

Helping your students gain the most from PBL

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Abstract:

PBL is more than an extremely effective environment to learn subject knowledge. It can be used to help students develop skill in lifetime learning, change management, teamwork, conflict resolution and problem solving. However, for this to be effective, there is much that a teacher can do to help the students acquire these abilities.

These skills need to be identified as valued outcomes of the program. Learning objectives and criteria should be created. Journal writing provides an excellent way to help students gather evidence of accomplishment. Options for assessment will be discussed.

Linda's complaint

You, a teacher in a PBL program, are talking to Linda, a student graduating from your PBL program. She confides in you, "I believe I know the expected subject knowledge but I really don't think that my problem solving skill or group skills have improved. Perhaps the curriculum planners can look more closely at the skill development being claimed in the program."

In this paper, I try to model elements of a version of PBL where

- a problem is posed, **Linda's complaint**;
- we identify issues pertinent to the problem by identifying what we know already from similar scenarios and experiences and what new information we need to know;
- we consider information and ideas about selected issues raised by the case,
- we use that information to "pose a solution" to **Linda's complaint** and then
- we elaborate that knowledge.

Consider each in turn.

1 What are the issues in this scenario?

In conventional lecture programs, the teacher will have created a set of learning objectives that he/she wishes the participants will achieve. The teacher may have used this scenario to introduce a "lecture" on the development of skill in lifetime learning, change management, teamwork, conflict resolution and problem solving.

In the context of PBL, we discuss how well the scenario or case problem is written, activating prior knowledge, ways that students can be empowered to create and prioritize the issues and some example issues.

MIIs the scenario well-crafted?

In most PBL programs, the goal is to empower the students with the task of creating the learning objectives that are important to them. The scenario should be posed such that (Dolmans et al., 1997, Alverno College, 1977) and Drummond-Young and Mohide, 2000)

1. the learning outcomes expected by the teacher are identified correctly by the students; the scenario contains “cues” that will trigger the desired search for learning objectives;
2. the learning outcomes are consistent with the stage of development and builds on and activates prior knowledge;
3. an appropriate level of complexity is included;
4. the scenario requires integration of knowledge, skills and attitudes across topics;
5. the scenario allows an openness;
6. the scenario is motivational and relevant; the scenario is similar to one we might encounter in professional practice;
7. the scenario promotes student activity;
8. the scenario identifies the context, gives a concrete scenario and clearly identifies the expected task.

Hopefully for this conference this scenario addresses issues that are important in your application of PBL in your context. I hope it builds on and activates past knowledge. I selected this case because it resembles scenarios that I encounter frequently when I consult with different groups about PBL. This case addresses the assumption that if we use a small group, self-directed, self-assessed, problem-based learning model then this should develop skill in such “process skills” as change management, teamwork, conflict resolution and problem solving. Researchers (Norman, 1988, Norman and Schmidt, 1992, 1993, Woods, 1989, 1993a,b) report that this is a faulty assumption.

Now let’s use the case to activate prior knowledge similar to that presented in the case, **Linda’s complaint**.

M Activating prior knowledge/experience. Have you seen something similar before?

To facilitate learning, Schmidt (1983) emphasizes the importance of activating previous knowledge gained from “similar situations.” Have you encountered anything like this before? Perhaps you worked as a volunteer for the Red Cross in the community and the expected goals for the Red Cross program had not been achieved. An issue in Linda’s scenario is that a person in a program, Linda, feels that her expectations had not been met. Is this educational situation similar to one you have encountered previously? Maybe you felt as Linda felt. What did you do? What turned out to be the major issue?

Now that we have helped relate the case to the known, what new information is needed to resolve the problem posed in the case **Linda’s complaint**?

M How might we empower student groups to generate the learning issues?

The options we might use to generate the learning issues include:

- the teacher gives the student groups a list of “teacher-generated” learning objectives.
- large groups (>6 students) of students generate and prioritize a list via a tutor-facilitated discussion.
- small, tutorless groups of students generate and prioritize a list as a small group (<7 students) and their results are validated by the tutor or www program.
- small groups students with a tutor generate and prioritize a list with the tutor gently guiding the activity.

M What are some issues that this scenario might generate?

Some issues that might be generated by teachers with/without experience in PBL are given below. We find it useful to consider the problem from different perspectives and to focus on different cue words used in the scenario.

From the perspective of the teacher: “cues” from the case include such words as: you, teacher in PBL, confides, graduating, claim in the program.

- S Does the student have the skill but doesn’t realize it? Is her skill in self assessment weak? perhaps Linda didn’t receive feedback?
- S Is Linda’s expectation justified? Have we said we would develop this skill? or is she equating PBL = problem solving? small group = skill in teamwork?
- S Is this a widespread concern? (Linda confides only in you; did she tell others?)

- S Is this a major frustration for Linda? or is she just giving suggestions to improve the program?
- S Why does she express this now instead of earlier in the program? have we poor methods of gathering student comments throughout the program? Is the issue one of monitoring the program continually?
- S What actions do I, as a tutor, take to try to develop my student's skill and confidence in these skills? Should I take any?
- S Do I have skills in coaching students in the development of these skills?
- S Have I received training in coaching?
- S What do I mean by "problem solving"? "teamwork"? what other skills and attitudes besides these are addressed in our program?
- S How do I assess these skills? How do I provide feedback to the students about their skill development?

From the perspective of the student: "cues": confides, improved, I know.... but I don't think,

- S What skills did Linda possess when she entered the program? should she expect to see an improvement?
- S Has there been an improvement in skill but she lacks confidence?
- S Has she personally benchmarked her behaviour, set personal goals, criteria and selected forms of evidence to improve? Should she be expected to do this?
- S What is Linda's role and obligation? and what is the tutor's role and obligation? and what is the program's role and obligation ?
- S Is this an issue of skill? or confidence in the skill? or both?
- S What is Linda's definition of "problem solving"? "teamwork"? What other skills should she expect to be developed in the version of PBL she experienced?
- S Linda identifies that she "knows the subject knowledge." This suggests some skill in self assessment. Can the same forms of feedback, that told her she knew the subject knowledge, be effective in telling her that she is skilled in problem solving and team work?
- S If Linda feels these are important, why didn't she let us know earlier? An issue might be one of trust and openness in the learning environment or one of monitoring.

From the perspective of PBL learning process: "cues": PBL program.

- S Which form of PBL was used? Is the form likely to explicitly develop the target skill?
- S Class size?
- S Assessment?
- S Role of tutor? subject specialist? skill development specialist?
- S Do all - students and staff - agree that skill development is important?

From the perspective of the program: "cues": in the program, curriculum planners

- S What skills do students have entering the program? How do we know?
- S What are the expected outcomes from our program? are these published? do they include confidence and skill?
- S Do the tutors, teachers, students, and administration all understand the expected outcomes?
- S Have we defined places, times and activities in the PBL program (or before the PBL program) for the development of the confidence and skill?
- S Have we trained the tutors to be effective coaches?
- S Have we trained the students?
- S How do we assess the student skill?
- S How do we evaluate the program effectiveness?
- S How do we monitor the program?
- S How do we obtain student input continually?
- S Do we, as teachers, know the skill is developed but the students don't?
- S How do you develop self confidence?

From the perspective of the skills: "cues": skill

- S What is the definition of the skill?
- S Have published learning objectives and measurable criteria been developed for this skill? How are the outcomes

generated? How can we create measurable criteria?

- S Is the skill identified as an outcome of the program?
- S How is the skill assessed?
- S Have we really helped the student see the skill development or have we been ineffective in communicating?

From the perspective of learning/acquiring skill: “cues”: skill, skill development

- S Is developing skill established by methods similar to learning knowledge?
- S How do you teach skill?
- S How do you assess skill?
- S How do students self assess skill?

Synthesis and prioritization of issues:

Many issues were repeated when seen from the different perspectives. However, some main issues are:

- A. issues related to developing process skills: how, when and how to assess.
- B. issues related to embedding the process skill development into and throughout the program.
- C. issues related to assessment especially as it applies to process skill and “intuitive” behaviour.
- D. issues related to developing student awareness, confidence and trust.
- E. issues related to selecting options for your approach to PBL and your culture.
- F. issues related to gathering student feedback, monitoring and program evaluation.

Lots of issues from this case! You have probably identified others.

2 Reporting back on selected issues

Here we summarize ideas for each of the six issues. Consider each in turn.

A. Developing process skills

Using small group, self-directed, self assessed, interdependent PBL assumes that the participants use (and are skilled in that use) skill in problem solving, group work, self-directedness, teaching, self assessment and communication (Woods, 1994).

How to develop: For problem solving, what doesn't work seems to be giving the students many problems to solve, using challenging problems, watching the instructor/tutor solve the problem, watching others solve problems (Woods, 1993b). We might generalize these conclusions to the development of any skill or attitude.

What seems to be effective is to use research to identify target behaviours (see how the experts do the task); convert these into learning objectives with measurable criteria, identify forms of evidence that students can collect that show their performance, give students opportunities to try the skill, provide feedback, more practice, feedback and continue until students “believe” they have mastered the skill (Bandura, 1982, Schon, 1987, Woods et al., 1997, Woods et al., 2000a, Alverno, 1977).

Example evidence-based target skills, learning objectives, criteria, forms of evidence, and assessment are listed for problem solving, change management, group work, self assessment, conflict resolution (Alverno, 1977, Woods, 1999a,b; Woods et al. 2000a, Woods et al. 2000 b, and Woods et al. 2000c,d). Example levels of development for team skills are given in Table 1; target skills, in Table 2.

Insert Tables 1 and 2

We have used a workshop style learning environment to develop process skills (Woods et al., 1997, Woods, 1999d).

A workshop is designed to:

- help individuals become aware of how they do the skill,
- provide target skills for the effective application of the skill,
- give an opportunity to reflect and self assess,

- gives students a chance to gather evidence about individual use of the skill,
- provide benchmarks and encourage students to create goals for growth of the skill development.

Example transparencies, timing outlines and descriptions of some of the workshops are available (Woods, 1999d).

An alternative to the use of workshops is given by Alverno College. Alverno (1977) integrates the development throughout all of its courses with published lists of objectives and levels of development for each course. They have a separate assessment department to assess some skills.

When to develop: Four options that have been used include:

- prescreen and only admit students into your program who have the skills already and continue with monitoring, assessment and feedback (McMaster MD approach);
- prePBL workshops. Provide workshops before students start the PBL activities and continue with monitoring, assessment and feedback (our approach in engineering);
- integrate the workshop skill development with the early PBL cases and continue with monitoring, assessment and feedback (McMaster Theme school approach);
- integrate the development throughout the whole program with a published progression through four levels of skill development as the students move through the program (Alverno College model).

Assessment of student skill: If the objectives, criteria and forms of evidence are clearly developed and published, then assessment is easy. More on assessment is given in section C.

B. Embedding the development of process skills into PBL

To embed the skill development into the program requires action at the program or departmental level, general considerations and at the individual PBL unit level.

M Program actions:

1. Make the process skill a valued and published outcome for your program.

Example:

“Graduates of this program will think rigorously and critically and solve problems effectively and efficiently.”

2. Build student assessment and program evaluation into the program right from the start. Don't tack this on as an afterthought. How are you going to test skill in teamwork? How will an individual be graded? How do we evaluate whether our efforts are successful? How do we benchmark and set goals for growth to improve our program?

For example, all students could complete the Heppner PSI (Heppner, 1986) and the Billings-Moos inventories (Billings and Moos, 1981) at the beginning of the program to establish benchmark data. The first PBL case could address issues of teamwork, the second addresses assessment and self assessment and so on.

3. The goals, criteria and methods of assessment should be consistent across the whole program. Publish details of where and how the skill will be developed. Alverno College provides an excellent example (Alverno, 1977).

For example, “Problem solving is defined in the course pack. The focus in the first semester will be on developing...”

M General Principles

4. Treat the development of process skills with the same rigor and scholarship that you use in the development of subject knowledge.
5. Create the framework for assessment and evaluation. Details are given in Section C.
6. *Make the implicit behaviour explicit.* So much of the processing occurs automatically in our heads and in the

heads of other skilled practitioners. When asked “*How do you do that?*” she replies “*I don’t know; it just happens.*” Our task is to take the skill and behaviour apart; discover what really is important based on research, make goals and criteria and then present the experiences in bits and bites that can be mastered by our students. This provides the *context* for skill development.

7. *Encourage monitoring.* Provide a checklist of questions the students can use to monitor their process skill development. This provides the student with one form of evidence.
8. *Ask students to reflect on the process.* For each team meeting held, ask them to write out their reflections of how they did the task. This provides the student with one form of evidence.

M For your PBL activity.

9. In your syllabus, restate the program outcomes, list the outcomes that will be addressed explicitly in your course.

For example,

*In these next PBL units, you will learn new knowledge and synthesize previous knowledge to solve problems related to the cardiovascular system [the subject-specific skill development or new subject knowledge gained] **and** you will develop skill in working in teams, (or critical thinking or problem solving or communication).*

10. Know what previous training in the target process skills the students have had and build on those.
11. Use terminology, assessment forms and standards of assessment consistent with the overall program.
12. Gather benchmarking data to aid in the program evaluation.
13. Usually assign students to the groups unless there is a compelling reason to allow them to select their own groups. Keep the same groups for at least eight weeks.
14. *Assign a chairperson for every meeting.* Research has shown that groups function better with a designated chairperson. Require the chairperson to prepare and circulate an agenda ahead of time. Ask the group to give written feedback to the chairperson at the end of each meeting. The chairperson uses this input to reflect on his/her skill and to set targets for development. This provides the student with one form of evidence.
15. Work with students *at their stage of need.* For example, don’t expect team performance and use team criteria for assessment when the group is really a fairly effective group. Apply standards of assessment consistent with the level of development. Secondly, we could help them see the big picture, and nurture, encourage and reward them on their journey toward effective teamwork.

C. Principles of Assessment

Assessment we define as a judgement based on the degree to which the goals have been achieved based on measurable criteria and on pertinent evidence. We have found that breaking this definition into five principles assists in applying this definition. The five principles are: (Alverno, 1985, 1994; Woods, 1994 and Boud 1993)

1. Assessment is a judgement based on performance - not personalities. We need to help a student realize that a poor mark does not mean he/she is a bad person. The judgement is made about performance in completing a task. It has nothing to do with his/her value as an individual. This is an issue, especially for students with attitudes characterized by Perry’s level 2. More details about Perry’s levels and their implications to teaching and learning are given elsewhere (Perry, 1970; Woods, 1994; Woods et al., 2000a).
2. Assessment is a judgement based on evidence - not feelings. We might intuitively feel that a student is a good problem solver. However, we need to replace that intuitive feeling with physical evidence such as the written script

on an exam or in a project report. Help the students (and staff) gather evidence. Provide time for students to write reflections. The staff responsibility is to create well-designed standardized feedback/assessment forms. Provide practice understanding the terms and working with the forms **before** the program.

3. Assessment should be done for a purpose with clearly-defined performance conditions. The student should know when he/she is being assessed.
4. Assessment is a judgement done in the context of published goals, measurable criteria and pertinent, agreed-upon forms of evidence. Use research, not personal intuition, to identify the target skills. Publish goals with measurable criteria for process skill. Such goals should provide clear needs for documented evidence. These should be published at the start of the program so that there are no surprises for the students and no unwanted student backlash to the teacher. Examples for some process skills were described in Section A with ideas for team skills given in Tables 1 and 2. Example forms of evidence for team work are given later in this section.
5. Assessment should be based on multidimensional evidence: static and dynamic situations; small assignments and lengthy projects; academic, social and personal contexts; under a variety of performance conditions (exams and homework, written and oral, performance as an individual and as a member of a group,) formative and summative data and with different persons being the assessors (self, peer, teacher and trained external observers).

To remove ambiguity from the assessment the following six *issues in practice* should be addressed (Alverno, 1985, Woods, 1994).

1. Goals: What is being assessed? Knowledge in engineering or a discipline subject? Skills? Attitudes? Have the goals been expressed unambiguously in observable terms? Who creates the goals? Are the goals explicit and published?
2. Criteria: Are there criteria that relate to the goals? Can each criterion be measured? Who creates the criteria? Are the criteria explicit and published?
3. Form of evidence: What evidence is consistent with the criteria? Are the checklists used for the assessment asking questions related to the criteria? Do both the assessor and the student know that this form of evidence is acceptable?
4. Resources: Are the goals and the collection of the evidence possible to achieve in the time and with the resources available?
5. Assessment process: What is the purpose of the assessment? Under what conditions is the student's performance assessed? Who assesses? What type of feedback is given by the assessor? (For example, Pass fail? a grade? five strengths and two areas to work on?) What is the form of feedback? Verbal? Written? What is the timing of feedback? Who delivers the feedback?
6. Training in the assessment process: Have both the student and the assessor received training in assessment?

Failures of assessments to accomplish their purpose can usually be traced to violations of any of these five principles or to the incorrect application of the six issues in practice. The major challenges students have seem to be:
 M Students can understand goals and objectives for subject knowledge. "*It's Chapter 3 in the text.*" or "*It's like the assignments we've had, only changed a little (at least we hope it is changed only a little).*" But how do you assess teamwork? An answer is that we need to create easy-to-understand and demonstratable goals.
 M Students underestimate the importance of evidence. Furthermore, they have trouble seeing the types of evidence that might be useful.

Example forms of evidence for problem solving are available (Woods, Wood, Sheardown, Kourti and Crowe, 2000b). Here are some examples for team work (Woods, 2000a):

Open 1 Attendance records. No a very useful form of evidence. A person can be present and sleep through the activity (Woods, 1996).

Option 2. Test and Exams in Process Skills, TEPS: Create examinations that test the achievement of the published objectives for team skills. Some example questions are given in Resources Chapter D (Woods, 1999a).

Option 3: Peer and self assessment of individual contributions to the team using a well-designed, standardized observation/feedback form (Woods, 1994 and Woods et al., 2000d, Woods, 2000a).

Option 4: Reflective journals for individual growth. Individuals gather evidence about his/her own contributions to the team: reflections, peer feedback, agendas of meetings, documents brought to the group for a task, monitoring records.

Option 5: Reflective journals for team growth: Individuals gather evidence from the reflections about group behaviour after each group meeting, add reflections about what they personally did to help the team grow. Examples are available (Woods, 1993-95; 1999c).

Option 6: Individual assessment of team activity using a standardized form (Woods et al., 2000c).

Option 7: Observer assessment of the team performance.

Option 8: Observer assessment of the individual performance.

Option 9: Portfolio that synthesizes all the above evidence.

Option 10: Published validated questionnaires for component skills: listening, responding trust, conflict resolution. See Woods, 1999e for a listing of some possible inventories.

Option 11: Feedback or self reflection about the assessment process. Maturing and moving toward teamwork brings with it skill in self awareness, self acceptance and self assessment. The form in Table 3 can be used to provide evidence about skill in self assessment and in assessment (Woods, Marshall and Hrymak, 1988). This reminds us of the Principles of Assessment outlined above.

Insert Table 3

D. Issues related to helping students see success, developing confidence and trust.

Here are some suggestions:

M Provide frequent and prompt feedback; work in the context of evidence-based targets; require reflection and journal writing. Follow the principles of assessment. Encourage personal goal setting.

M Use validated inventories to help individuals identify his/her uniqueness and personal style (such as Kirton's KAI, Schutz's FIRO-B, Jungian Typology, men and women in conversation, the Perry inventory (Woods, 1994) the Lancaster Approaches to Studying (Ramsden, 1983) and Johnson's approaches to resolving conflict (Johnson, 1986)). Help students move from self awareness to self acceptance, to acceptance of others with different styles and to self confidence.

M Alert students to the four keys to effective interpersonal relationships:

Key #1. Honour the seven fundamental rights of individuals, RIGHTS (Woods, 1994)

R to be Respected

I Inform or to have an opinion and express it

G have Goals and needs.

H have feelings and express them

T Trouble and make mistakes and be forgiven

S Select your response to others expectations

Claim these rights and honour these in others.

Key #2. Avoid the four Killers of relationships (Woods, 1994):

Contempt
 Criticism
 Withdrawal and stonewalling
 Defensiveness

Key #3. Build trust. Trust glues relationships together.

We build trust by

keeping commitments to yourself and others.
 clarifying expectations that you have of yourself and of others.
 showing personal integrity, honesty and loyalty to others, especially when they are not present.
 promptly and sincerely apologizing when you know you are wrong.
 honouring the fundamental RIGHTS listed above and avoiding the killers.
 taking time to see things from the perspectives of others.
 accepting others "warts and all."

We destroy trust by

the reverse of the Builders of trust listed above, and
 not meeting commitments.
 selectively listening, reading and using material out of context
 not accepting experience of others as being valid.
 making changes that affect others without consultation.
 playing the broken record until you're eventually worn them out or subtly make changes in the
 context/issues/wording gradually so that they are unaware of what is happening until it is too late. They
 were sideswiped.
 asking others to give up their fundamental RIGHTS.

key #4. Give feedback to others to encourage and help them; not for you to get your kicks and put them down (Woods, 1994).

This approach applies to help build relationships between teacher/tutor and students and among students.

E. Issues related to selecting options for your approach to PBL and your culture.

PBL is an extremely effective environment for learning subject knowledge. But it also is a misunderstood, popular, flavour-of-the-month option. Some introduce PBL just because "it is the thing to do this year." In deciding what version of PBL might be appropriate for you and for your institution let's remind ourselves of basis behind PBL. Here's my version of the basics:

PBL is a learning environment where a problem is posed first **before** the students have learned the knowledge. PBL is like research: we have a conundrum to resolve; what do we have to learn/do to resolve it? There are many versions of PBL. For example, a lecturer could pose a problem first, and then lecture. *The challenge is to us this opportunity effectively to develop problem solving skill.*

PBL helps students create knowledge structures that will prompt rapid recall in future practice. The memory patterns are different from those generated when the subject knowledge is learned structured around typical textbooks. *The challenge is for us to facilitate the development of cues and the appropriate knowledge structure* (Schmidt, 1983, 1993).

Self-directed PBL empowers the students with the tasks of learning (many of which are owned by the teacher in conventional programs). Students identify learning issues, create learning objectives and criteria, contract with members of the group to learn and teach parts of the unknown stuff, teach others, elaborate and self-assess how well the learning has progressed. Students are empowered; *the challenge is that we need to make them accountable.*

Self-assessed PBL empowers the students with parts of , if not all of, the assessment. Gibbs (undated) and Novak (1989) say “whoever owns the assessment, owns the learning.” Many other options can be used to empower students with assessment (see Felder et al., 2000). PBL is one exciting option. *The challenge is to develop self-assessment skills in our students and to shift the teacher’s role so that the teacher monitors the assessment process, rather than doing the assessment.*

Small group PBL uses an active, cooperative learning environment. Research in learning (Chickering and Gamson, 1987) suggests that learning improves if students are active, work cooperatively, have clear time on task, receive prompt feedback, and are in an environment that expects success and that caters to their personal learning style. Small group PBL provides a wonderful opportunity to achieve these. *The challenge is for use to create a small group environment that does indeed include these characteristics.* Other learning environments can be designed for active learning; for cooperative learning; to provide prompt feedback (see Woods, 2000b, Felder et al., 2000), but small group PBL offers an ideal environment that applies most of the principles to improve learning.

Small group, self-directed, self-assessed PBL tends to create a learning environment that nurtures “deep” learning rather than “surface/rote” learning. The latter tends to be promoted by traditional lecture environments (Ramsden, 1983; Woods, Hrymak and Wright, 2000e).

Small group, self-directed, self-assessed PBL provides probably the best option for the development of lifelong learning skills. *The challenge is to explicitly develop lifelong learning skills following the same guidelines given Section A.*

Small group, self-directed, self-assessed, interdependent PBL may not be the format that fits your culture or your personal style. What we can do is:

M Use the knowledge of how best to facilitate student learning as the basis for choosing of learning environment.
M If small group, self-directed, self-assessed, interdependent PBL is selected, then address the challenges so that your students gain the most.

F. Issues related to gathering student feedback, monitoring and program evaluation.

Give PBL the best chance to succeed and be scholarly in your approach to program evaluation,

M Whatever approach to PBL you take, give your interventions the best chance to succeed. Whenever you try something new, most students resist.

- *Students prefer the familiar* to something new. They know the “lecture system” and how to make it work for them to get the highest marks. If we change the familiar “system”, most resist the change (Benvenuto, 1999). When they experience change, students often follow the eight-step grieving process of shock, denial, strong emotion, resistance, acceptance, struggle, better understanding and integration (Woods et al., 2000a; Woods, 1994). To help them through the process, run a workshop.
- *Explain why* you are making the change.
- *Help students see their personal benefits* of the new approach in the short term and in the long term.
- *Explain your role.* Students may believe that they are paying for teachers to “lecture.” (Benvenuto, 1999). Use Perry’s inventory (Perry, 1970, described in Woods, 1994; Woods et al., 2000a) to help students understand their perceptions; explain your role in terms of the Perry model.
- *Monitor the program frequently.* Use ombudspersons or one minute papers (described in Felder et al., 2000) and adjust in response to their feedback.
- *Be flexible.* If this particular class is vehemently opposed to the new approach, explore options to achieve your goals and theirs. Perhaps scale down the intervention. Gather data on how to make the intervention more effective the next time you try it.
- *Bring in success stories.* Invite recruiters or students, from other programs where the intervention has been effective, to give testimonials at the start of your course.
- *Help students cope with the upheaval when old habits are identified and changed.* This is particularly true

for problem solving. For example, part way through a program to develop problem solving, students complained that *“focussing on the process of problem solving has meant that they could no longer solve problems.”* We used the following analogy to help them through this frustration.

Consider that you are a reasonably good tennis player. You go to an expert to improve your game. The expert takes your game apart. As you relearn how to do each part, your game is not what it used to be. Be patient. Gradually you improve and surpass your past skills.

M *Be scholarly in your approach to program evaluation.* Unfortunately, when it comes to teaching many faculty “diddle around”. They try one thing in the classroom; then they try another. Their approach evolves like Topsy with them never sure as to what works and what doesn’t. They would never do research in our subject discipline that way. In “research” they create a hypothesis, create models or experiments and test the hypothesis and draw conclusions. With just a little more effort, we can bring that same scholarship to teaching. The hypothesis is that “by making a change your students will learn more effectively and/or they will develop process skills of value to them as professionals.” Your intervention should make a change. But does it? Consider using some simple and easy-to-administer pretests and post-tests. Examples for process skills have been cited (Woods, 1999e; Woods et al., 2000b, Woods et al., 1997). Gather data from exit surveys. Queen’s University has developed an excellent survey (Queen’s, 1994). Reflect on what went on. Gather evidence. Write journal articles and seek grants. Being scholarly in your approach means that right from the start you plan how to test and monitor the effectiveness of what you do.

3. Use the new knowledge to solve a problem

In **Linda’s** context we find that:

1. Published outcomes of the program are:

“Graduates of our program will be skilled problem solvers and team players.”

2. Skill development is identified but confidence in applying the skill is inferred.

3. Few formal mechanisms are in place for gathering student feedback about the program.

4. The assessment is done by the tutor for each of the seven students in the group. The assessment is done by the tutor who ticks off boxes related to skill development.

5. Feedback to the student is through the student reading the file that includes all of her tutor’s forms. The overall grade is a Pass/fail. The student receives no guidance as to how to interpret the forms.

6. No formal training is given to the students on group skills or problem solving.

7. The tutor assumes the role of chairperson at all PBL meetings; the meeting don’t start until the tutor arrives; no agendas are circulated.

8. The feedback forms used by the tutor to assess the team skills and the problem solving skills do not include the criteria; the only time the student sees the forms is in the files.

9. The student is not asked to present evidence about her skill in problem solving or team work.

10. Some self assessment is expected but, as Linda says, “It’s a joke. We receive no training. I was surprised when you showed me the principles of assessment, in Section C. No target skills or detailed objectives and criteria are published. We just tick “Good” in all categories. If we tick “Excellent” then we know we might be challenged by the tutor. If we tick “Needs work” or “Poor” then I’m shooting myself in the foot. My rating is wishful thinking. I really wish I had some concrete evidence about my skill so I could remove the hazy feeling I have about it all. Besides, I don’t think anyone pays any attention to my rating. The only rating that counts is the tutor’s.”

Comments: This program violates most of the principles of assessment. Although the program has the development of problem solving and team skills as an outcome, there does not seem to be any formal structure to help meet that claim. Consider, in turn, the principles of assessment:

Principles 1 and 3. The assessment should be based on performance. The performance conditions were not clearly defined so that Linda did not know the conditions when she was being assessed for these skills. She assumes that the conditions are her day-to-day performance in the tutorial group. The major assessor seems to be the tutor, who plays many roles including facilitator and chair of the group. Although some self assessment is asked for, Linda is not clear about the role her self assessment plays in the overall assessment. The form she uses seems poorly designed because it lacks target skills and measurable criteria.

Principle 2. The student is not assessed based on nor is given time to produce written evidence.

Principle 4. Published goals and criteria (whether they be created by the students or created by the tutors for the program) are missing. Linda does not know any acceptable forms of evidence.

Principle 5. The many different forms of evidence that could be used are not clearly identified.

Everything seems to be based on the tutor's use of a checklist. de Stephen (1985) and Swanson et al. (1991) suggest that one assessor cannot do a reasonable assessment (via observation of a tutorial group) of more than three people at one time. In Linda's school one tutor is expected to assess seven people! in addition to facilitating the tutorial process.

A solution:

Revamp the assessment process based on the principles from Section C.

Provide training in the process skills and in self assessment for Linda and her classmates.

Adding such structure will improve student accountability.

Provide better communication between the tutors, program administrators and the students about the program and its expectations.

Provide monitoring activities, such as classroom assessment techniques, CATS (Angelo and Cross, 1993), ombudspersons or one-minute papers to provide the tutors and administrators with a better understanding of how well the teaching and learning is progressing in the context of PBL.

4 Elaborate the knowledge

Schmidt (1983, 1993) and Coles (1990, 1991) emphasize the importance of asking students to elaborate on the new knowledge. Expand on the relationship between concepts, explicitly consider how things come together, see tasks as linking together aspects of knowledge both within and between subjects. Link theory with practice, make connections. Relate the new to past knowledge. Some example tasks that help students elaborate include: private study, essay writing, problem solving in groups, preparing and presenting a paper or case, studying for exams, creating concepts maps, posing and answering questions, taking notes, discussing with others, teaching peers what they first learned themselves, summarizing, reflecting, formulating and criticizing hypotheses, writing what they DISCOVERED, extending the application to other scenarios, creating other scenarios, and extending from education to everyday life.

For **Linda's complaint**, we can extend the use of the same principles to improve staff performance reviews, to improve our interaction with our children, and to guide our goal-setting and self-improvement activities.

5. Summarizing

Instead of me presenting a summary of what I hoped to highlight in this paper, I ask you to use Table 4 and elaborate and reflect on what you discovered and rate the ideas as they apply to your situation.

Insert Table 4

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Table 1 Example list of levels of skill development for “team skills”

M Alverno’s model (Alverno, 1977)

Level 1. Identify own interaction behaviors utilized in a group problem solving situation. (Eleven behaviors for the task activities used as criteria; observation by peers, strengths and weakness noted; agreement between observer and client).

Level 2. Analyze behavior of others within two theoretical frameworks: task and morale components..

Level 3. Evaluate behavior of self within two theoretical frameworks for at least three different, videotaped situations. Self, peer and teacher assessment. Growth contract created.

Level 4. Demonstrate effective social interaction behavior in a variety of situations and circumstances.

Level 5. Demonstrate effective interpersonal and intergroup behaviors in cross-cultural interactions.

Level 6. Facilitate effective interpersonal and intergroup relationships in one’s professional situation.

Forms of evidence and criteria are available.

M MPS model (Woods, 1999b, Woods et al., 1997; Woods, 2000a)

Level 1. Self awareness, self acceptance and acceptance of personal style and preferences of others: MPS 11

Level 2. Awareness of attributes of successful groups/teams for the two theoretical frameworks of task and morale: part I MPS 28; Groups can self assess, set goals for growth.

Level 3. Self awareness of own contributions to the group/team: MPS 28; 29. Individuals can state his/her contribution to the group process. Gather evidence about effectiveness in role as chairperson; set goals for growth. Understand the implications of FIRO-B for personal contribution to group evolution.

Level 4. Being an effective member of a “good group” MPS trust, conflict resolution, problem solving, give receive feedback, assertiveness

Level 5. Being an effective member of a team. MPS 51

Table 2 Evidence-based targets for group skills (reprinted from Woods, 2000a)

Evidence-based targets	Progress toward internalizing these targets				
	20%	40%	60%	80%	100%
M Performance improves when we have goals.					
M Assessment must be related to the goals					
M Both Task (getting the job done) and Morale (feeling good about the group work and about how you have interacted with the other group members) are important					
M Any group functions better with a chairperson.					
M Chairperson and leadership are different; different people may become leaders at different times.					
M Group evolution tends to follow a pattern described as by such descriptors as “forming, storming, norming and performing”. Schutz’s instrument FIRO-B seems to provide reliable insight as to the personal style of individuals towards other group members during three of these phases.					
M We can list the roles needed in both Task and Morale to make an effective group.					
M When each person has a clear idea of roles and group norms, the group functions better.					
M When groups are functioning effectively, about 75% of the time is spent on the task; 15% on morale building activities and 15% of task process activities (how the problem solving process is going; summarizing ideas, guiding the process).					
M The products from groups or teams is improved when members have different “styles” (in Jungian terminology some members are dominant S, and some, dominant N). The products from groups tend to be inferior when all the members “think and behave alike”.					
M The quality of decisions, product, task is improved if group members offer different perspectives, disagree and seem to introduce conflict into the process. The trick is to manage the apparent conflict well.					
M The characteristics of “meetings of individuals,” “effective groups” and “teams” fall on a spectrum with sufficient differences that it is useful to differentiate based on those characteristics					
M In a decision-making mode, after 20 minutes of discussion on any one topic, few new ideas are presented and repetition of previously stated ideas occurs.					

Table 3 Feedback about assessment

Goals: Content is well identified, goals are challenging and achievable, goals are written in observable terms, goals are unambiguous, the "given" conditions are specified.

None of these behaviours	Few of these behaviours but major omissions		Most features demonstrated		All of these behaviours	
G 1	G 2	G 3	G 4	G 5	G 6	G 7

Criteria: Criteria are consistent with the goals and are measurable and practical. The criteria are challenging and achievable.

None of these behaviours	Few of these behaviours but major omissions		Most features demonstrated		All of these behaviours	
G 1	G 2	G 3	G 4	G 5	G 6	G 7

Evidence: The type and quality of evidence gathered is consistent with the goals and criteria. The evidence has been gathered conscientiously over a long enough period of time. The evidence is well organized. The quality and extent of evidence is sufficient to allow me to judge the extent to which the goals have been achieved.

None of these behaviours	Few of these behaviours but major omissions		Most features demonstrated		All of these behaviours	
G 1	G 2	G 3	G 4	G 5	G 6	G 7

Process: The assessment process has been applied and as an independent assessor I concur with the decision as to the degree to which the goals have been achieved.

None of these behaviours	Few of these behaviours but major omissions		Most features demonstrated		All of these behaviours	
G 1	G 2	G 3	G 4	G 5	G 6	G 7

Strengths

Areas to work on

from D.R. Woods, "How to Gain the Most from Problem-based Learning" (1994)

Table 4. Reflection about and self rating of the ideas in this paper
Reflection and DISCOVERY

Rate the ideas				
	already do this	would work	might work	not my style
Well crafted problems				
Meets learning objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contains “cues”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In context of the program and activates previous knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Appropriate complexity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Integrates knowledge, skill attitude across topics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Similar to one from future professional practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promotes student activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identifies context and activity, concrete	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your use of PBL				
Take time for students to activate previous knowledge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilitate and validate the generation of learning objectives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ask for elaboration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing process skills				
Create target skills based on research.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create goals for learning and measurable criteria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide opportunities for students to gather evidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use a workshop to develop skill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use Alverno’s model of continual development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decide on When to develop: pre-screen entrants?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
develop before PBL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
integrate development with early units	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
integrated throughout whole program	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Embedding within the program				
Publish outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Build in assessment and evaluation from the start	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identify where the skill is developed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Consistent assessment throughout	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate the ideas

already do this would work might work not my style

Principles of Assessment

Based on performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Based on evidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has a purpose and performance conditions are defined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the context of published goals, criteria, forms of evidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multidimensional evidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Share experiences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Six issues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Forms of evidence:				
Use of TEPS for process skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use reflective journal writings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use self-assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use peer assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use individual assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use portfolio writing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use trained observers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use assessment of the assessment process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Developing student confidence and trust

Provide prompt and frequent feedback	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work in the context of targets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use reflections and journal writing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use principles of assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help students identify personal uniqueness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Honour seven fundamental RIGHTS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoid four killers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Build trust	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Give feedback that is helpful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Select PBL style effective for you

Pose problem before students learn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use opportunity to build problem solving skill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Help student build knowledge structures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Empower students with elements of the learning process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Build in student accountability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Empower students with parts of the assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Train and use self assessment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
See myself as monitor of the assessment process	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Build in the key elements to improve learning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Try to develop “deep” learning instead of “surface”	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use PBL effectively to develop lifelong learning skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate the ideas

already would might not my
do this work work style

Give PBL the best chance for success

Rationalize to students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use the grieving model	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
See the “opportunity” in the change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explain your role	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Monitor via “one minute paper” or ombudspersons	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Be flexible: change if needed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bring in success stories: Use testimonials	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Evaluate program: be scholarly

Write out your hypothesis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Plan and gather data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use exit surveys	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Test and monitor effectiveness	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Use new knowledge to solve the problem

Give students with the time to solve the problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Elaborate the knowledge

Rationalize to students why elaboration is important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use concept maps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provide activities to reflect	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Extend the application to other venues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use DISCOVERY	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use checklists, like this one	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>