

Writing Effective PBL Problems



**Courtesy of
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*University of Delaware***



Writing Your Own Problem Starter





Step One: *Identify Learning Objectives*

Think of a learning objective in your course.

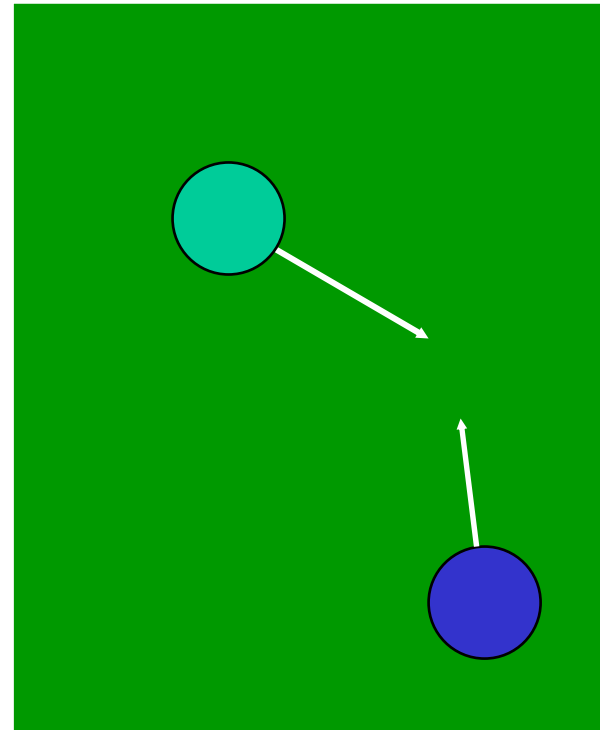
How do you usually address this learning objective? What kind of problem or activity do you usually assign?

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

Example from Physics: Solving Problems Using Conservation of Momentum

Traditional examples:

- **Pool balls colliding**
- **Bullets hitting blocks of wood**





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.





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).





Sample Learning Objectives

BISC301 Molecular Biology of the Cell

Flo Schmieg (partial list)

- 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 at least three learning objectives for your PBL course; consider both content and process goals.
- Traditionally, how might this learning objective 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.**

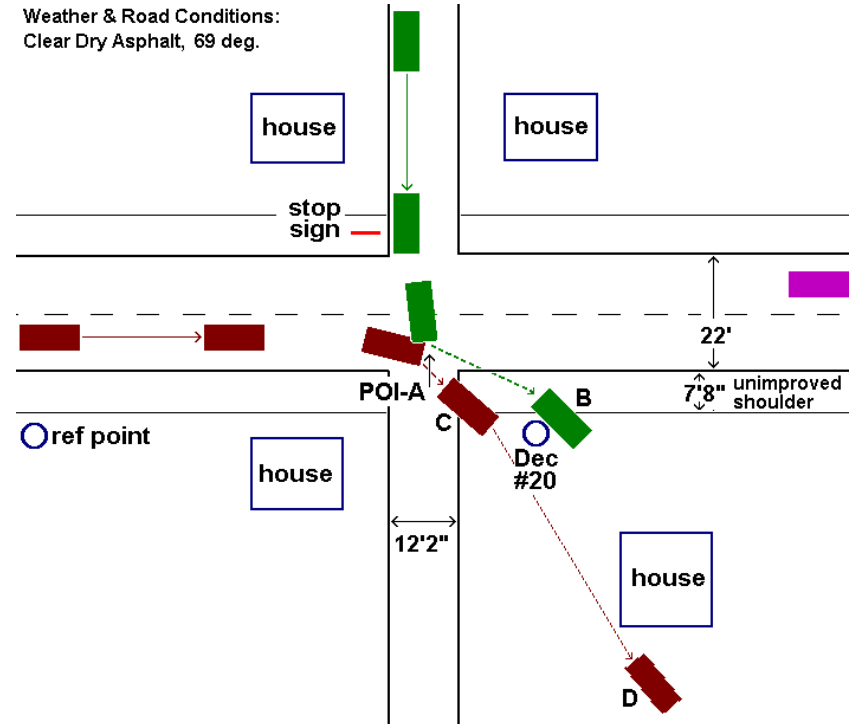
Ideas:

- **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





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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 - leave students guessing!**
- **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.



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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?

A Day in the Life of John Henry, Traffic Cop

Part 2.

Refer to the attached sketch. Main street, a thoroughfare, has a 45 mile per hour speed limit. State Street also has a 45 mile per hour limit, but has a stop sign on either side of the road. Vehicle 2, which weighs 5800 lbs, skidded for 24 feet before coming to a stop next to the utility pole, marked Dec #20. Vehicle 1, which weighs 2060 lbs, showed no skid marks after the impact and came to a rest next to the house on the corner. Looking at the impact areas of the cars, it was clear to Lt. Henry that the cars impacted at right angles, hitting the front right bumper of vehicle 2 and the front left bumper of vehicle 1. After impact, they initially were traveling in the same direction. Lt. Henry noted that the weather was clear and sunny, 69° and the roadway was dry.

Before John Henry got any further in his analysis, he was informed that driver who was unconscious at the scene of the accident died at the hospital.

Questions:

4. Can you make an educated guess about which driver died based on the evidence so far? Justify your answer.
5. Why would John Henry note the weather and the condition of the road?
6. Why did vehicle 1 travel further than vehicle 2?

Part 2. (contd.)

John Henry has to determine whether the driver of vehicle 2 ran the stop sign and/or if the driver of vehicle 1 was speeding. Outline a procedure that Lt. Henry can use to answer these important questions. Be sure that your reasoning is sound, since he will have to testify in court on the evidence.

Question:

7. Does John Henry have all the information he needs to determine the velocities?

A Day in the Life of John Henry, Traffic Cop

Part 3.

Lt. Henry used a drag sled to determine that the coefficient of friction between the tires and road was 0.60. He can't use the drag sled to determine the coefficient of friction between the tires of vehicle 1 as they roll over the roadway and grass.

Questions:

8. Does he need this information? What procedure can he use to find out this information?
9. Using your outlined procedures, find the velocities of the two vehicles just prior to impact and estimate the coefficient of friction between the rolling tires of vehicle 1 and the roadway and grass. Be sure to state any assumptions that you make and justify them.
10. During the collision, which vehicle delivered the greater force of impact? Justify your reasoning using physics principles.
11. How can Lt. Henry determine the speeds of both vehicles just before they applied their brakes? What further information will he need?



Problem Progress Report

For presentation:

Basic features of course

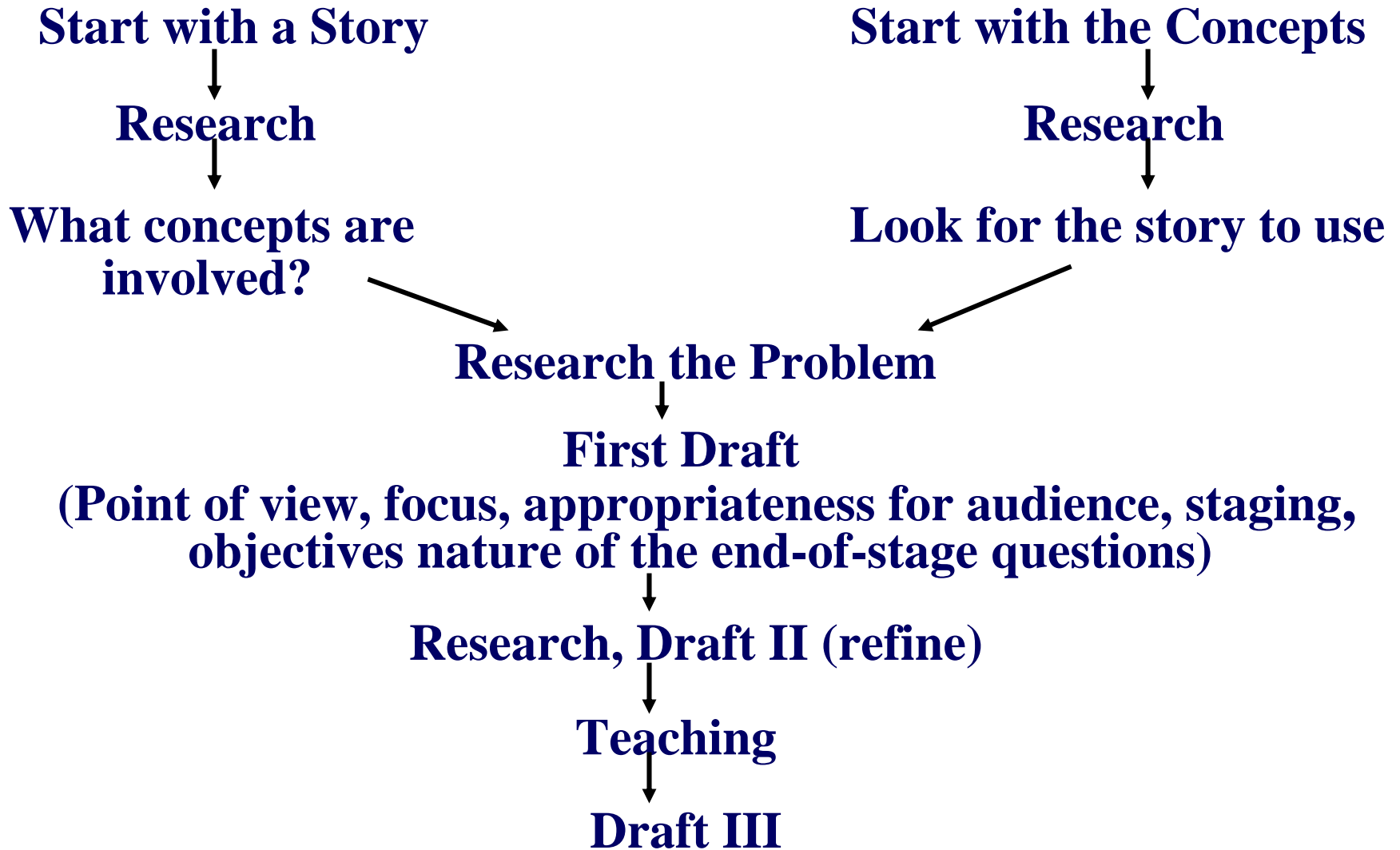
Objectives for student learning

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



Some Additional Considerations for Step 4

A good PBL problem leaves just the right information out!

Challenge students to come to consensus, reach conclusions, and make judgments.