Many simulations on the web can be used in a variety of ways within a class or across different courses. One of my favorite simulations to use is “Masses and Springs” from the PhET website (http://phet.colorado.edu) because I can use it in so many ways.

**Explore**

Early in my physics course, during the force unit, before we have investigated Hooke’s law, I have asked students to open the simulation and answer the following questions:

1. In its startup configuration, are the three springs “the same”? What is your evidence?
2. What is the rule for how far the spring will stretch?
3. Once you have the rule, what are the values of the red, green and gold masses?
4. What is the relationship of the acceleration due to gravity on Planet X compared to Earth?

We follow this exploration with real springs in the classroom and use that experience to verify the reliability of the model. Whenever computer simulations are used, it is important to engage students in a discussion of the source of information for computer simulations or models, their advantages and limitations.

**Extend**

Later in the course, when we are ready to investigate simple harmonic motion, we observe an oscillating spring and ask what factors might affect the period of the oscillation. Some variables like mass and the spring constant can be investigated during a hands-on lab. However, the effect of the acceleration of gravity and friction cannot be observed in the lab. So the class returns to “Masses and Springs” where friction can be varied and gravity can be set for Earth, Moon, Jupiter or none.

**Explain**

Finally, we can look at conservation of energy using probeware and/or the model. Again, the model allows us to take the exploration one step further, since we can turn friction on or off, the model illustrates the conversion of mechanical energy to heat energy. In addition, the model allows the user to slow time down so that students have time to relate the motion with the change in energy from kinetic to potential and back again.

**Evaluate**
An important step in the use of any model or simulation is to ask students to evaluate the model. Is it true to what we know about the science? What simplifications have they made and why? What can we learn from this model? What is an artifact of the model and does not reflect reality? For example, in this model, it is impossible to stretch the springs past their elastic limit and it is possible to remove all friction. Can that happen in the “real” world?

There are many useful models and simulations on the web. Some are useful for a single concept while others, like “Masses and Springs” allows the class to explore multiple concepts. Models and simulations are an important part of the scientific process and the wealth of rich, attractive and engaging computer models and simulations makes it easy to include these as part of our instruction.

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