What Is PBL? Why PBL?

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What Is PBL?

“The principal idea behind PBL is that the starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve.”


What are the Common Features of PBL?

Learning is initiated by a problem.
Problems are based on complex, real-world situations.
All information needed to solve problem is not given initially.
Students identify, find, and use appropriate resources.
Students work in permanent groups.
Learning is active, integrated, cumulative, and connected.

What Is PBL?

“…careful inspection of methods which are permanently successful in formal education…will reveal that they depend for their efficiency upon the fact that they go back to the type of situation which causes reflection out of school in ordinary life. They give pupils something to do, not something to learn; and if the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results.”

John Dewey (1916)

Characteristics Needed in College Graduates

- Excellent communication skills
- Ability to define problems, gather and evaluate information, develop solutions
- Address problems in a complex real-world setting
- Team skills – ability to work with others

PBL: The Process

Resolution of Problem; (How did we do?)
Integrate new Information;
Refine questions
Reconvene, report on research;
Research questions; summarize; analyze findings

Presentation of Problem
Organize ideas and prior knowledge (What do we know?)
Pose questions (What do we need to know?)
Assign responsibility for questions; discuss resources
## Factors in Choosing a Model

- Class size
- Intellectual maturity of students
- Student motivation
- Course learning objectives
- Instructor’s preferences
- Availability of peer facilitators

## Common Classroom Models

- Medical school
- Floating Facilitator
- Peer Facilitator
- “Hybrid”

### Medical School Model

- Dedicated faculty tutor
- Groups of 8-10
- Very student-centered environment
- Group discussion is primary class activity

**A good choice for**

- Highly motivated, experienced learners
- Small, upper-level seminar classes

### Floating Facilitator Model

- More structured format: greater degree of instructor input into learning issues and resources
- Group size: 4-6

**A good choice for**

- Less experienced learners
- Classes of all sizes

### Peer Facilitator Model

Advanced undergraduates serve as facilitators
- Help monitor group progress and dynamics
- Serve as role models for novice learners
- Capstone experience for student facilitators

**A good choice for**

- Classes of all sizes

### Dealing with Large Classes

Floating facilitator or peer facilitator models are the most appropriate.
Requires a more teacher-centered, structured format: instructor directs group activities
Group size: 4
Reduce grading burden through group (vs. individual) papers, projects
**“Hybrid” PBL**

- Non-exclusive use of problem-driven learning in a class
- May include separate lecture segments or other active-learning components
- Floating or peer facilitator models common

*Often used as entry point into PBL in course transformation process*

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**Other Reasons for Using PBL?**

Students learning to communicate in a common language.
International Islamic University of Malaya

Innovation and thinking ‘outside of the box’.
Republic Polytechnic, Singapore

Student engagement; learning ‘how to learn’.
Inquiry-based approach, bringing research-like approach to thousands of students.

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**UD PBL online**

PBL at UD  
www.udel.edu/pbl

PBL Clearinghouse  
www.udel.edu/pblc

Watson homepage  
www.physics.udel.edu/~watson

This presentation  
www.udel.edu/pbl/belmont
Using Groups

Courtesy of Hal White and Deb Allen

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The Top 5 Ways to Wreck a Group

List 5 behaviors or actions that can undermine good group function.

Report out in 5 minutes.

Video Clip

http://www.udel.edu/pbl/groups-in-action/mpegs/dawn.mpg

Questions to Consider:

What if anything is wrong with this group?
What could be done to help this group work better?
Could this situation have been prevented?

Videotape Credits

Author:
“Dawn’s Eight O’Clock” – Harold White

Director:
Nancy King

Producers:
Deborah Allen and Harold White

Student Actors:
Melissa Reddish, Michelle Lyons, Eric Moskal, Crystal Mack, Amanda Simons

Suggestions for Using Groups

Homogeneous vs. Heterogeneous

Set the stage early.
Form heterogeneous groups.
Use permanent groups.
Rotate roles of responsibility.
Rely on group-selected ground rules.
Conduct peer evaluations.

Forming Groups

Courtesy of Hal White
What Aspects of Heterogeneity are Important for You?


Factors to Consider When Forming Groups

Is the size of the group appropriate for the task?
For this task, is it better to select the students for the groups or allow students to select their group?
For this task, is it better to form heterogeneous or homogeneous groups?
Will you need to keep the group together or break it up throughout the semester or problem?
Are students with different ability levels placed in the same group?

Factors to Consider When Forming Groups

Are the personalities of students in the group compatible?
Are some members likely to be dominated by others? (by virtue of gender, cultural differences)
Does the physical arrangement of the room affect how you need to select groups?

Roles of Responsibility

**Discussion Leader**
Keeps group on track; maintains full participation

**Recorder**
Records assignments, strategies, unresolved issues, data; convenes group outside of class

**Reporter**
Reports out during whole class discussion; writes up final draft of assignments

**Accuracy Coach**
Checks group understanding; finds resources

Sample Ground Rules

Come to class on time every day
Come to class having done the assignment and prepared to discuss it
Must notify members of the group ahead of time if must miss class for any reason
Be willing to share information
Respect the views, values, and ideas of other members of the group

*If members of the group violate these ground rules, other members of the group may impose the following consequences:*

Peer Evaluation

Some general suggestions:

Use predetermined written criteria that focus primarily on behaviors.
Do at least 2 times per semester.
Factor results into students’ grades?
Summarize results and distribute summaries.
Keep the process simple.
Incorporate into group assignments.
Recommendations for Evaluating Student Performance

Focus questions on observable behaviors, not generalized assessments

– Good: The team member had a positive attitude toward this project.
– Questionable: The team member was a good performer

Student perceptions of other’s behaviors are relevant; their assessment of another performance may be less valid.

Using Groups in Larger Classes, with Inexperienced Students

Use well-defined activities with clearly stated objectives.
Bring the class together for discussion and/or clarification at frequent intervals.
Plan both group and individual assignments.
Watch for signs of behaviors that undermine group function.
Use peer group facilitators.

Jigsaw Group Scheme

4 home groups, with 4 members each

4 new expert groups, with one representative from each home group

Assessment of Individual Performance in Groups

Name of Person You Are Assessing: 
Your Name: 
Group Name: 

For each of the assessment categories below, place an "X" in the box that best indicates the extent to which you think that statement describes the person you are assessing. Fill one out for each member of your group and one for yourself. Forms are due at the start of class on the date given in the syllabus.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>somewhat agree</th>
<th>agree</th>
<th>strongly agree</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Does not miss out on group activities by being absent.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>Does not miss out on group activities by being late.</td>
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<td>3.</td>
<td>Finishes all jobs assigned by the group on time.</td>
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<tr>
<td>4.</td>
<td>Comes to class having read the material necessary for advancing group discussion.</td>
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<tr>
<td>5.</td>
<td>Listens well to others' presentations.</td>
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<td>6.</td>
<td>Contributes to the group's discussion.</td>
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<td>7.</td>
<td>Does not dominate the discussion.</td>
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<tr>
<td>8.</td>
<td>Brings new and relevant information to the group's discussion.</td>
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<tr>
<td>9.</td>
<td>Uses appropriate resources for researching presentations.</td>
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<tr>
<td>10.</td>
<td>Presents logical ideas and arguments.</td>
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<tr>
<td>11.</td>
<td>Asks questions that promote clearer and deeper understanding.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12.</td>
<td>Communicates ideas and information clearly.</td>
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<tr>
<td>13.</td>
<td>Helps to identify and implement ways that the group can function better.</td>
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</tbody>
</table>

Please circle an overall rating:

1. Excellent - Exceeds expectations
2. Good - Meets expectations
3. OK - Improvement in some key areas needed
4. Major improvement needed

Please use the back of the form to respond to the following two statements. Link your responses to the ratings above as appropriate.

1. Describe the ways in which this individual most helps your group's learning.
2. Describe the ways in which a change in this person's behavior could improve your group's learning.

Borrowed from Deb Allen (Biological Sciences) website for BISC2078 at the University of Delaware. "http://www.physics.udel.edu/~watson/scen103/colloq2000/groupevals.html"
© Deb Allen, Univ. of Delaware, 2000.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>3 (ideal)</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realism</td>
<td>Based on an actual or fictionalized real-world situation linking topic to learner.</td>
<td>Contrived or contains unrealistic elements that decrease credibility.</td>
<td>Unrealistic, lacking relevant context.</td>
</tr>
<tr>
<td>Content</td>
<td>Addresses significant conceptual issues; directly related to major content goals.</td>
<td>Encourages superficial rather than in-depth understanding concepts.</td>
<td>Relevance of topic peripheral or not apparent.</td>
</tr>
<tr>
<td>Engagement</td>
<td>Stimulates discussion and inquiry through its relevance and presentation.</td>
<td>Generates limited or superficial discussion; provokes little curiosity.</td>
<td>Lacks a “hook”; obscure or pedantic presentation.</td>
</tr>
<tr>
<td>Complexity</td>
<td>Appropriately challenging; group effort and cooperation required; some ambiguity appropriate; integrates multiple concepts.</td>
<td>Difficult but may encourage a “divide and conquer” approach. Concepts not well integrated.</td>
<td>Solution accessible to most students working alone; focused on single concept.</td>
</tr>
<tr>
<td>Resolution</td>
<td>Open to multiple resolutions or multiple pathways to solution, depending on student assumptions and reasoned arguments.</td>
<td>Resolution is more obvious but allows reasonable opportunity for judgment and discussion.</td>
<td>One right answer is expected; limited opportunity for analysis and decision making.</td>
</tr>
<tr>
<td>Structure</td>
<td>Progressive disclosure via multiple stages, builds on existing student knowledge.</td>
<td>Staging does not flow well; transition could be improved.</td>
<td>Too much or too little information provided at once; short cuts thinking/research.</td>
</tr>
<tr>
<td>Questions</td>
<td>Limited in number, short, and open-ended; stimulate probing for deeper understanding.</td>
<td>Most are directive; preempt student-generated learning issues.</td>
<td>Lead to “yes-no” answers rather than thoughtful discussion.</td>
</tr>
<tr>
<td>Research</td>
<td>Promotes substantive research using multiple resources.</td>
<td>Research limited to textbook material.</td>
<td>Limited necessity for research.</td>
</tr>
</tbody>
</table>

Other possible rubrics:
  Problem Delivery and Process
  Associated Assignments
  Student Products and Presentations
Writing Effective PBL Problems

Steps One: Identify Learning Objectives

Think of a learning objective in your course.

How do you usually address this learning objective? What kind of problem or activity do you usually assign?

- Typical end-of-chapter problem?
- A reading?
- Other?

Example from Physics: Solving Problems Using Conservation of Momentum

Typical end-of-chapter problem

A 1500-kg car traveling east with a speed of 25 m/s collides at an intersection with a 2500-kg van traveling north at a speed of 20 m/s. Find the direction and magnitude of the velocity of the wreckage after the collision, assuming that the vehicles undergo a perfectly inelastic collision (i.e., they stick together).


Types of Learning Objectives

Content-oriented: subject specific
- Basic knowledge and understanding of specific concepts, techniques, etc. in the discipline

Process-oriented: global skills
- Effective communication: oral and written
- Acquiring and evaluating information
- Working effectively with others
- Higher order, critical thinking

Sample Learning Objectives

• CNST 114 (10): Clothing in Contemporary Society
  Jane Lamb
  • Examine how psychological, social, economic, and technological forces influence today’s fashions
  • Explain the role of different businesses in developing, producing, and distributing apparel products
  • Depict how an apparel product moves from concept to design to production to distribution to consumer
  • Judge value and quality of apparel products
  • Develop skills for professional success (analytical thinking, communication, decision-making, teamwork).
BISC301 Molecular Biology of the Cell
Flo Schmieg (partial list)
• Students will have learned to retrieve and share information with others
• ...be able to draw conclusions from scientific data.
• ...be able to construct a laboratory report in manuscript format.
• ...be able to evaluate scientific claims using substantiated criteria.

Step 1: Writing Learning Objectives
- Identify several learning objectives for your PBL development; consider both content and process goals.
- Traditionally, how might these learning objectives be addressed? What kind of problem or activity would you assign?

Step Two: Identify Real-World Context
Name a realistic application of the concept.
Outline a scenario.

Ideas:
• Add story-telling to end-of-chapter problem.
• Add motivation, require students to go beyond rote learning, do research.
• Include decision-making, analysis, or both.
• Other?

A Real Traffic Accident
- Based on police sketch
- Students need to make assumptions and approximations
- Information given gradually throughout problem

Two Schemes for Writing Problems?
1. Think of one or more learning objectives in your course
2. Name a realistic application of the concept(s). Outline a scenario.

1. Think of a realistic scenario from the news, a videotape, or popular press article
2. What learning objectives for your course are evident in the scenario?

Step Three: Draft the problem
Outline the problem (create a ‘story board’) First consider, “What will be on the first page?”

Suggestions:
• Good PBL problem has multi-page, multi-stage construction – progressive disclosure.
• Not all information given in chapter or text - students look for resources.
• Challenge students to come to consensus, reach conclusions, and make judgments.
Consider the Following
Problem Types:

Explanation or Analysis Problems
'What is going on here?'

Decision or Dilemma Problems
'What would you do? 'What do you think?'

Task-Oriented Problems
Doing an activity or carrying out a project - for example, interviewing patients or designing a brochure.

Problem Progress Report

For presentation:
Basic features of course
Objectives for student learning
Synopsis of problem
Scenario for first page, including guiding questions
What comes next?

Problem Writing Step 4

Continue to draft the storyline beyond a sketchy scenario – begin to write the first stage
Think about point-of-view, nature of the end-of-stage questions, suitability for 'audience,' alignment with problem and course objectives

Remember: A good PBL problem leaves just the right information out!
Challenge students to come to consensus, reach conclusions, and make judgments.
Comparison of Teacher-Centered and Learner-Centered Paradigms

From Figure 1-2 in Huba and Freed, Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning, 2000

Comparison of Paradigms

Teacher-Centered
Knowledge is transmitted from professor to student. Students passively receive information.

Learner-Centered
Students construct knowledge through gathering and synthesizing information and integrating it with the general skills of inquiry, communication, critical thinking, and problem solving.

Comparison of Paradigms

Teacher-Centered
Instructor’s role is to be primary information giver and primary evaluator.

Learner-Centered
Instructor’s role is to coach and facilitate. Instructor and students evaluate learning together.

Comparison of Paradigms

Teacher-Centered
Emphasis is on acquisition of knowledge outside the context in which it will be used.

Learner-Centered
Emphasis is on using and communicating knowledge effectively to address enduring and emerging issues and problems in real-life contexts.

Comparison of Paradigms

Teacher-Centered
Assessment is used to monitor learning. Teaching and assessing are separate.

Learner-Centered
Assessment is used to promote and diagnose learning. Teaching and assessing are intertwined.

What I know best I have taught...
...the individuals learning the most in the typical classrooms are the teachers there. They have reserved for themselves the very conditions that promote learning:

actively seeking new information, integrating it with what is known, organizing it in a meaningful way, and explaining it to others.

Page 35, Huba and Freed, Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning, 2000
**Comparison of Paradigms**

**Teacher-Centered**
Focus is on a single discipline.
Emphasis is on right answers.

**Learner-Centered**
Approach is compatible with interdisciplinary investigation.
Emphasis is on generating better questions and learning from errors.

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**Outcomes?**

**Moving away from:**
Are students getting the right answer?

**Moving to:**
Can students demonstrate the qualities that we value in educated persons, the qualities we expect of graduates?
Can students gather and evaluate new information, think critically, reason effectively, and solve problems?

Can students communicate clearly, drawing upon evidence to provide a basis for argumentation?
Do students’ decisions and judgments reflect understanding of universal truths/concepts in the humanities, arts, etc.

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**Comparison of Paradigms**

**Teacher-Centered**
Culture is competitive and individualistic.
Only students are viewed as learners.

**Learner-Centered**
Culture is cooperative, collaborative, and supportive.
Teachers and students learn together.

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**Outcomes?**

**Moving to:**
Can students work respectfully and productively with others?
Do students have self-regulating qualities like persistence and time management that will help them reach long-term goals?