STEM TOOLKIT ACTIVITY

Boat Race Challenge

SOCIAL-EMOTIONAL CONNECTION: buoyancy GRADES: 5th TIME: 90 Minutes

INSTRUCTOR EXPERIENCE: Intermediate

OBJECTIVES: To design, build, and race boats using a variety of materials, while applying principles of buoyancy and engineering.

ESSENTIAL QUESTION: How can you design a boat using the materials provided that will float and hold weight?

MATERIALS:

- Book- What Do You Do With an Idea
- Boat Racing Lab Sheet
- Boat Kit
- Computer
- Projector
- Bracket

STANDARDS: VA STEM 5.1a-f;5.2a,b, and c

SCIENTIFIC AND ENGINEERING PRACTICES:

5.2b: make observations to provide evidence that energy can be transferred from place to place through contact between objects

5.2c: apply scientific ideas to design, test, and refine a device that converts energy from one form to another

Lesson delivery note: This lesson is designed to take approximately 90 minutes. Adapt the lesson to fit the amount of available time.

INSTRUCTIONS

1. Ask (5 minutes)

   Today, we're embarking on an exciting journey that combines creativity, engineering, and a dash of competition! We'll be diving into the world of boat design and racing. But, before we set sail, let's ponder a crucial question together.

   Imagine you have an idea – a small spark of creativity. What do you do with it? How do you bring it to life? How does it evolve and transform into something tangible?

   Your challenge is not just to build a boat; it's to bring an idea to life.

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2. Research (15 minutes)

Read the book titled, “What Do You Do with an Idea?”
Hold up the book and ask students to join you for a whole group read aloud.

- Preview the book by showing the cover and a few images.
- Read the story aloud, pausing periodically to ask students:
    - Why is it important to protect your ideas?
    - How does the child’s perspective toward the idea change throughout the story, and what does that convey about creativity?
    - In what ways can the message of the book be applied to our own lives and endeavors?
- Once the story is finished, revisit the question, “How can we solve problems?”
    - identify some problems the characters in the book solved or tried to solve.
    - Ask how the characters in the book solved these problems and if there would be additional ways to solve the same problem.

Now, let's connect this powerful message to our upcoming boat design challenge. Your challenge is not just to build a boat; it's to bring an idea to life. The boat is your idea, and it's your task to nurture it, refine it, and make it sail successfully.

As we transition into our boat design challenge, think about the parallels between the child in the book and your own journey in crafting a boat. Just like the child's idea, your boat will evolve and take shape through creativity, experimentation, and problem-solving. Let's set sail on this exciting voyage of design and discovery!

3. Connect to Careers (10 minutes)

Help students understand careers that may be related to boat building. Tell students there are numerous careers that might perform work to design boats:

- Oceanic Engineering
- Fluid Dynamics

Have a class discussion about the skills or qualifications a person would need for these careers.

1. **What are some challenges that oceanic engineers may face when designing boats, and how do they overcome them?**
2. **How would they create a process to test and refine boats to be more successful?**

4. Tinker to Discover (10 minutes)

Distribute the boat materials.

- Have students brainstorm how they will build and decorate their boat from their materials.

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- Then, have students draw an example of their prototype using the boat challenge handout.

5. Build a Prototype (15 minutes)

Next, introduce the four types of energy to students by providing definitions. These are:

- **Buoyancy** – An upward force that causes an object to float in water or air.
- **Motion** – described by an object's direction and speed.
- **Lift** – Force that is perpendicular to the flow direction.
- **Drag** – Force that is parallel to the flow direction.
- **Kinetic Energy** - The energy an object has because of its motion.
- **Fluid Dynamics**- Describes the flow of fluids

Students will used the materials that they are provided to build a boat and decorate the boat.

6. Test & Improve (15 minutes)

Have stations around the room for students to raise their boats through an obstacle course. Students will test their prototype and make improvements in the testing area before racing. They will use a bracket to see which boat is fastest. The obstacle course will have cargo to pick-up along the way. Students will use a straw to blow on the sails.

7. Discuss and Reflect (10 minutes)

As we conclude our Boat Design Challenge, let's dive into a discussion and reflection on three fundamental principles that played a crucial role in the success of your boats: Lift, Buoyancy, and Drag.

1. Lift
   - How did you incorporate the concept of lift into your boat design?
   - Consider moments when your boat seemed to "lift" or rise in the water. What factors contributed to this, and how did it impact the boat's movement?

2. Buoyancy:
   - Were there any surprises or challenges related to buoyancy that you encountered during the testing phase?

3. Drag
   - In what ways did drag influence the movement of your boat in the water?
   - How do water conditions and the shape of the boat affect drag?

The Boat Design Challenge not only tested your creativity and engineering skills but also introduced you to the fascinating world of fluid dynamics. As you reflect on your experiences, remember that these principles are not just confined to boat design; they are integral in various fields, from engineering to maritime industries. Bravo on navigating the challenges and discovering the science behind successful boat design!

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EXTENSION ACTIVITIES

- Design a badge activity