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SCSU CRISP CCSA Kit Pages 2016

Title of Module: Boat Basin Battle

Subject or Unit of Study: Forces and motion (Buoyancy)

GRADE LEVEL: 9-12

LENGTH OF DEMO/LESSON: 3-4 class periods

STUDENT OBJECTIVES

Students will...

Design and build a cardboard boat that will meet specifications of

- a given size range
- ability to hold a given mass without sinking
- ability to float across the tank
- cost of materials is no more than \$ ____

Keep an engineer's logbook

NEXT GENERATION SCIENCE STANDARDS

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

NATIONAL STANDARDS & COMMON CORE

CCSS.ELA-LITERACY.WHST.9-10.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

RST.11-12.8 "Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results..."

MATERIALS

Corrugated cardboard

Duct tape
Cool temp hot glue
Dowles (15 cm?)
Plastic straws
Fan
Aquarium tank or kiddie pool.

SAFETY

Standard precautions for use of hot glue gun and cutting various materials.

LEARNER BACKGROUND

High school students will be familiar with linear measurement, simple shapes, measuring mass and time, and estimating costs. Simple cardboard construction is part of past experience.

LEARNING ACTIVITY OR PROCEDURE:

1. Begin by providing materials to students and explaining the problems: construct a boat that can hold a weight without sinking and travel across a body of water. Optional: show segment of movie "Apollo 13" about the CO₂ scrubber.
2. Allow time for students to research the scientific principles of buoyance, gravity, water displacement and force. Make additional literature resources available in the room for students to explore on their own. Allow time for students to experiment with materials and discover their properties including interactions with water.
3. Explain to students that their team will be required to log their work in the Engineer's Logbook (optional: Google Doc template can be shared by team members as their log). Allow enough time for them to brainstorm, design, build and test their models.
4. When students have had time to test and improve their initial models, host a Classroom Boat Design Competition. Each team must have an up-to-date summary in their engineering log before the contest. Encourage students to estimate costs for the model.
5. At the conclusion, consider another round of competition after each group has completed another iteration on their boat. Also consider a presentation component on the life cycle of their boats and what they have learned from this experience.

ASSESSMENT:

At each iteration, the Engineer's Logbook page summarizing the test results will be checked for completeness and the results compared to specifications. Written recommendations for changes between iterations must be justified and present. Analysis of improvements must be written.

TEACHER NOTES:

Differentiation can be included by modifying specifications for ability level.

STEM CAREERS:

Engineering, manufacturing, physicist, life and physical science technician, research analyst, logistics, and marine biologist