

## What Is a Good PBL Problem?



*Institute for Transforming Undergraduate Education*  
University of Delaware



[www.udel.edu/pbl/southwesterncc](http://www.udel.edu/pbl/southwesterncc)



## Good PBL Problems...

- relate to real world, motivate students
- require decision-making or judgments
- are multi-page, multi-stage
- are designed for group-solving
- pose open-ended initial questions that encourage discussion
- incorporate course content objectives, higher order thinking, other skills



## Rubric to Evaluate PBL Problems

Criteria	Descriptors		
	3	2	1
<b>Realism</b>	Based on an actual or fictionalized real-world situation linking topic to learner.	Contrived or contains unrealistic elements that decrease credibility.	Unrealistic, lacking relevant context.
<b>Content</b>	Addresses significant conceptual issues; directly related to major content goals.	Encourages superficial rather than in-depth understanding concepts.	Relevance of topic peripheral or not apparent.
<b>Engagement</b>	Stimulates discussion and inquiry through its relevance and presentation.	Generates limited or superficial discussion; provokes little curiosity.	Lacks a "hook"; obscure or pedantic presentation.



## Rubric to Evaluate PBL Problems

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<b>Complexity</b>	Appropriately challenging; group effort and cooperation required; some ambiguity appropriate; integrates multiple concepts.	Difficult but may encourage a "divide and conquer" approach. Concepts not well integrated.	Solution accessible to most students working alone; focused on single concept.
<b>Resolution</b>	Open to multiple resolutions or multiple pathways to solution, depending on student assumptions and reasoned arguments.	Resolution is more obvious but allows reasonable opportunity for judgment and discussion.	One right answer is expected; limited opportunity for analysis and decision making.



## Rubric to Evaluate PBL Problems

Criteria	Descriptors		
	3	2	1
<b>Structure</b>	Progressive disclosure via multiple stages, builds on existing student knowledge.	Staging does not flow well; transition could be improved.	Too much or too little information provided at once; short cuts thinking/research.
<b>Questions</b>	Limited in number, short, and open-ended; encourage deeper understanding.	Most are directive; preempt student-generated learning issues.	Lead to "yes-no" answers rather than thoughtful discussion.
<b>Research</b>	Promotes substantive research using multiple resources.	Research limited to textbook material.	Limited necessity for research.

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		<b>3 (ideal)</b>	<b>2</b>	<b>1</b>
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**Other possible rubrics:**

**Problem Delivery and Process**

**Associated Assignments**

**Student Products and Presentations**

## Writing Effective PBL Problems



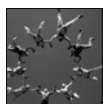
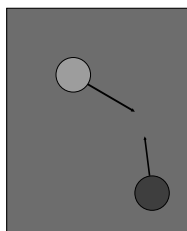
Courtesy of  
Deborah Allen  
University of Delaware



### Example from Physics: Solving Problems Using Conservation of Momentum

#### Traditional examples:

- Pool balls colliding
- Bullets hitting blocks of wood



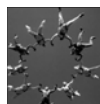
## Types of Learning Objectives

#### 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

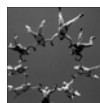


## Step One: Identify Learning Objectives

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: Traditional 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 (ie, they stick together).



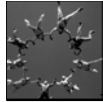
Serway and Faughn. 3rd ed. College Physics, Saunders, 1992.



## 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).



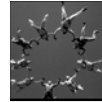


## Sample Learning Objectives

### BISC301 Molecular Biology of the Cell

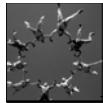
Flo Schmieg (partial list)

- 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.

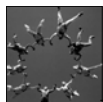
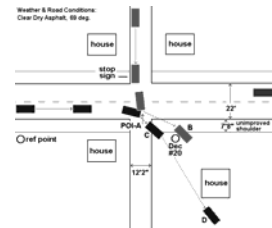
Ideas:

- 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?



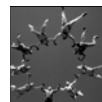
## A Real Traffic Accident

- 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             | 1. Think of a realistic scenario from the news, a videotape, or popular press article |
| 2. Name a realistic application of the concept(s). Outline a scenario. | 2. What learning objectives for your course are evident in the scenario?              |



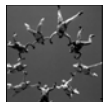
## Step Three: Draft the problem

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.*



A Day in the Life of John Henry, Traffic Cop



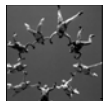
#### Part 1.

At 13:20 on the last Friday in September, 1989 a frantic call was received at the local police station. There had been a serious automobile accident at the intersection of Main Street and State Street, with injuries involved. Lt. John Henry arrived at the scene 10 minutes after the phone call and found that two cars had collided at the intersection. In one car, the driver was unconscious and in the other car both driver and one passenger were injured.

After the emergency vehicles transported the injured to the hospital, Lt. Henry's responsibility is to investigate the accident in order to determine whether one of the drivers (or both) are responsible. With the severity of injury in this accident, the investigation is critical because there may be a fatality involved.

#### Questions:

1. What questions does John Henry have to answer in this investigation? What measurements does he need to take? What data should he collect? What other information does he need to record in order to aid the investigation? What physics principles will John Henry need to use in order to help analyze the data and answer his questions?



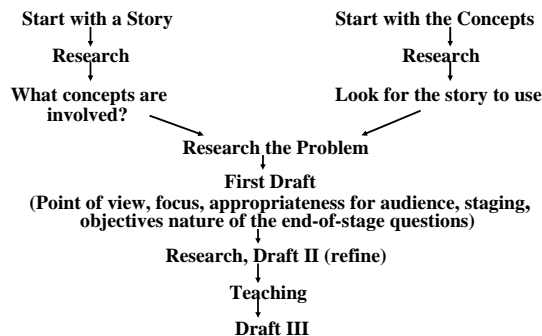
## Problem Progress Report

*For presentation:*

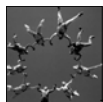
- Basic features of course
- Objectives for student learning
- Synopsis of problem
- Scenario for first page, including guiding questions
- What comes next?



### Writing PBL Problems

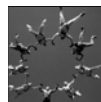


From C. F. Herreid, SUNY Buffalo & W. Welty, Pace University



## Sources and Strategies for Writing Problems

- Newspaper articles, news events
- Popular press in the discipline
- Make up a story – based on content objectives
- Adapt a case to a problem
- Research papers
- Other?



## 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



## 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

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

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

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

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.



## Comparison of Paradigms

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### 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.



## Comparison of Paradigms

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### 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.



## Outcomes?

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### Moving away from:

Are students getting the right answer?



## Outcomes?

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### 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?



## Outcomes?

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### Moving to:

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.*



## Outcomes?

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### 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?