Introduction to Scientific Models
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Purpose
This activity will introduce students to the concept of a scientific model, one of the central elements of computational thinking.

Overview
This lesson combines several activities.

- **Hook.** The teacher will present two examples of a model, one unscientific (e.g. a photo of a fashion model) and one scientific (e.g. a diagram of a cell). These images will help the teacher explain and illustrate the three defining characteristics of a scientific model.
- **Think, Pair, Share.** Students will individually brainstorm examples of scientific models. They will discuss their ideas with a partner, then share with the class. The teacher will use this as a formative assessment, to identify and clarify misconceptions.
- **Project.** The students will work in groups of 3-4 to make a model of the route from one location to another (e.g. the route from the school to a commonly known place).
- **Critical Comparison.** Each group will compare and contrast their model with another group’s model. In their groups, they will discuss and write an evaluation of the advantages and limitations of their model.

Student Outcomes
At the end of the lesson, students will be able to:

- Explain and apply the three characteristics of scientific models.
- Create a scientific process model.
- Describe similarities and differences between models of the same process.
- Identify some advantages and limitations of a particular scientific model.

Time
The total time for this lesson is two 40-50 minute class periods.

- Hook: 5 minutes
- Think, Pair, Share: 10 minutes
- Project: rest of period, plus first 15 minutes of next period
- Critical Comparison: rest of period

Level
Intended for high school, but may be used for middle school with modifications
(First used in high school environmental science at the regular and Advanced Placement levels)
Materials and Tools

- Hook: model images
- Think, Pair, Share: none
- Project: poster paper, markers, other arts and crafts material (optional)
- Critical Comparison: peer evaluation sheet, critical questions
- Other: rubric for grading project

Preparation

- Gather materials (above). Be sure to print copies of the project rubric, peer evaluation sheet, and homework sheet.
- Prepare explanation of modeling in science.

Prerequisites

None

Background

Basic map reading and navigation skills

Teaching Notes

Hook:

- Set up model images before class, so that students can examine them as they walk into the room.
- Explain that both of these subjects are models:
  - A model is a representation of something – an object, idea, or process.
  - Models are simpler than the real things they represent. They are similar to, but never exactly the same as reality.
  - Different models can be used to represent the same thing.
- Ask students to identify how they are similar and different. Make a list of these similarities and differences on the board. Then, explain the defining characteristics of a scientific model and write them on the board (leave them up for the entire lesson).
  - It represents real objects, phenomena, and processes.
  - It is based on objective, logical reasoning.
  - It is supported by data and observations.

Think, Pair, Share:

- Students will individually brainstorm examples of scientific models. Have them spend 2-3 minutes writing their ideas down.
- They will discuss their ideas with a partner, then share with the class. The teacher should use this as a formative assessment, to identify and clarify misconceptions.

Project:

- The students will work in groups of 3-4 to make a model of the route from one location to another. All students in the class should use the same origin and destination, but they are free to choose the mode (car, train, bus, walking, biking, etc.), the route, and method for representing their trip visually.
- Put the project instructions up on a projector, or print out one copy for each group.

Critical Comparison:

- Each group should pair with another group for the purpose of comparing models. The individual groups should discuss the questions on the “Critical Comparison” sheet and submit answers as a group. Encourage them to be honest in identifying limitations of their model—they may tend to get defensive and prefer to adopt a purely positive outlook on their work, rather than reflecting critically.
Assessment

• The Think, Pair, Share activity serves as a formative assessment. It will show the teacher whether the students have grasped the basic concept of a scientific model and allow the teacher to correct misconceptions before the project begins.

• The Project is partly a formative assessment because the teacher can ask leading questions and providing ongoing feedback as the students work. It also serves as the basis for the Critical Comparison, which is a summative assessment.

• The Critical Comparison will demonstrate whether students have achieved the learning outcomes:
  o Application of the three characteristics of a scientific model
  o Description of similarities and differences between models of the same process
  o Identification of the advantages and limitations of a their model

Additional Information

This lesson is a refinement of the lesson that was originally tested, and it incorporates feedback and responds to the results of that first experience. The primary goal is that students are able to articulate the difference between a scientific and unscientific model. Pursuing other learning objectives beyond that is optional, and while it may provide an appropriate challenge for upper level high school students, younger students may find it overwhelming. In order to adjust this lesson for lower level classes, we recommend altering the Critical Comparison component. Simplifying the questions asked in that part of the assignment will go a long way toward making the lesson more feasible for younger students.