

Designing PBL Problems, Part 2: Writing Effective Problems



*Institute for Transforming
Undergraduate Education*

University of Delaware



Problem-Based Learning:
From Ideas to Solutions through Communication
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Getting Started: Course Specifics

| | |
|-----------------|---------------------------------------|
| Students | Majors/nonmajors |
| | Novice/mature learners |
| | Prior experience with PBL, group work |

| | |
|----------------|---|
| Problem | One-time use vs. one of several |
| | Length of problem, timing within course |
| | Structure: staging, guiding questions |
| | Learning objectives to be addressed |
| | Student products, assignments, assessment |
| | Resources available (including peer tutors) |

Getting Ideas for Writing Problems

1. Begin with the desired learning objectives.
2. Look for a real-life example or situation that involves those concepts.

1. Begin with a real-life story or example.
2. What content and process objectives might be found in that story?

Problem Sources and Strategies

- News events, articles
- Popular or scholarly press in the discipline
- Authentic tasks, roles, etc. as triggers
- Case studies
- Adaptation of text problems or questions



Source Example: News Event



Trigger: NY Times report of Galapagos oil spill

Problem: Conversation between 2 oil molecules

“Boy, that really frosts me!”

“What are you griping about now?”

“That story about how those islands and their oh-so-precious life forms are in danger again from the nasty oil spill. Every time something like this happens, who’s the bad guy? Us, that’s who. Nobody ever thinks about what it’s like for us - one minute, all snuggled up together, safe and sound, inside a nice dark tanker hold - and then, all of a sudden, thrown out into that disgusting ocean. Does anyone ever care about what we have to go through? No - they just worry about stupid creatures without enough sense to get out of our way. And another thing...”

“Simmer down - if you get any more excited, you’re liable to change state - and where would that get you?”

“Far from here, I hope - I’ve had it with these seals sliding all over me! And think about it - do you still want to be here when those cleanup guys arrive? I’ve heard horror stories about that!”



Source Example: News Event



Task:

Be compassionate and try to see this situation from an oil molecule's point of view. Describe yourself; what is your (molecular level) environment like, both before and after the oil spill? Why do you behave as you do? What will the "cleanup guys" bring to this picture?

Concepts introduced:

energetics of solution formation, solubility and intermolecular forces, micelles, surfactants, chemical rationale behind cleanup, environmental issues



Source Example: Authentic Tasks

- **Trigger:** discussion of National Film Preservation Act
- **Problem:** choose a film to nominate for inclusion in the National Film Registry
- **Task:** prepare a critical analysis of the film and submit a persuasive nomination to the Library of Congress.
- **Concepts introduced:** theories and strategies of film analysis, development of evaluative criteria

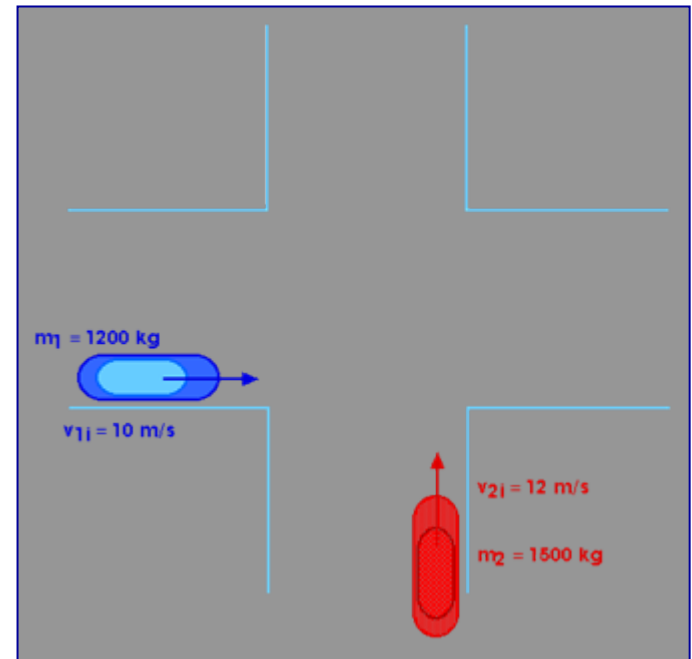
PBL Clearinghouse Problem submitted by Bryan Johnson, Samford University, 2001



Source Example: Textbook Problems

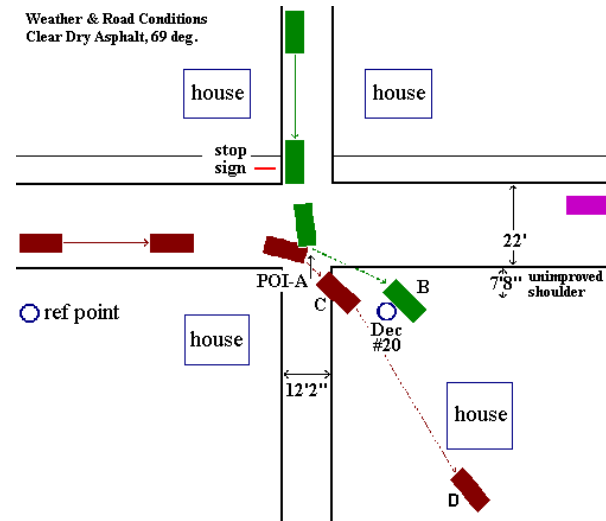
- **Physics concept:** conservation of momentum
- **Text examples:** colliding pool balls, car collisions

A 1200-kg car traveling east with a speed of 10 m/s collides at an intersection with a 1500-kg van traveling north at a speed of 12 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).



Source Example: Textbook Problems

- **Problem:** students, in role of police officer, must determine culpability in fatal car crash based on data (disclosed progressively) from actual police accident report. Assumptions/approximations required; different choices lead to different conclusions.





Problem Writing Exercise

1. Identify 1-2 major learning objectives that you want to address through a problem - consider both content concepts and process skills.
2. Identify a real-world context or application of those concepts. *(Steps 1 and 2 may be reversed.)*
3. Develop a scenario or story to set the stage.
4. Begin drafting the problem by outlining the first page.
5. Provide a brief synopsis of what the rest of the problem will look like: other stages, products, etc.

There will be time Friday morning for some to present their problem ideas and receive feedback from the group.



Problem Writing: Step One

1. Identify 1-2 major learning objectives that you want to address through a problem.
 - Consider both content concepts and process skills.

OR

1. Identify a real-world context or application of ideas related to your course.



Problem Writing: Step Two

2. Identify a real-world context or application of those concepts.
 - Why does a student need to learn this material?
 - How and where does it appear outside the classroom?

OR

2. Identify the learning objectives embedded in the example you have chosen.



Problem Writing: Step Three

3. Develop a scenario or story to set the stage.

- Current events or topical issues help capture interest.
- Consider a “story-telling” voice rather than straight presentation of information.
- Characters, dialogue, humor can help get students’ attention.
- Keep student perspective in mind: “why should I care about this?” Consider situations related to student life, interests, future career plans or roles, etc.



Problem Writing: Step Four

4. Begin drafting the problem by outlining the first page.

- Multi-page/stage problems often move from general questions (“what’s going on here?”) to more specific tasks.
 - Open-ended initial questions promote group discussion
 - Progressive elaboration of problem and/or disclosure of information helps to keep up interest.
- Resist the urge to provide too much information.
- Problems need not be “real”, but avoid overly contrived situations.



Problem Writing: Step Five

5. Provide a brief synopsis of what the rest of the problem will look like: other stages, products, etc.

- Ambiguities provide opportunities for students to make assumptions and to see their consequences.
- Elements of controversy and judgment help develop higher order thinking and communication skills.
- There need not be one “right” answer.

Another Scheme for Categorizing Problems - Based on Types of Knowledge

| Type of Knowledge | Descriptive | Explanatory |
|---------------------|---|---|
| Type of Problem | Fact-finding | Explanation |
| Examples | Following changes related to land use in Zimbabwe, many internal borders changed. | People in the 15 th century used to believe it was possible to fall off the earth. |
| Example of Question | What would a legal map look like? | Explain why? |

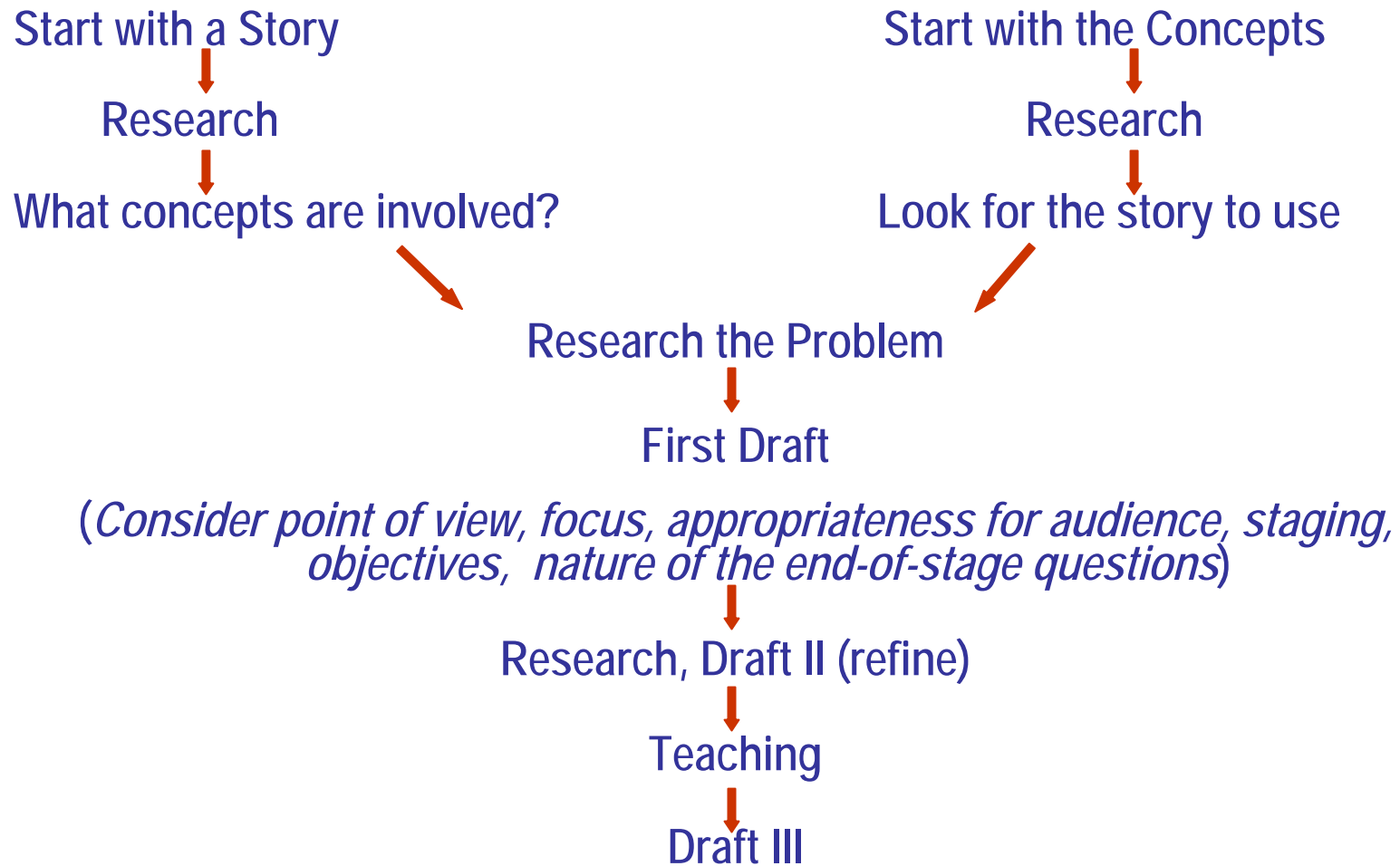
Source: M. Savin-Baden and C. Major. 2004. *Foundations of PBL*. Berkshire, England: Open University Press.



Types of Problems Based on Type of Knowledge

| Type of Knowledge | Procedural | Personal |
|---------------------|--|--|
| Type of Problem | Strategy | Moral dilemma |
| Examples | A 45-year old woman cannot lift her arm more than 45 degrees and she complains of pins and needles in her arm. | A mother breaks into a drugstore to obtain expensive, life-saving drugs for her child. The next day she tells her physician what she has done. |
| Example of Question | If you were this client's therapist, what would you do? | What should the physician do? |

Problem Writing Cycle



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

