Conor Hunt
Elective #5 (Modifying for Levels of Inquiry)

Overview of Simulation:

As mentioned in my Lab Practicum, this lab is designed to help students investigate Hooke's Law, using the Masses and Springs simulation. According to the lab, there are three major objectives: investigate Hooke's Law, determine the spring constant of a spring algebraically and graphically, and use Hooke's Law to determine unknown masses on a spring.

The experimental set up includes a spring suspended from a ceiling and a number of free masses, not yet attached to the spring

The simulation used, titled "Masses and Springs," allows users to directly measure a number of different physical quantities:

- Extension Length (with a ruler)
- Time (with a stop watch)

In addition to directly measuring these quantities,, the simulation allows for other quantities/system characteristics to be set or adjusted:

- The Mass of the suspended spring
- The Acceleration Due to Gravity (i.e. the planet the measurements are being taken on)
- The Damping

Other information that users can obtain from the settings provided include:

- Energy Graphs (to the left hand side)
- Velocity and Acceleration Vectors for if/when the mass is oscillating

Pros of Resource for Teaching Physics Content:

In terms of its state learning objectives, this lab does provide students with an opportunity to determine the spring constant both graphically and analytically. It guides students to measure the extension length of the spring for 3 different suspended masses. From this data, they create a Force (N) vs. extension length (m) graph and determine the value of the slope (in part b). This connection between spring constant and slope is initially spelled out in the Theory section of the lab.The following question (part c) asks students to calculate the value of the spring constant using Hooke's Law. While not spelled out in the objectives, it seemed as though an additional objective of this section of the lab was to build students' conceptual understanding of the spring constant and what it represents. Questions d, f, ang all ask the student to interest what the slope means and to spell out the explicit relationship between Force and extension length. This goes beyond just determining/calculating the spring constant.

Furthermore, Part 2 of the lab has students working backward to determine unknown masses. Similar to part 1, students still have to measure extension length, and use Hooke's Law to algebraically determine the unknown masses

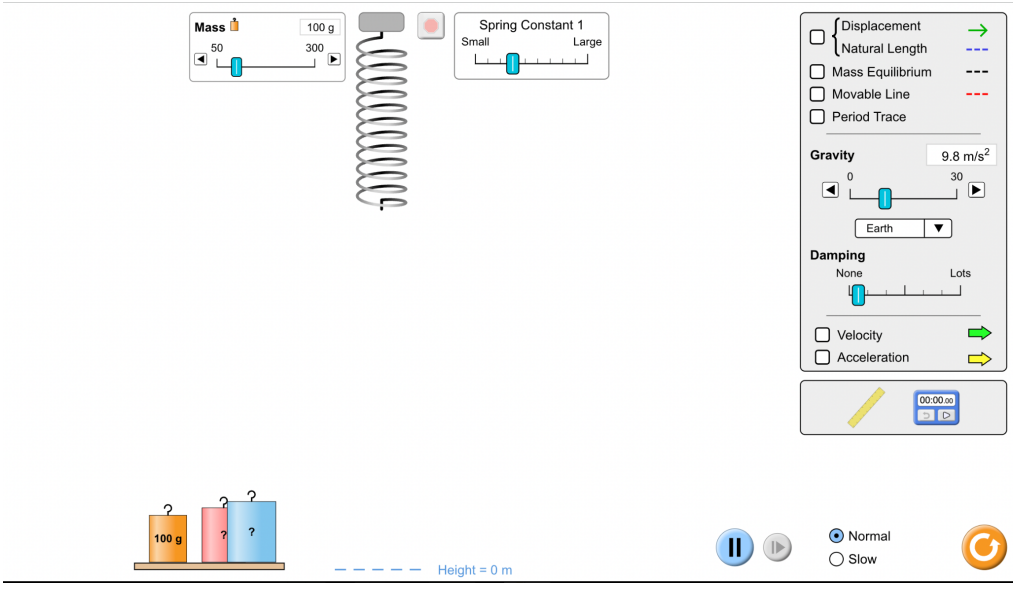
Cons of Resource for Teaching Physics Content:

As mentioned in the Lab Practicum assignment, this lab is a cookbook style lab with a low level of inquiry. While it gives students practice with calculating the spring constant with Hooke's Law, it does not provide students any agency to choose the quantities they measure, the procedure they follow, or the calculations that they make. Also, at one point, students are just told to multiply their mass by 9.8 m/s^2 to get weight, with no real explanation as to why. Students can walk away with being able to calculate the spring constant, but little understanding as to what Hooke's Law physically means or represents

Modifications for a Greater Level of Inquiry

My goal is to move this lab towards Bounded Inquiry. According to Wenning (2005), Bounded Inquiry is characterized by a clear and concise performance objective where students must decide what specific experiment to conduct, as well as how to collect necessary data. For example, the new lab objective might be, "Students will use the Masses a Spring Simulation to identify a relationship between two measurable quantities. There is limited pre lab instruction.

I would start off by showing students the simulation and asking them, 'What quantities can we measure." Some of the sample responses would include mass, length, and time. From there, I might place a mass on the spring and start to vary. I would then ask students what change they were seeing once I varied the mass. This would lead into a discussion about what tother things or quantities does mass change. We would write these answers on the board and use them to create a testable lab question. One example could include, "How does varying the mass affect the stretch length of the spring?"



After we developed a few testable questions together, I would instruct lab groups to choose oner and begin taking data in whichever ways they saw fit. This first day would be more free form data collection, where students have the opportunity to record initial measurements with limited guidance from me. On the second day of the lab, we would discuss effective ways to record our data, and I would share this spreadsheet with students. Here, students have to identify their lab question, their independent and dependent variables, as well as their procedure for data collection. In the past, I have had students take their data first, and then go back to spell out their explicit steps.

My name:					Procedure:
	Research/Lab Questions				
	Independent Variable:				
	Dependent Variable:				
	Controlled Variables:				
	Data Chart:				

On Day 3 or 4, I would teach into sense-making with graphs. Depending on when this happens in the year, I might need to plan a more extensive lesson for how we make meaning from graphs. Regardless, we will have to pay attention to the slope and what it physically means. Depending on which data students decided to collect, I might decide to explicitly teach Hooke's Law by looking at a Downward Force (N) vs. Extension Length (m) graph and what the slope of the graph represents. The intended takeaway is that slopes of graphs provide us with additional information and quantitative data. Lab groups would then be prompted to finish graphing their data, provide a slope calculation, and then each group would share their slope calculations and sense making with the class