Lunch Summary 09/16/2015
Topic: Integrating modeling instruction throughout a large lecture introductory biology course
Presenter: Lisa Limeri (mentee), biological sciences, Sam Donovan (mentor), biological sciences

While modeling instruction has been used in Sam Donovan's introductory biology courses, students often are not aware that they are actually using models or creating models. The goal of the project is to make modeling more explicit to the students.

Modeling activities are used in the introductory biology course, but Lisa and Sam have developed an additional modeling activity that students work on during the first recitation. This is meant to make the modeling approach more explicit to students. The activity is called a "Black Box," in which students have to determine the location of objects which can reflect light in different ways (it is like a puzzle). In the pre-recitation activity, students are first given "rules" for the model and have to use the model to make predictions. In the recitation, students are given a similar setup, but the "rules" are changed (students don't know how the rules change), and students have to determine the new rules (the new model) and make predictions. Students tended to like the puzzle-like nature of the activity.

It was mentioned that perhaps this activity is abstract and students may not connect it to biology. Sam and Lisa noted that they will continue to refer back to this initial activity to help students think about creating, using, and testing models. Furthermore, the activity is meant to help students develop general science skills that they can use in other domains besides biology.

Participants also mentioned that this activity can also be related to other learning goals, i.e., communicating hypotheses, testing/retesting.

There was some discussion on the definition of modeling – is it problem solving or is it connecting a quantitative expression to a natural phenomenon? Is the Black Box activity a problem solving activity (puzzle) and not quantitative modeling? Actually, the Black Box activity uses logical rules (as opposed to a mathematical expression) to define the model. The logical rules are predictive, and set up sophisticated ideas in a simple form. An example of a model which is not necessarily quantitative is genetics – one can predict genetic outcomes without doing a quantitative analysis.

It was mentioned that modeling activities often promote students' metacognitive thinking. Students sometimes feel uncomfortable if there is no set "answer" to a problem. However, as students learn how to model, they become more comfortable with the fact that they (and scientists in general) have to come up with their own models and test them. This can encourage students to be more cognizant of what they're doing, why they're doing it, and what they'll do next.

How can one assess whether using the Black Box activity at the beginning of the class makes students more aware that they are using and creating models in the biology course? Sam and Lisa plan on giving surveys and conducting focus groups to determine the extent to which students focused on the idea of modeling. They will also include questions on exams which assess whether students can define what a model is, how they would test a particular model, and the different components of a model (assumptions, limiting cases, etc.). It was mentioned that although students do not have enough time to create their own model for a particular phenomenon on an exam, they could do this outside of class with a partner and present their models, hypotheses, and tests.