

## Purposes of Lab in Modeling Instruction

Labs in Modeling Instruction are primarily used to introduce phenomena that can then be the basis for a new round of model development; this is the notion of what Halloun calls paradigm labs. However, several labs are used to apply the models to generate and confirm predictions. The ball in the cup lab is a good example of this. The primary goals for Modeling Instruction labs are to have students look for patterns, and find ways to represent those patterns. From these patterns, the model develops as a way of describing, being consistent with, and predicting, the patterns identified in the labs. The basic idea in these types of labs is that the students' starting point should be a model. For example, when students begin investigating energy, they begin by making kinematic models of the phenomena that they are going to be investigating. This has some important implications for how labs are carried out and how they are evaluated.

1. A heavy emphasis on exploration is included in each lab. The labs tend not to be overly prescriptive, but instead encourage students to 'muck about.' For example, in the Newton's 2<sup>nd</sup> law lab, students are asked to propose and identify relationships among the data. The idea is to constrain students in the types of relationships that they are looking for, but to allow them space to develop approaches to collecting data that can be used to support claims regarding patterns. The challenge of this is that the instructor will regularly be required to quickly help students evaluate experimental design and to parse data for relationships.
2. This approach, looking for patterns within phenomena, is different than what students often expect. They tend to expect confirmatory labs during which they are expected to get right answers.
3. Looking for patterns within data also presents a challenge of what type of lab report should be completed. We tend to do one of two things: when the labs are heavily scaffolded, such as the Investigating Constant Motion and Accelerated Motion labs, we expect that students complete the activity and turn in a completed worksheet which is then graded for completeness. The other option is that we ask students to write up the lab by describing the pattern(s) that they found, and by providing evidence that supports their claim(s). For example, in the Proposing a Quantitative Energy Relationship lab, some students may begin with a claim that  $E_k = mv$ , which is a reasonable place to begin (it depends on mass and it depends on velocity). After some investigation, students may end up having a curve that they fit with a line that suggests  $E_k = 1/3 mv^2$ . Although this isn't 'right,' we evaluate this based on the evidence that they used to support the claim.