

Major Project: Engineering Design Challenge
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Phase I

Identify the “Big” concept for engineering design challenge:

Students will make an object that will float on water. Students will design a boat that will travel across water faster than other boats carrying cargo.

This design challenge comes from Discovery Education. My school will utilize Discovery Education for Project-Based Learning during the 2022-2023 school year.

[Discovery Education](#)

Learning Standards: Next Generation Science Standards

- MS-ETS 1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS 1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS 1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS 1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Declarative Knowledge Needed: Students need to understand which materials float on water, how to inflate a balloon, what surface tension is

Procedural Knowledge Needed: How the physical design of a boat helps it to travel faster, how decorative materials aren't needed on a boat and will prevent the boat from traveling at a higher speed, how correct weight distribution helps a boat to travel faster

Objectives:

To explain the basic chemistry of water

To understand surface tension

To investigate properties of water

To understand how air from a balloon propels a boat to move at a faster rate of speed

Student Activity:

Building boats that hold “cargo” and are the fastest to cross a body of water using an attached balloon to propel the boat upon release of air from balloon

Building Challenge

“Suppose you are a nautical engineer working for a ship building company. Your company supplies ships to other companies that transport goods across the ocean. Your clients have said that they need ships that can travel across the ocean more quickly and that can carry more cargo than their older ships. How can the design of a boat be changed to increase its speed or the weight it carries?”