisms responsible for the problem and its management, the areas of needed learning through self-directed study are identified.

5. The appropriate resources for this learning are decided upon and also the time required for self-directed learning before the group returns to the problem.

C) Self-directed study is carried out by the individual members of the group for the time negotiated. During this, members of the group may decide to work together and consult, but there is no formal group meeting.

D) Follow-up session, following self-directed study, to complete work with the problem.

1. The learning resources used in self-study by each member of the group are critiqued and decisions are made about more appropriate resources in the future.

2. The problem is encountered again from the beginning, now that the group has learned all it thought it needed to learn in the first encounter with the problem. Problem solving with new knowledge, applying what has been learned in self-directed study. The same stages are used as in B2 (above). As this is done, the group critiques its prior thinking. Further learning issues may surface and a new self-directed study period may be necessary before the next few steps are undertaken.

3. Conscious integration of new learning. The group verbalizes, systematizes and integrates the new information and skills gained.

4. Evaluation of problem solving skills, self-directed study skills and group support skills of each student is carried out in the group. The evaluation of each student is initiated by the student himself.
II. The **structure** of the Tutor’s teaching process

A: Modeling the performance expected of the students through example by the tutor himself or through close coaching by the tutor to produce the desired performance in the students.

B: Guiding the students with challenges and comments at the metacognitive level.

C: Withdrawal from the group as the students begin to function effectively on their own, until the tutor is no longer necessary.

III. The **structure** of the group’s interpersonal process

A: Initially, the students are courteous to each other and to the tutor and on their best behavior.

B: Eventually conflicts in personalities, behaviors and opinions invariably become apparent and may detract from the group’s effectiveness.

C: Conflict resolution is followed by effective, high output by the group.

This scaffold is useful as a more detailed break-down of the triple jump process, with further support in the intervening steps. It is particularly useful for in-person group work and in the early stages of group work, when students are less familiar with the PBL process and with working with others in the group.
Goals, strategies and techniques for facilitators of PBL

Identifying goals and matching facilitation strategies

“The PBL teacher is a facilitator of student learning, and his/her interventions diminish as students progressively take on responsibility for their own learning processes. This method is characteristically carried out in small, facilitated groups and takes advantage of the social aspect of learning through discussion, problem solving, and study with peers...The facilitator guides students in the learning process, pushing them to think deeply, and models the kinds of questions that students need to be asking themselves, thus forming a cognitive apprenticeship...As a cognitive apprenticeship, PBL situates learning in complex problems...Facilitators make key aspects of expertise visible through questions that scaffold student learning through modeling, coaching, and eventually fading back some of their support. In PBL the facilitator is an expert learner, able to model good strategies for learning and thinking, rather than providing expertise in specific content. This role is critical, as the facilitator must continually monitor the discussion, selecting and implementing appropriate strategies as needed. As students become more experienced with PBL, facilitators can fade their scaffolding until finally the learners adopt much of their questioning role. Student learning occurs as students collaboratively engage in constructive processing. The dilemma for the facilitator is to provide affordances for this constructive processing in the same way as Chi, Siler, Jeong, Yamauchi, and Hausman (2001) have argued that good tutors do.

The facilitator’s overall educational goals for the student [are] for them to be able to:

(E1-5)

(1) [develop factual, procedural and conceptual knowledge and awareness of the links among them]
(2) Employ an effective reasoning process
(3) Be aware of knowledge limitations
(4) Meet knowledge needs through self-directed learning and social knowledge construction
(5) Evaluate their learning and performance

The facilitator’s performance goals [are] to:

(P 1-4)

(1) Keep all students active in the learning process
(2) Keep the learning process on track
(3) Make the students’ thoughts and their depth of understanding apparent
(4) Encourage students to become self-reliant for direction and information

The facilitator’s overall strategy to help students address these goals [is] to use open-ended questions and the PBL process. The open ended questions [address] most of the educational goals while keeping all students involved and making their thinking visible.
The PBL process refers to the small-group process that features:

- Ill-structured problems
- Hypothesis generation
- Revision and evaluation
- Inquiry
- Decision making
- Identification of learning issues
- Self-directed study
- Reflection

A list of some of the strategies as well as the goals they address are summarized in Table 1:

<table>
<thead>
<tr>
<th>Facilitation strategies</th>
<th>Goals</th>
<th>How goals accomplished?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of open-ended and metacognitive questioning</td>
<td>E1--4, P1, P3, P4</td>
<td>General strategy to encourage explanations and recognition of knowledge limitations</td>
</tr>
<tr>
<td>Pushing for explanation</td>
<td>E1, P3, E3, P3, P4</td>
<td>Construct causal models Students realize limits of their knowledge</td>
</tr>
<tr>
<td>Revoicing</td>
<td>E1, P2, P1, P1</td>
<td>Clarify ideas Legitimate ideas of low-status students Mark ideas as important and subtly influence direction of discussion</td>
</tr>
<tr>
<td>Summarizing</td>
<td>E4, P1, P1, P3, P4</td>
<td>Ensure joint representation of problem Involve less vocal students Help students synthesize data Move group along process Reveals facts that students consider to be important</td>
</tr>
<tr>
<td>Generate/evaluate hypotheses</td>
<td>E2, E4, P2, E1, E2, P3, P4</td>
<td>Help students focus their inquiry Examine fit between hypotheses and accumulating evidence</td>
</tr>
<tr>
<td>Map between symptoms and hypotheses</td>
<td>E1, E2, P3, P4</td>
<td>Elaborate causal mechanism</td>
</tr>
<tr>
<td>Check consensus that whiteboard reflects discussion</td>
<td>E5, P2, P4, P1, P3, P4</td>
<td>Ensure all ideas get recorded and important ideas are not lost</td>
</tr>
<tr>
<td>Cleaning up the board</td>
<td>E5, P4, P2, P2</td>
<td>Evaluate Ideas Maintain focus Keep process moving</td>
</tr>
<tr>
<td>Creating learning issues</td>
<td>E4, P4, P2, P4</td>
<td>Knowledge gaps as opportunities to learn</td>
</tr>
<tr>
<td>Encourage construction of visual representation</td>
<td>E1, E5, P3, P4</td>
<td>Construct integrated knowledge structure that ties mechanisms to observable effects</td>
</tr>
</tbody>
</table>

Questioning skills in PBL

Questioning is consistently recognized as an essential tool for facilitators in PBL learning environments. However, questioning skills and practices should be developed consciously in order to ensure that they are used as effectively as possible to help achieve intended learning goals.

“Questions can help with

- goal setting,
- guiding cognitive processing,
- activating prior knowledge,
- focusing attention,
- promoting cognitive monitoring, and;
- promoting displays of knowledge

One might ask information-seeking questions in response to a knowledge deficit. Questions can also be used to check whether participants have a shared understanding, which may be important in creating norms for collective responsibility. Participants may use questions to coordinate interactions thus allowing effective collaboration. Task-oriented and monitoring questions can help maintain effective group discourse, support meta-cognitive processes, and keep the group focused on the task at hand. They can help expose students’ thinking and make it available for discussion of discrepancies that emerge and subsequent negotiation of understanding... Different types of questions can afford different kinds of reasoning, independent of the mechanisms that generated them. Questions that require deep reasoning and explanations are associated with improved learning outcomes.

Good teachers help provide learning opportunities for students and they often do so by asking questions rather than providing explanations... Such teachers tend to use questioning techniques that build on students’ ideas to promote deep thinking... In PBL, it is the students who assume much of the agency and authority for their own learning. Good questions can help students take on this responsibility.”


Such skillful questioning requires careful consideration of the aims, type and wording of a specific question in relation to what it hopes to achieve. Use the table below to help examine your understanding and use of questions, and how they can help your students progress through the PBL process.
<table>
<thead>
<tr>
<th>Question Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short answer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Verification</td>
<td>Yes/no responses to factual questions.</td>
<td>Are headaches associated with high blood pressure?</td>
</tr>
<tr>
<td>2. Disjunctive</td>
<td>Require a simple decision between two alternatives</td>
<td>Is it all the toes? Or just the great toe?</td>
</tr>
<tr>
<td>3. Concept completion</td>
<td>Filling in the blank or the details of a definition</td>
<td>What supplies the bottom of the feet? Where does that come from?</td>
</tr>
<tr>
<td>4. Feature specification</td>
<td>Determines qualitative attributes of an object or situation</td>
<td>Could we get a general appearance and vital signs?</td>
</tr>
<tr>
<td>5. Quantification</td>
<td>Determines quantitative attributes of an object or situation</td>
<td>How many lymphocytes does she have?</td>
</tr>
<tr>
<td>Long Answer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Definition</td>
<td>Determine meaning of a concept</td>
<td>What do you guys know about pernicious anemia as a disease?</td>
</tr>
<tr>
<td>7. Example</td>
<td>Request for instance of a particular concept or event type</td>
<td>When have we seen this kind of patient before?</td>
</tr>
<tr>
<td>8. Comparison</td>
<td>Identify similarities and differences between two or more objects</td>
<td>Are there any more proximal lesions that could cause this? I mean I know it's bilateral.</td>
</tr>
<tr>
<td>9. Interpretation</td>
<td>A description of what can be inferred from a pattern of data</td>
<td>You guys want to tell me what you saw in the peripheral smear?</td>
</tr>
<tr>
<td>10. Causal antecedent</td>
<td>Asks for an explanation of what state or event causally led to the current state and why</td>
<td>What do you guys know about compression leading to numbness and tingling? How that happens?</td>
</tr>
<tr>
<td>11. Causal consequence</td>
<td>Asks for explanation of consequences of event/state</td>
<td>What happens when it's, when the, when the neuron's demyelinated?</td>
</tr>
<tr>
<td>12. Enablement</td>
<td>Asks for an explanation of the object, agent, or processes allows some action to be performed</td>
<td>How does um involvement of veins produce numbness in the foot?</td>
</tr>
<tr>
<td>13. Expectational</td>
<td>Asks about expectations or predictions (including violation of expectation)</td>
<td>How much, how much better is her, are her neural signs expected to get?</td>
</tr>
<tr>
<td>14. Judgmental</td>
<td>Asks about value placed on an idea, advice, or plan</td>
<td>Should we put her to that trouble, do you feel, on the basis of what your thinking is?</td>
</tr>
</tbody>
</table>

(Continued on next page)
<table>
<thead>
<tr>
<th>Question Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Group dynamics</td>
<td>Lead to discussions of consensus or negotiation of how group should proceed</td>
<td>So Megan, do you know what they are talking about?</td>
</tr>
<tr>
<td>16. Monitoring</td>
<td>Help check on progress, requests for planning</td>
<td>Um, so what did you want to do next?</td>
</tr>
<tr>
<td>17. Self-directed learning</td>
<td>Relate to defining learning issues, who found what information</td>
<td>So might that be a learning issue we can, we can take a look at?</td>
</tr>
<tr>
<td>18. Need clarification</td>
<td>The speaker does not understand something and needs further explanation or confirmation of previous statement</td>
<td>Are you, are you, Jonathan are you talking about micro vascular damage that then, which then causes the neuropathy?</td>
</tr>
<tr>
<td>19. Request/Directive</td>
<td>Request for action related to PBL process</td>
<td>Why don’t you give, why don’t you give Jonathan a chance to get the board up.</td>
</tr>
<tr>
<td>Statement Type</td>
<td>Definition</td>
<td>Example</td>
</tr>
<tr>
<td>----------------</td>
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</tr>
<tr>
<td>Collaboration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. New idea</td>
<td>Mentioned idea not previously introduced</td>
<td>Uh, it’s a deficient, deficiency of cobalamin</td>
</tr>
<tr>
<td>2. Modification</td>
<td>Changing an idea previously mentioned—may include elaboration, clarification, revision</td>
<td>Vitamin B12, cobalamine or</td>
</tr>
<tr>
<td>3. Agreement</td>
<td>Indication of shared opinion or understanding</td>
<td>Oh. You’re right.</td>
</tr>
<tr>
<td>4. Disagreement</td>
<td>Indication of difference of opinion or understanding</td>
<td>But their ileum is gone and they can’t absorb the B12. That’s different than pernicious anemia.</td>
</tr>
<tr>
<td>5. Meta</td>
<td>Indication of monitoring individual or group understanding, progress, self-directed learning</td>
<td>We all just did a, we kind of talked about something that wasn’t right. And you clarified it. That the pernicious anemia refers specifically to vit, intrinsic factor.</td>
</tr>
<tr>
<td>6. Other</td>
<td>Statements that do not fit into categories 1–5 or were unintelligible</td>
<td>Hmmm. That’s [unintelligible]</td>
</tr>
</tbody>
</table>

Complexity (for categories 1–4)

| 1. Simple      | Claims or assertions without any elaboration or justification | Like pernicious anemia is a big one. |
| 2. Elaborated  | Statements that include definitions, examples, comparisons, judgments, and predictions without causal warrants | Technically pernicious, pernicious anemia is technically just the loss, the lack of intrinsic factor. |
| 3. Causal elaborated | Includes explanation of how an event or process occurs, how current state arose, or consequence of a process or event | Vitamin B12 and folate both lead to megaloblastic situation. |
Intervention Workflow Chart

**Decision 1**
Identify problem in PBL group

**Decision 2:** Select the educational (E1-5) and/or performance goal/s (P1-4) which need to be addressed in order to solve this problem

- **(E1-5)**
  1. Develop factual, procedural and conceptual knowledge and awareness of the links among them
  2. Employ an effective reasoning process
  3. Be aware of knowledge limitations
  4. Meet knowledge needs through self-directed learning and social knowledge construction
  5. Evaluate their learning and performance

- **(P 1-4)**
  1. Keep all students active in the learning process
  2. Keep the learning process on track
  3. Make the students' thoughts and their depth of understanding apparent
  4. Encourage students to become self-reliant for direction and information

**Decision 3:** Select facilitation strategies to help address those goals (refer table below or section 6)

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Goals</th>
<th>How goals accomplished?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of open-ended and metacognitive questioning</td>
<td>E1-4, P1, P3, P4</td>
<td>General strategy to encourage explanation and recognition of knowledge limitations</td>
</tr>
<tr>
<td>Pushing for explanation</td>
<td>E1, P3, E3, P3, P4</td>
<td>Construct causal models Students realize limits of their knowledge</td>
</tr>
<tr>
<td>Revolving</td>
<td>E1, P2, P1</td>
<td>Clarify ideas Legitimate ideas of low-status students Mark ideas as important and subtly influence direction of discussion</td>
</tr>
<tr>
<td>Summarizing</td>
<td>E4, P1</td>
<td>Ensure joint representation of problem involve less vocal students Help students synthesize data Move group along process Reveals facts that students consider to be important</td>
</tr>
<tr>
<td>Generate/evaluate hypotheses</td>
<td>E2, E4, P2, E1, E2, P3, P4</td>
<td>Help students focus their inquiry Examine fit between hypotheses and accumulating evidence</td>
</tr>
<tr>
<td>Map between symptoms and hypotheses</td>
<td>E1, E2, P3, P4</td>
<td>Elaborate causal mechanism</td>
</tr>
<tr>
<td>Check consensus that whiteboard reflects discussion</td>
<td>E5, P2, P4</td>
<td>Ensure all ideas get recorded and important ideas are not lost</td>
</tr>
<tr>
<td>Cleaning up the board</td>
<td>E5, P4</td>
<td>Evaluate ideas Maintain focus Keep process moving</td>
</tr>
<tr>
<td>Creating learning issues</td>
<td>E4, P4</td>
<td>Knowledge gaps as opportunities to learn</td>
</tr>
<tr>
<td>Encourage construction of visual representation</td>
<td>E1, E5, P3</td>
<td>Construct integrated knowledge structure that ties mechanisms to observable effects</td>
</tr>
</tbody>
</table>

**Decision 5:** How will strategies be implemented/worded/presented to group?

If helpful, refer to relevant question/statement types (from tables on previous three pages) to formulate template for implementation.

**Decision 6:** Has strategy been successful in achieving goals and solving problems?

Monitor results of intervention, reflect on successful elements of strategies, adjust and maintain strategies as needed, record results for future reference.
Reflective aids for PBL facilitators

**The role of reflection in learning**

“Productive reflection promotes important knowledge integration processes of

- expanding one’s repertoire of ideas, and;
- identifying weaknesses in one’s knowledge.

The combination of these two knowledge integration processes spurs engagement in other knowledge integration processes where students link and distinguish among ideas, thus fostering the development of coherent understandings.

In the knowledge integration perspective ... a learner is considered to have a repertoire of ideas that the learner applies in different contexts. As learners integrate their knowledge, they

- add ideas to their repertoire (expand their repertoire),
- identify weaknesses in their knowledge (critique their knowledge),
- differentiate among the ideas (make distinctions), and;
- make connections or links among them.”


**Effective reflection on learning promotes maximum learning outcomes in any learning environment, and should therefore be employed by both PBL students and facilitators. Following is a framework to aid in examining reflection as a complex, hierarchical and cumulative process.**

**The 5Rs Reflective Scale**

The 5Rs Reflective Scale is a hierarchy which describes the levels and complexity at which reflection can occur. Reflection in its most basic form occurs at component 1; the reporting level, and at its most complex at component 5; reconstructing. This scale is cumulative, however, with each prior level being contributing to the next. Students should be encouraged to work towards reflecting at the highest level, through awareness and practice of the reflective scale, and the behaviours such reflection involves. The following checklist may be distributed to students for their own use, or to aid in facilitator assessment of reflective behaviours. Alternatively, facilitators may use the scale to guide an in-depth examination of their own practice.

The 5Rs Reflective Scale

Component 1  Reporting
The learner describes or reports what happened or what the issue or incident involves

Level 1  A minimal description of the incident or issue is given.
Level 2  A broad description of the incident or issue is given, with limited elaboration of potentially significant details.
Level 3  The description provides sufficient detail to allow readers to draw their own conclusions about the incident or issue

Component 2  Responding
The learner responds to the incident or issue by making observations, expressing feelings or asking questions.

Level 1  Learner draws attention to significant aspects of the incident or issue or expresses their feelings in relation to the incident or issue.
Level 2  As for level 1, but the learner also makes a judgment regarding the incident or issue, for example “the session went well”
Level 3  As for level 1 or 2, but in addition the learner poses a question or identifies a problem

Component 3  Relating
The learner relates or makes a connection between the incident or issue and their own skills, experience learning or understanding.

Level 1  The incident or issue is related to:
- the learner’s own strengths, weaknesses or personal learning, or to
- professional matters, or to
- future practice.
Level 2  As for level 1, but the learner includes a superficial rationale for, or limited discussion of the connection.
Level 3  As for level 1 or 2, but the rationale or discussion is expanded to include an insight or understanding arising from the connection/s made.
Component 4  
**Reasoning**

The Learner *highlights in detail* significant factors underlying the incident or issue and *shows why* they are *important to an understanding of the incident or issue*.

**Level 1**
At least one relevant factor underlying the incident or issue is analysed in detail, giving consideration to such matters as:

- why it is important in the circumstances
- how it impacted on the situation
- what questions this raises for future practice/learning

**Level 2**
As for level 1, but the discussion considers or compares possible alternative explanations *and/or* considers the inter-relationships among a number of factors and how the combination of factors is important in the circumstances.

**Level 3**
As for level 2, but the discussion incorporates insights from a different perspective, for example, a personal perspective, a student perspective, a learning perspective, a theoretical perspective.

Component 5  
**Reconstructing**

The understanding developed through reasoning (component 4) is used to *reframe or reconstruct* future practice or *professional understanding*.

**Level 1**
The discussion leads to a conclusion or a plan for future action, based on a reasoned understanding of the incident or issue.

**Level 2**
As for level 1, but the discussion also considers the reasons for, or possible implications of, the conclusion or plan.

**Level 3**
As for level 2, but the discussion also considers the possible impacts of different circumstances, e.g.,

- “what would happen if..?”
- “under what conditions would the plan not work?”

**Level 4**
As for level 3 but the new understanding is integrated with the learner’s personal approach or theory of practice/learning.
**Students and reflective writing**

When students are asked to do some formal reflective writing the results are often disappointingly bland and unhelpful, full of high-minded politically correct statements about how much they learned but no real evidence of critical engagement with the process.

Student reflective writing has been found to improve where:

- the purpose of the reflective writing is clearly related to overall course objectives eg. where it is used to develop professional skills in a project,
- they are given plenty of practice and feedback throughout the semester,
- where it is supported by guidance from the tutor in the shape of helpful questions for reflection or an established protocol.

Christine Hogan (1995) suggests using the SAID approach (Situation, Affect, Interpretation, Decision) to structure reflective writing:

1. **Situation**: what actually happened? (see the Observation Fact Sheet)
   - What images/scenes do you recall?
   - Which people/words/comments struck you?
   - What sounds/smells/sensations do you recall?
   - Were there any other elements?

2. **Affect**: incorporating your feelings and intuitions is important
   - What was the high/low spot?
   - What was your mood/feeling?
   - What was your gut reaction?

3. **Interpretation**: what did you learn?
   - What can you conclude from this experience?
   - What was your learning?
   - How does this relate to appropriate concepts, theories, skills?

4. **Decision**: what will you do as a result?
   - What do you need to do before this sort of thing happens again?
   - What should you do differently next time?
   - What would you say to people who weren't there?
   - What was the significance of this experience in your life?

Managing Interaction

“Another skill expected of the tutor working with a small group of students is an ability to help the student group deal with their own problems of interpersonal dynamics. Interpersonal problems inevitably arise in any tutorial group and can inhibit its effectiveness.”

“Interpersonal problems usually do not surface until students and tutor have gotten used to each other and let their guards down. Eventually, differences, individual behaviours, habits, values, opinions, and desires become less tolerable once the group knows each other. This may take three to four weeks. The tutor needs to be sensitive to cues of disharmony or ineffectiveness in the group:

- silence or sarcasm
- late arrival,
- lack of individual productivity,
- lack of spontaneity,
- arguments in the place of relaxed discussion,
- students taking sides on an issue,
- expressions of dissatisfaction with learning, or;
- attempts by a student to take over a group

are all symptoms. A most common symptom, often not recognised, is a lack of progress in the group’s tasks – things get bogged down because they cannot agree on where to go with a problem or task, or spend a long time on cyclic or trivial discussions. An awareness of the possibility that these kinds of problems may surface at any time is a key to managing these problems. The earlier they are recognised, the more effectively and promptly they can be handled.”

“When interpersonal problems become apparent...the approach is best aimed at the metacognitive level. The first important issue is how to get the group itself to or any student in the group to recognise that there is a problem... The tutor’s metacognitively tuned responses would be, in effect, “What do you suppose is going on?” – and later – “What shall we do about it?” etc.”

“Oftentimes the tutor cannot let the group deteriorate while he waits for someone to say something. Early in the group process he may have to set the example for problem recognition by modelling the behaviour he hopes the students will acquire and say, for example, “There seems to be something going on here between us in this group,” or, nodding to a particular student, “Why are you behaving this way?” or “We seem to be going nowhere as a group.”...If the ensuing discussions cannot resolve the problem, then the group has to get the issues involved in their behaviours, and the feelings behind them, out on the table and design a way to manage them. The tutor can suggest that the group considers itself and its interpersonal problem(s) as the next item to be tackled by the group in its studies...Once these inevitable interpersonal dynamic problems are resolved, most groups become very efficient and productive.”


The following pages contain resources for managing interaction, for use by yourself or by your students.
The nature of conflict and negotiation

“Conflicts are inevitable in problem solving groups. If handled effectively conflict may be highly constructive.

Conflicts may arise from:

(i) controversies – differences in information, beliefs, assumptions, ideas, etc., or;

(ii) conflicts of interests – incompatible activities desired by group members. The basis of the incompatibility may be controversy.

The resolution of:

(i) controversies may be achieved by determining the basis of the disagreement, i.e. information, belief, etc. and either agreeing to disagree by accepting the differences in belief and respecting the right of each individual to hold different values, etc. Resolution is not a problem unless individual values, beliefs etc. impinge on the selection of activities to be performed by the group.

(ii) incompatibility of activities desired by individual group members is harder to manage as it must be settled by negotiation.

Negotiation is a process by which people who want to come to an agreement, but disagree on the nature of the agreement, try to work out a settlement.

The goals of negotiation are to reach an agreement and not to damage the basic cooperative independence among the members.

In negotiating a resolution to a conflict of interest, a group member has to be concerned not only with what is more desirable for him/her in the short term, but also with what is most desirable for improving the effectiveness of the group.

Negotiation Strategies

Problem Solving Strategy or “Role Reversal”

1. Clarify issues
2. Define them as a problem
3. Diagnose causes of conflict
4. Search for alternative settlements
5. Decide on, implement an agreement that is satisfying to both parties.

Bargaining Strategy or “Win-Lose”

1. Undermines trust; promotes competition and hostility
2. Inhibits dialogue and communication
3. Diminishes likelihood conflict will be resolved constructively.
Norms regarding constructive management of conflict

1. Conflict should be over issues, not between people. Feelings should be clarified and understood.
2. Good timing observed regarding scheduling negotiations, i.e.
   a) announcing conflict of interest
   b) stating the conflict
   c) asking for group time to negotiate issues
3. Understanding of group members in circumstances precipitating conflict
   a) barriers to beginning negotiation
   b) events that trigger expression of conflict
      i.e. internal and external
      - attitudes, values
      - fears, anxieties
      - habitual patterns
      - task requirements, group norms
      - perceptions of vulnerability vs strength of group members
      - of avoidance
4. Confrontation which is constructive
5. Present state of group member’s ability to deal constructively with conflict, e.g. communication, withstanding stress, cohesion.

Group Behaviour Checklist

1. Do I help others express their ideas?
2. Do I listen alertly and with understanding to what others are saying?
3. Do I communicate my ideas well?
4. Do I avoid conflict when I should/shouldn’t?
5. Am I overly stubborn about my opinions?
6. Do I often provide leadership for my group?
7. Do I seek and use other people’s opinions well?
8. Am I overly aggressive?
9. Do I give in too quickly/not at all when I am opposed?
10. Am I sensitive to others’ feelings?
11. Do I take responsibility readily?
12. Am I more often disruptive than constructive?
13. Am I too quiet/active?
14. Do I participate enough/too much?
15. Do I appear to believe people?
16. Am I tolerant of opposition viewpoints?
17. Do I dominate/participate at all in the conversation?
18. Do I appear willing to support other people’s ideas?
19. Do I "own" my ideas and feelings

Considerations for the online PBL environment

“The role of the facilitator in a face-to-face discussion has several aspects. First, the facilitator needs to help maintain the agenda and manage time. Second, the facilitator needs to ensure that ideas are addressed at a deep, conceptual level. Third, the facilitator needs to keep the group moving and ensure that everyone participates. These roles are critical in an asynchronous facilitation but enacting them will have some qualitative differences:

- In face-to-face tutorials, it is critical to get to the learning issues before a session ends. Session boundaries are not always clear in online PBL. Online systems need to consider timeframes and embedded activity structures for accomplishing PBL activities to create these boundaries.

- It is more difficult to keep an online group moving without the visual cues available in face-to-face interaction.

- Finally, it is likely that the facilitator has an additional role in asynchronous PBL—helping the group to converge rather than continuing to diverge.

Understanding how to address these differences is critical in developing systems to support both students and tutors in asynchronous discussion.”

Please see the attached readings for some suggestions of how to manage these issues, develop online facilitation skills and promote positive online learning behaviours in students

Reading 1: Chapter 7 Handy Techniques for Moderators: Online Conferences
Reading 2: Chapter 14 Developing E-Communicators and E-Collaborators
Specific strategies for improving online discussion

These points provide specific strategies which can be implemented at the beginning of semester and in ongoing practice, with the expectation that students will improve over time.

1. **Recommend to students that they create and use content/concept related threads of discussion.**

   Groups in previous semesters which have created threads to discuss content or concepts involved in their project, and have taken part in genuine discussion in these threads, have had the opportunity to make visible links among these content and concepts, and between the work of all the group members. In doing so, each team member may improve their understanding of how their work fits in to that of the group overall, and may access more content knowledge than if they only paid attention to the content that they themselves collect.

   To be productive, posts to these threads should involve students explaining, analysing, summarising, synthesising, evaluating or drawing conclusions from content for the benefit of the group, rather than just re-presenting information they have found.

2. **Recommend to students that they create and use team dynamics/team functioning and problem solving process threads.**

   As above, students should be encouraged to consciously consider and actively discuss not just the theory of team functioning and problem solving but how it seems to apply in their present project. For students to achieve learning transfer from their problem solving and group work experiences they need to be able to identify how instances of their practice relate to strategies which may be used in future contexts. Facilitators may prompt such considerations with questions such as

   - “what do you know about team functioning that you can see occurring/not occurring in your team?”
   - “what is the difference between cooperation and collaboration in terms of team functioning – how do you see this played out in your group?”, or;
   - “what stage of the problem solving process is your group operating in now – what is next?”

   Such questioning should promote reflection on and monitoring of the process of group work, and should reduce the perception that groups function by simply dividing tasks to be worked on individually. It should also highlight that problem solving has important cognitive and meta-cognitive stages, and is not just a process of information collation and decision making.

3. ** Require that students make one post to each of these, and respond to another student’s post for each of these per week. Provide frameworks for useful responses.**

   To promote genuine, sustained discussion it would be useful for students to have a requirement to post to these threads regularly and work within a framework for doing so. The exact nature of posts to be made will be somewhat dependent on what stage of the PBL process the group is engaged in, but should involve some form of these learning activities;

   - “cognitive activities – debating ideas, using external information and experiences, and linking or repeating internal information
• metacognitive activities – planning, keeping clarity and monitoring

• affective activities – general reaction, asking for general feedback, and chatting and social talk” (Pifarre, 2007, p.397).

A suggestion of a framework of types of effective responses available to students (extracted from Pifarre, 2007):

• “Clarification type: this is useful for clarifying some parts of the document [discussion post]...

• Support type: this is useful for expressing agreement with the document, e.g. ‘In my opinion this document is very useful and is easy to read.’

• Review type: this is useful for suggesting additions to the document (‘addition’ type) or for suggesting changes to the document (‘correction’ type), or for making open questions about the document (‘question’ type).”

In promoting discussion within these frameworks, the online forums should become more interactive, rather than just a site for the gathering of information which is never worked through by the group as a whole.

4. Maximise your social presence in online discussion.

“A complaint that one sometimes hears from online students is that posting messages to discussion forums is like writing a message, placing it in a bottle, and dropping the bottle in the ocean. Without feedback, one can never be sure that someone has ever read the message. There is little or no gratification for time spent composing the message...A challenge for the online instructor in establishing and maintaining social presence is to show that student postings are read without the instructor becoming the centre of all discussions” (Rovai, 2007, p. 82).

At the most basic level, facilitators in online PBL can make their students aware they are present in asynchronous forums simply by leaving a calling card on threads that have been read. This may be a smiley face or a ‘read, date and time’ stamp. Facilitators may also make affective comments about the discussions in the form of feedback or personal responses. For example: “I’m excited by how well your group is collaborating on this aspect of the task”, “I’m excited that your solution is shaping up so well/disappointed that that option didn’t work out.” In doing so, they are reinforcing the importance and centrality of the social and emotional nature of working in a learning community. “Postings can be as simples as expressing appreciation, agreement, support, and encouragement. Avoid being sharply or overly critical” (Rovai, 2007, p.82). This technique models how students themselves should interact in their online community.

At a more complex level, facilitators should aim to prompt students regularly and in a number of ways by asking questions in response to online activity (see next section). Without such involvement in the process, tutors cannot be a genuine member of the learning community, an important tenet of PBL.

5. Use prompting questions to encourage students to pay attention to process, meta-cognition and reflection.

In following discussion threads there are ample opportunities to prompt students to consider process, metacognition and reflection as part of their coursework, group work and problem solving tasks. By encouraging students to step out of the moment to consider where they are and what they are doing, they will develop a better understanding of their learning as a whole, and, consequently, how it may be transferred to other learning and professional contexts. Such questioning skills will improve quickly with a little practice and persistence on the part of tutors, once these opportunities begin to be recognised and acted upon.
For example, within just about any discussion thread tutors could ask:

- “What do you think is happening here guys, in terms of the functioning of the group? Is there any way you could do it better?”
- “What stage of the problem solving process are you up to now? Is this the best way to be tackling the issues at this stage of the game? Is there a more effective strategy for this point?”
- “What are you noticing about what you are working on – how is it coming together towards solving the problem? How is it contributing to how you understand what is going on?”
- “How do you feel about how the group/project is progressing? Where would you like to see the group work go now? How do you feel the work has been effective/ineffective so far?”

6. Give recognition of effective process, metacognition and reflection when these are visible in online discussion.

For effective strategies to become apparent, facilitators should attempt to point out when these are being used. It is enough to say “great example of in depth reflection here guys,” but tutors could also follow this up with a question about how this behaviour/type of interaction could be applied to future areas of practice. For example, “where else could your project benefit from this type of reflection?”, or “at what point should your team examine your problem solving process again, to ensure that the best decisions are made and the best solution put forward?” Such recognition and questioning not only rewards effective strategies, but promotes that they be carried forward to future learning and professional contexts. Everyone benefits from being told when they are doing something well. Merely acknowledging effective strategies can make students think “well what did I do there to warrant that praise, and how can I do it again?”

The following pages provide exemplars of effective student interaction in online discussions from previous semesters. Each discussion thread demonstrates a different learning behaviour/strategy which should be promoted by facilitators. Whilst these examples elucidate what it looks like when students get it right, it is worthwhile to spend some time in consideration of how your interactions with students could elicit such behaviours and strategies. Consider:

- What do you see as the most productive behaviours demonstrated by students in these examples?
- In trying to promote such behaviours in less effective discussions, which of the above tutor strategies would be appropriate for which desired result?
- What questions can a tutor ask to promote better interactions or more effective learning behaviours?
- When should the tutor participate and when should they stand back?
- What do reflection, metacognition and attention to the processes of group work and problem solving look like when they are demonstrated in online discussions?