**Teacher Tips**

* It’s important to both students and teachers that students are clear on their initial ideas. Giving them a way to record and express their thoughts before discussion gave students a reference point when working with their groups. The teacher was able to use their written thoughts to assign them to groups of students who had different ideas, prompting students to evaluate and defend their answers.
* Students need opportunities to build and explore physical models. Not only does this support conceptual change (for many of the students, the status of their original ideas about current electricity was lowered when they see that both light bulbs have the same brightness), but it also allows students to participate in authentic scientific processes—predicting what will happen in the circuit, making observations, evaluating the evidence, and drawing conclusions.
* Using simulations can help students make connections between physical models and conceptual models. The students weren’t comfortable with this way of thinking at first, but with the teacher breaking down the simulation piece by piece, they were able to better understand the circuit. Additionally, this activity allowed the teacher to provide the students with the vocabulary they need to discuss circuits. By directly connecting the vocabulary to the simulation and physical model, students understood the meanings better and rarely confused the terms.
* Some things just aren’t observable, like electrons moving in a wire; in these cases the use of a simulation can help students explore deeper into their models. Some students were able to infer the direction of the current, the simulation provided confirmation for their conceptual models. Other students needed the simulation to make an abstract, invisible concept more intelligible. Additionally, the simulation provided a simple way to collect clean data that can be used to derive a mathematical model of Ohm’s Law.
* Students needed a way to keep track of their conceptual models and the new information they were collecting. The posters created a way to record their ideas, integrate new information, and create connections among the varying thoughts of the group members. The posters created a visual map of the conceptual change route that students took, supporting students in explaining not just their current thoughts about electricity, but how they arrived at these thoughts from their starting point.