Why Group
Problem Solving
May
Not Work

1. **Poor structure and management of Groups**
2. **Inappropriate Grading**
3. ***Inappropriate Tasks***

2

Appropriate Group Problems

The problems must be challenging enough so there is a *real* advantage to solving the problem in a group .

1. The problem must be complex enough so the best student in the group is not certain how to solve it.

   The problem must besimple enough so that the solution, once arrived at, can be understood and appreciated by all group members.

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3



2. The task must be designed so that

- the major problem solving heuristics are required (e.g. physics understood, a situation requiring an external representation);
- there are several decisions to make in order to do the task (e.g. several different quantities that could be calculated to answer the question; several ways to approach the problem);
- the task cannot be resolved in a few steps by copying a pattern.



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3. The task problem must connect to each student's mental processes

- the situation is real to the student so other information is connected;
- there is a reasonable goal on which to base decision making.

5

What Characteristics of Textbook Exercises Promote the Plug-and-Chug Strategy?

Cart A, which is moving with a constant velocity of 3 m/s, has an inelastic collision with cart B, which is initially at rest as shown in Figure 8.3. After the collision, the carts move together up an inclined plane. Neglecting friction, determine the vertical height *h* of the carts before they reverse direction.

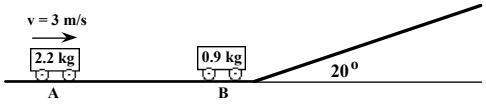

Figure 8.3

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Context-rich Problem

You are helping a friend prepare for the next skate board exhibition. The plan for the program is to take a running start and then jump onto a heavy duty 8-lb stationary skateboard. Your friend and the skateboard will glide in a straight line along a short, level section of track, then up a sloped concrete wall. The plan is to reach a height of at least 10 feet above the starting point before turning to come back down the slope. The fastest your friend can run to safely jump on the skateboard is 7 feet/second. Knowing that you have taken physics, your friend wants you to determine if the plan can be carried out. When you ask, you find out that your friend's weight is 130 lbs.

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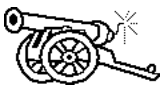
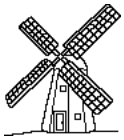
Context-rich Problems



1. Each problem is a short story in which the major character is the student. That is, each problem statement uses the personal pronoun "you."
2. The problem statement includes a plausible motivation or reason for "you" to calculate something.
3. The objects in the problems are real (or can be imagined) -- the idealization process occurs explicitly.
4. No pictures or diagrams are given with the problems. Students must visualize the situation by using their own experiences.
5. The problem cannot be solved in one step by plugging numbers into a formula.



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Context-rich Problems

In addition, more difficult context-rich problems can have one or more of the following characteristics:

- The unknown variable is not explicitly specified in the problem statement (e.g., Will this design work?).
- More information may be given in the problem statement than is required to solve the problems, or relevant information may be missing.
- The solution requires using geometry/trigonometry of physical situation to eliminate an unknown. .
- The problem may require more than one fundamental principle for a solution (e.g., Newton's Laws and the Conservation of Energy).
- The problem consist of more than 2 subparts (e.g., more than 2 interacting objects, time intervals, or different types of events.

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Why is this not a context-rich problem?

A 44-kg mass is suspended by two ropes, as shown in Figure 4-3. Find the tension in each rope.

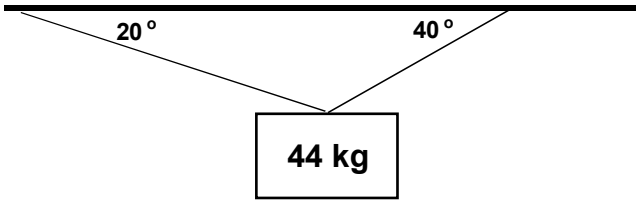

Figure 4-3

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Context-rich Problem

You are part of a team to help design the atrium of a new building. Your boss, the manager of the project, wants to suspend a 20-lb sculpture high over the room by hanging it from the ceiling using thin, clear fishing line (string) so that it will be difficult to see how the sculpture is held up. The only place to fasten the fishing line is to a wooden beam which runs around the edge of the room at the ceiling. The fishing line that she wants to use will hold 20 lbs (20-lb test) so she suggests attaching two lines to the sculpture to be safe. Each line would come from the opposite side of the ceiling to attach to the hanging sculpture. Her initial design has one line making an angle of 20 ° with the ceiling and the other line making an angle of 40 ° with the ceiling. She knows you took physics, so she asks you if her design can work.

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Why is this not a context-rich problem?

If an aircraft is properly banked during a turn in level flight at constant speed, the force F_a exerted by the air on the aircraft is directed perpendicular to a plane which contains the aircraft's wings and fuselage (Fig. 6-25). Draw a free-body diagram for such an aircraft.

(*Hint:* Note the similarity to the conical pendulum in Example 6-7.) An aircraft traveling at a speed v = 75 m/s makes a properly banked turn at a banking angle of 28°. What is the radius of curvature of the turn?

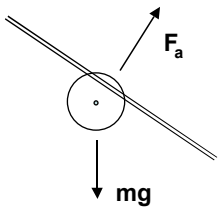

Figure 6-25

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Context-rich Problem

You are flying to a job interview when the pilot announces that there are airport delays so the plane will have to circle the airport. The announcement also says that the plane will maintain a speed of 400 mph at an altitude of 20,000 feet. To pass the time, you decide to figure out how far you are from the airport. You notice that to circle, the pilot "banks" the plane so that the wings are oriented about 10° to the horizontal. An article in your in-flight magazine explains that an airplane can fly because the air exerts a force, called "lift," on the wings. The lift is always perpendicular to the wing surface. The magazine article gives the weight your type of plane as 100 x 10^3 pounds and the length of each wing as 150 feet. It gives no information on the thrust from the engines or the drag on the airframe.

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Why is this not a context-rich problem?

As you are driving to school one day, you pass a construction site for a new building and stop to watch for a few minutes. A crane is lifting a batch of bricks on a pallet to an upper floor of the building. Suddenly a brick falls off the rising pallet. You clock the time it takes for the brick to hit the ground at 2.5 seconds. The crane, fortunately, has height markings and you see the brick fell off the pallet at a height of 72 feet above the ground. Your friend in the car with you asks, "I wonder how fast the pallet was rising before the brick fell off?" Since you are taking physics, you quickly calculate the answer for him.

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Context-rich Problem

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