I’m tired of keeping track of worksheets and passing them out and forgetting to copy them, so I’m thinking about copying all of them (well, at least several units worth) and giving them to the students ahead of time and telling them to put them in a notebook. They would be responsible for having the worksheet when we need it. Does anyone see any flaws in this plan?

Gene Newman <emnewman@TOAD.NET>

I’ve been handing out readings and worksheets together now for a couple of years, works great, no problems.

Jim Schmitt <jschmitt@ECASD.K12.WI.US>

Now that the year is winding down, I’ve been reflecting on the use of the Modeling worksheets. Specifically, how do you introduce them? For example, after a paradigm lab, do you send them out "cold" to see how they can implement the new concept without any practice? Do you provide examples before sending them off to do the worksheet, or does this lead to too much "algorithm memorization", and not enough concept implementation? Do you give them time in class to collaborate on the worksheets, or only when they whiteboard?

Additionally, how do you assess/value worksheets to make students take them seriously?

I’ve had pretty good success with the worksheets this year, but am always interested in what ideas you all have to make them more meaningful and constructive.

Joseph Vanderway <jvanderway@CSUN.EDU>

I was just re-evaluating my use of the worksheets myself. Here’s what I currently do, and how I plan to change it.

What I do:
1. Post Lab (mini-lecture/discussion)
2. Hand out the worksheet (cold) and assign a few problems for homework
3. Next day, groups whiteboard these problems. Every group does the same problem, or two problems are divided among the 12 groups. After a 7-10 minute preparation period, I check all the boards, give some token points and select a group to present their solution strategy.
4. The selected group presents, students ask questions and there is much learning.
5. Worksheets are collected the day of the quiz. Each worksheet is worth about 1/10 the total value of a quiz each.

The problems:
Students have discovered that we will work out the problems in class, and that they most likely won’t have to present so they don’t spend the time necessary outside of class to
understand the application of the models. This means that they can’t prepare a whiteboard in 7-10 minutes, so I end up giving them more time in preparation so at least they will have something to present and discuss. We rarely get more than two problems done in a class period. This slows down the pace of the course considerably, so that students lose the continuity of moving building and expanding the models. Students also fail to connect the abstract pencil-paper problems to the real world.

My untried idea:
1. Post the lab.
2. Hand out a worksheet with very few, basic pencil-paper problems that ask students to apply the model developed in the previous lab.
3. Students come into class the next day and are presented with a NEW problem which has been physically created in class.

Example: "Here is a dynamics cart on an inclined track. If I release the cart from rest so that it rolls down to the end-stop and bounces back using its internal spring, how high up the ramp will it bounce?"

Students would be provided with mass, angle, energy dissipated (based on my previous testing of the apparatus), and other information. This provided information could vary, depending on the amount of calculation/estimation I feel is necessary for the class.

4. Students spend a fixed amount of time (variant depending on the complexity of the problem) and then WBs are evaluated and a group is selected to present.
5. The selected group presents and the class asks questions.
6. We actually do the problem (in the example, we drop the cart) and see if these models are actually good for anything...

Repeat with a new problem the next day. What do you think?

All of this brings up a point of modeling that I believe needs refinement. We spend a very long time developing a small number of models: Constant Velocity (Equilibrium), Constant Acceleration (Constant Force), Projectile Motion, "The Equation of Everything" (Energy Conservation), "Momentum Conservation".

For many of us, it takes over a semester to develop these basic models. At the end, students finally begin deploying the models, but rarely before. The worksheets are pretty much structured such that students don’t have to work hard to select the model. Ok, so we spend all this time teaching students to develop models from observations. This is great, but I’m starting to feel that it is perhaps more important to get the students to recognize that we apply models to physical systems all of the time. By applying a known model to an unknown situation, we can determine what will happen in the situation. Students need to evaluate the situation and decide which model to apply.

[Note: Read Joseph’s update at the end of this compilation.]
This past year was the first year that I used all of the modeling materials. I used the worksheets in a different way. When it was time for the worksheet to follow the classroom work, I used them as instructional tools. We work together in class. Sometimes I led the work, sometimes one of the students led the work. Then I always had a quiz that was related to the types of problems the students had worked on. Sometimes I had an additional paper for the students to take home and work, sometimes I found problems/questions in their text for the students to complete for homework. ...

I truly believe the worksheets are valuable because of the style of problem design. The problems build on the concept from one to the other and the final problem on the paper serves as a good culmination of the concept with a multilevel problem that unites all of the ideas in the unit as they are developed. It is this multilevel problem that can represent the lab work, but often it goes beyond.

[Note: read Trina’s complete post in the compilation on "homework management".]

When reviewing the worksheets, we whiteboard every problem usually. Each group does one problem, with no groups doing the same problem (usually). Board preparation time can vary widely. I have let them take between 10 and 30 minutes depending on the difficulty of the problems and how many students are having trouble. In any case, I set a time limit at the beginning of the session to keep them moving.

Presentation time requires each group to present their problem. Each person in the group is required to present something. If one person doesn’t speak or contribute, they know that they will be asked a question (by me). Students in the audience are required to provide one question per group in order to get points on their presentation grade (I have a rubric, that I stole from another teacher).

This level of accountability during the presentation phase tends to motivate the students not only to understand things before they get up and speak, but to do a better job at home on the problems. They know that the harder they try at home, the less likely it is that they will look like an idiot in front of the class.

[Note: read a related post by Jim in the compilation on "homework management".]

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UPDATE:
Date: Wed, 28 Aug 2002
From: Joseph Vanderway <hrggh003@csun.edu>
Hello Jane-

I haven’t actually tried my "worksheet strategy" in my classes. Upon reading it, I think it will take far too long to prepare several physical situations per class each day. To that end, I will most likely return to the way I have been doing worksheet problems in the past.
I will, however change the nature of some of the problems from "find a specific (number) answer to "the MODEL is the answer type problems". This is a result of several long discussions with Rob MacDuff this summer at ASU.

The problems (or more specifically "situations") are very open-ended. Something like: "A stone is dropped from the top of a cliff." Students will MODEL the problem - that is to say, they will describe what models they will apply (and why) and provide ANY & ALL information they can about the situation.

In the above example, students would provide some (but probably not all) of the following:
- model the stone as a constant accelerating particle
- note that its speed is increasing at a constant rate
- provide graphs of x, v & a vs. t
- a motion map
- indicate that if the height of the cliff were known, they could determine the impact velocity (and how they would do this)
- note that if asked, they could determine the velocity of the stone at any position or time or that they could determine where the stone is when it has a specific speed and so on...

I think this will allow more positive participation from all students during the WB sessions. I haven’t done this yet. I will let you know how it works out.