iScience
Readers

Models and Designs:
It's a Roller Coaster Ride!

by Emily Sohn and Anya Hansen

Science Objective

Children will discover how models help people in many different fields develop and test new ideas, make predictions, and solve problems. Models can be conceptual or physical and include maps, drawings, and structures that are built to scale. Computers and video technology allow scientists to create virtual models that can be programmed to show results based on specific data.

iScience Puzzle: Get Ready to Roll

This puzzle presents children with a challenge to design a roller coaster. They are presented with four options for designing or building their models. Each solution has advantages and disadvantages. As they read this book, children will learn about different types of models and how they can be used to develop and test ideas.

Objectives ➤ Children will:

- learn that there are several kinds of models, which suit different needs.
- understand why scientists build models to test, observe, evaluate, and retest technologies.
- develop an appreciation for precise measurement when building scale models.
- recognize that the materials used to build models and real structures have properties and limitations.
- make models to test ideas.

Materials

- map with scale

Lesson Plan

Before Reading

Investigation	Science Concepts
Ask children to share experiences they have had making models or structures with building blocks and construction sets. Ask: *Did you just start building or did you create a drawing first? If you made a drawing, how did it help you?*	Drawings are one form of model that can help a designer plan and visualize a structure or device.
Ask: *What would be the best way to plan a treehouse?* Discuss options, such as "write a description," "draw a picture," "draw the inside layout to scale," and so on. Encourage children to tell why each option would be useful.	Descriptions, explanations, and models are all useful tools to use when conceptualizing, designing, developing, and testing a structure or device.

Explain that children will learn about the many kinds of models that engineers, designers, and scientists use to develop and test designs and structures. Some models are built to show how systems work and help developers solve problems. Others are built to test and improve products. Making models involves design, construction, testing, evaluation, and redesign based on ideas, observation and evidence.

During Reading

Investigation	Science Concepts
pp. 6–11: Ask: *What do you think are the advantages of each solution? What are the disadvantages?* Write children's responses on the board. Refer back to these ideas when children reach the end of the book.	Engineers build models to test how something works or to plan its construction.
pp. 12–14: Ask: *How does the model help you understand how tornadoes form?*	Models can be used to study and demonstrate weather systems. They are also used to study things that are difficult or dangerous to study directly.
pp. 15–18: Brainstorm ways that models can help engineers, contractors, scientists, and designers. Ask: *Why is a map considered a model?*	Models are used for problem solving, testing, evaluating, and redesigning. They are made and adjusted according to observation and evidence. They can be used to see how something works or how something looks or both. To be useful, some physical models must be bigger than the real thing they represent. For example, a model of a plant cell would be much bigger than a real cell. Other models must be smaller than the real thing. For example, a useful model of an airplane would have to be much smaller than the real thing.

During Reading (continued)

Investigation	Science Concepts
p. 19: Explain that a simulation is a test of a model.	A simulation tests a system or a process. It can be performed on a computer or sometimes with a physical scale model.
pp. 20–22: Bring in a map that has a scale on it. Show children how to use the scale to read and interpret the map. Then ask: *How is the scale of a model like the scale of a map?*	To be really useful, a scale model requires precise measurement. A scale model can show how different parts of a structure work together.
p. 23: To help children understand the difference between a scale model and a system model, give them a few examples of scale models that can be put in a larger system model. Some examples include a rib bone (scale model) that goes into a skeleton (system model), and a bathtub (scale model) that goes into a bathroom (system model). In some cases, something that is a system model in one way (bathroom) can be part of another system model (house or apartment).	A system model is made up of many scale models put together to scale. It can show how different structures work with other structures.
pp. 24–25: Review children's skill at making measurement conversions, such as yards to inches or meters to centimeters.	Accurate measurement conversions are crucial to making accurate scale models and system models.
pp. 26–27: Tell children that simulation games aren't always made just for entertainment. Flight simulators, for example, help pilots practice flying in bad weather or at unfamiliar airports before they try it with live passengers.	Fun simulations sometimes have real-world applications.
pp. 28–32: Ask: *What is an example of technology today? What was an example of technology 100 years ago? What new technology would improve our lives?*	Technology includes the practical knowledge, processes, and machines that we use to make work easier and serve our needs. We use technology to make life easier (dishwashers), safer (antilock brakes), and more entertaining (CD players).
pp. 33–36: Ask: *Why is it important to understand laws of motion when constructing a model that includes moving components? Why do architects need to understand properties of materials when designing walls and roofs?*	Designs have limitations based on the materials they are made of and how they work. Depending on what they are making, designers need to understand friction, weight-bearing limits, elasticity, heat tolerance, and many other details of the materials they are working with.
pp. 37–41: Ask: *How would you design a comfortable classroom chair? What would you need to consider? What steps would a design team take?* Create a chart for responses. Have children consider materials, color, style, function, comfort, and durability.	Different people have different skills. Designers often work collaboratively to create and improve designs. Teams often make something better than any one team member could have made alone.

During Reading (continued)

Investigation	Science Concepts
pp. 42–43: Discuss the choices. Refer back to the answers children gave when they first read the iScience Puzzle. Discuss changes in their answers.	Steps to follow when making a model include design, construction, testing, evaluation, and redesign based on observation and evidence.
p. 44: After children have worked through the Beyond the Puzzle activity, have them make presentations to the class.	Creative thinking processes and research are crucial to good design.

After Reading

Restate the key ideas in the book. Models and designs help scientists and people in many different fields solve problems, make predictions, and create and test designs. Models can be drawings, maps, structures, and simulations. Models can be drawn to scale based on precise measurements. Design of some structures requires knowledge of scientific principles, such as the laws of motion, or properties of materials, such as weight-bearing limits. Models and designs advance technology. They add to our general knowledge, and improve the processes and products we use to improve our lives.

Investigation	Understanding Science
Challenge children to create a model of their choice, following the steps in the book. Assign children to work in small groups. They might design a model car and make improvements to increase its speed down a slope. They might build a scale model of a home. Have them share their projects with the class.	Scientific models require testing, observation, evaluation of evidence, and redesigning. Collaborative work aids in problem solving.