How do 7th Graders Interpret Computer Models of Science Phenomena?

**Goal:** Determine how students make sense of rules governing computer models.

**Method:** 133 7th graders of one teacher responded to questions about interactive computer simulations, which modeled scientific phenomenon and produced graphs of the data.

**We Found that Students:**
- Rarely extract normative causal relationships.
- Often expressed ideas about the underlying science when asked about rules that govern a model.
- Rarely consider the concept of model accuracy.

**Conclusion:** 7th graders need support to understand models as tools for communicating and testing hypotheses. Instruction on models will likely support learning the science content.

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**Probing Middle-School Students’ Understanding of Computer Models**

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**Students Rarely Find Normative Causal Relationships When Asked to Explain What the Model Shows:**

**Plants:** According to the model, what is the relationship between light and glucose? What does the graph show about the relationship between glucose made, glucose stored and glucose used?

**Climate:** What is the effect of running the factory? Explain how the model shows the relationship between greenhouse gases and the temperature?

**Chemical Reactions:** Explain the relationship between the movement of the molecules and the temperature.

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**Students Rarely Evaluate Accuracy Meaningfully, And When They Do They Are Skeptical:**

Baohui says: “This model is completely accurate: it shows exactly what happens when there are hydrogen molecules, oxygen molecules, and a spark.” Agree or Disagree? Explain.

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**Students Have Difficulty Applying Counterfactual Model Rules, Yet Doing So Can Elicit Causal Mechanisms:**

A programmer added a new rule to this model: “When solar radiation reaches the surface of the earth, the solar radiation will always bounce off.” Given this new rule, what would be the effect upon temperature compared to the original model?

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**Students Often Misunderstand the Nature of a Model**

**Role of icons.** Some students believe that changing the icons in a model will automatically change their behavior. They do not realize that the behavior is specified by a programmer.

**Role of the model.** Some students recommended prosocial or anthropomorphic model changes, rather than ones that will test a scientific hypothesis.

**Plant Growth:** How can the model show the effect of natural light? MC: Remove the on/off switch, and replace the light bulb with the sun shining. Explain: It’ll be more helpful if they got the real thing instead of the factory to release greenhouse gasses.

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**Students Have Difficulty Applying Counterfactual Model Rules, Yet Doing So Can Elicit Causal Mechanisms:**

A programmer added a new rule to this model: “When solar radiation reaches the surface of the earth, the solar radiation will always bounce off.” Given this new rule, what would be the effect upon temperature compared to the original model?