Problem Based Learning: 
Part 2: How do we learn with a problem?

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Overview of the “problem”

- Authentic
- Ill-structured
- Complex (multiple answers)
- Ill-defined
- Aligned with content objectives / standards
Scenario and Resources Reviewed

• Real-world format
• The “hook” to engage and motivate students
• Roles for students
• Resources to support learning
• Concept Map of sub-problems and possible solutions
PBL Design Process

Choose a Relevant Problem of Worth → Develop the PBL Learning Adventure → Build the Teaching and Learning Template → Coach Critical Teaching and Learning Events → Embed Periodic Assessments and Appropriate Instruction

Problem Design → Problem Implementation

Reprinted from Torp & Sage (1998), p. 17. © 1995 Illinois Mathematics and Science Academy, Center for Problem-Based Learning, Aurora, IL.
PBL: Learning and Teaching Process

1. Introduction
2. Provide Problem
3. Group Assignment
4. Identify, Define, Gather (Researching)
5. Solution
6. “Best-fit” Solution
7. Present / Assessment
8. Reflect
PBL Learning Template

1. Develop Problem
2. Create Scenario
3. Locate Resources
4. Concept Map of Sub-problems and Possible Solutions
5. Decide Group Roles and Methods
6. Create a Questioning Guide
7. Create or Locate Cognitive Aids
8. Develop Assessment(s)
Cooperative Learning Benefits According to Research

- Promotes achievement (Slavin, 1980)
- Increases student retention
- Enhances satisfaction with learning experience
- Develops oral communication
- Develops social skills
- Promotes self-esteem
- Promotes positive race relations (Aronson, 1978)
Cooperative Learning Methods and PBL

- Think Pair Share
- Jigsaw (Aronson)
- Team Pair Solo (Kagan)
- Group Investigation (Sharan & Sharan)

**Remember**: Application of method can be vary within the PBL Learning and Teaching Process.
Cooperative Learning Roles and PBL

• Academic / Structure
• Role-playing
• Both
Questioning

• Benefits of questions
  – Natural part of learning
  – Assess confusion
  – Expand on understanding
  – Used everyday

• 2 main types of Questions
• Close (lower-level)
• Open (higher-level)
Lower Level Question Types

- **Monitor**: encourage students to monitor their inquiry and problem-solving processes
  - ex: *Do you have everything you need to report out in your group?*

- **Refocus**: assist students in staying on problem
  - ex: *What is the problem we are trying to solve?*
  - ex: *What were the 3 things you found in your research? Do you think they are important?*

- **Goal-setting prompt**: help students set goals
  - ex: *Where do you think we can find out that information?*
Higher-Level Question Types

- **Probe**: to go deeper into an idea or concept
  - ex: *Can you say more about that?*

- **Challenge**: prompt students to support their claims or validate their reasoning
  - ex: *How do you know that to be true?*

- **Redirect**: bring students back to the problem
  - ex: *Before our discussion you said ____; what do you think now?*

- **Socratic**: help students expand and explain to further dialogue
  - ex: *What are the consequences of that assumption?*
Teacher Questions and Research

- Teachers ask 300 to 400 questions a day (Levin & Long, 1981; Stevens, 1912).
- 60% are recall (lower-level) and 20% required thinking (Gall, 1970).
- Teacher questioning can positively influence student achievement, higher-level thinking skills and reasoning (Wilen, Bosse, Hutchison, & Kindsvatter, 2004).
Questioning Guide

• Create a guide with questions that you can use when you spend time with each group.
• Use the guide as you spend 3 to 5 minutes with each group.
PBL and Teaching

• “...[Teaching] is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process not a product” (Bruner, 1966, p. 72).
Cognitive Aids

• What is a cognitive aid?
  • A Resource or tool to assist a student in cognitive development and skills.
  • Cognitive tools are both mental and computational devices that support, guide, and extend the thinking processes of their users (Derry, 1990).

• Why important to PBL?
  • Building and practicing higher level thinking, metacognition, and reasoning skills.
Cognitive Overload and Inexperienced

- When the problem is first introduced, students might panic. You want me to think?
- During the research process students might feel overwhelmed at first.
- You are going to allow me to choose the final or end product?
- Students will experience shock or emotional disturbance
- Creates disequilibrum
Brain Storming

• The primary purpose is for the student to reflect on past knowledge and make a plan for researching and collecting additional information to solve the problem(s).
  – Google Docs or Wikis

<table>
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<th>Issues</th>
<th>Actions</th>
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KWL Varieties

- The primary purpose is for the student to
  1. Reflect on previous knowledge and experiences.
  2. Decide on what they need to know to make a plan.
  3. Reflect on what is learned to make connections between old and new information.

- KWL
- KWHL
- KWLS
- KSWQ
Thinking Logs

• The primary purpose is for the student to reflect and develop critical perspective(s) and connections

• Could also include
  – Journal
  – Reflection Notebook
  – Blog or Vlog (video blog)

1. What is the problem you are trying to solve?
2. What are additional problems that need to be solved?
3. List 2 things you want to learn at the library?
4. What did you learn in your group discussion today?
5. What is your solution and why?
Graphic Organizers

• The primary purpose is for the student to reflect on past knowledge and organize new information in a meaningful way to increase retention.

• Concept Maps
• Charts
• Graphs
• Data Sets
• Drawing
PBL: Teacher Role

• Embed Instruction and assessments
• Coach or Guide learning process
• Questioning Types
• Group Methods
• A member of a learning community
Teacher vs. Student Role

**Teacher’s Role**
- Teacher designs and engages students in a problem-based inquiry that unravels the situation and exposes the root problem.
- Teacher empowers students as investigators of the problem, tacitly and overtly affirming their control of the inquiry, while serving as metacognitive coach for the process.
- Teacher coaches from the sidelines as students generate possible solutions and problem resolution.

**Student’s Role**
- Students seek needed information, pursue the investigation, and actively learn. Students are coached and supported as they self-direct their learning.
- Drawn into the problem, students apply knowledge, skills, and habits of mind to meaningful and authentic activity. Students emerge as self-directed learners and problem-solvers.

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Teacher at the top of the triangle, Student at the bottom.

The “run” of a problem
Student Reaction to PBL:

• “Well personally I don't like PBL at the moment. I feel very very lost with PBL. It's something you have to do lots and lots of work for, and if you're not focused then there's not much point in coming to class.”
  – College Undergraduate Student
Learning Template

• Problem
• Scenario
• Resources
• Introduction to PBL, problem, and scenario
• Group Methods
• Student Roles
• Cognitive Aids for learning process
• Questions