

Solar Boats

Lesson 6: Solar Boat Science Investigation

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DESCRIPTION: Design a science investigation to test a solar speedboat, airboat, and surface submarine. Students will use the "Planning an Investigation Template" in order to determine their motivations for designing a solar boat, make predictions about the outcomes with this design, plan the construction by determining materials to be used in the design, diagram their plans, outline a step-by-step testing method, record data, and write a conclusion based on the data that they collected in their process.

GRADE LEVEL(S): 4, 5, 6

SUBJECT AREA(S): Science, energy, energy transfer, force, Laws of Motion, engineering design process, investigation, variable, fair test, dependent variable, independent variable, controlled variable, control

ACTIVITY LENGTH: 45 minutes

LEARNING GOAL(S): Students will design an investigation to test three models of solar vehicles. Students will justify which materials will be used in their construction. Students will be able to support their design with reasoning. Students will determine different methods of collecting data from their experiment relating to three types of solar boats.

NEXT GENERATION SCIENCE STANDARDS:

- 3-5-ETS1-1.Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3.Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
- PS2- 2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

STUDENT BACKGROUND:

Students have a basic understanding of: energy and energy transfer, Isaac Newton's Laws of Motion, forces acting on an object.

EDUCATOR BACKGROUND:

Educators must familiarize themselves with the engineering design process to follow through with each phase of the process. It is especially important to remember what we are driving our students towards as they design their experiment. Consider the following two versions of the engineering design process as backbones to guiding your student's inquiry process.



The Engineering Design Process

Figure 1 Engineering Design Process, as formulated by Engineering is Elementary. This process was designed in a simplified fashion to be especially accessible to elementary students. http://eie.org



Figure 2 Engineering Design Process from Teaching Channel partnership with Boeing. https://www.teachingchannel.org/engineering-curriculum-boeing

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Materials List (30-person class)

• Science Investigation Worksheet

Vocabulary

- **Fair Test:** refers to an experiment that is carefully controlled to ensure that the information gathered is reliable.
- Variable: any factor that can be controlled, changed, or measured in an experiment.
- Controlled Variable: Remains as is, constant or does not change during an experiment.
- Responding (Dependent) Variable: Reacts to the change, able to be measured or observed.
- Manipulated (Independent) Variable: a condition that you change in an experiment.

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Lesson Details

Activity – Science Investigation

- Introduce students to the three different types of solar boats that they will be creating and making observations of. Explain that they will be designing all three of these boat types.
- Follow the "Planning an Investigation" worksheet.
- Students will need to run through this process for each type of boat that they design, using data points to take note of the differences I the outcomes of the three different boat designs.
- In the materials section, have students begin by using materials that are part of the solar boat kit in their planning. However, as they begin to implement different types of boats in their testing process, provide new materials for them to use to construct the boats.

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