

Bruce Museum at Home ***STEAM Activities for Children***

Lesson # 2: The Penny Boat Challenge *Week of March 30, 2020*

The Penny Boat Challenge

This STEAM activity builds on concepts from the first Bruce at Home lesson, [Sinking and Floating](#), and focuses on displacement. If there is any confusion about vocabulary words, please revisit the brief glossary of terms listed in the prior activity. The Sinking and Floating lesson also includes instructions on how to make a science journal to record your observations, which is also part of this activity.



This week's activity contains, in order: a materials list, general instructions for the Penny Boat Challenge and an associated art activity, ways to supplement the activity, open-ended question ideas, instructions for making a sailor from pipe cleaners, and NGSS Performance Expectations.

Materials: tinfoil, at least 100 pennies (or 100 pieces of gravel, 100 marbles, etc.), something large enough to hold water and boats (a bathtub, large Tupperware container, or water table), pencils, and science journal.

Pipe cleaner sailors: pipe cleaners, tape, paper, colored pencils, crayons, or markers, googly eyes (if you have them), glue. If you don't have pipe cleaners you can use toothpicks or Popsicle sticks.

Procedure

If you and your learner participated in the Sinking and Floating activity last week, review the results of the activity using your learners' science journals. When you're done going through last week's results, keep the journals out. Your learners will need them throughout the activity.

Review:

- What sank and what floated?
- What did your learners discover about whether or not an object would sink or float?
- Are there objects that will float in some circumstances, but not in others?

Explain that this week we will be building our very own boat. **Our goals will be to build a boat that will float, and that will hold at least 100 pennies.** Before your learners get started with the activity, ask them to pull out their science journals again. Learners should write down some questions and ideas that they have about what kind of boat they will make, whether it will hold 100 pennies, etc. They can also draw a plan for what they think their boat will look like.

Some questions to get your learners thinking (and writing):

- What shape of boat do you think will hold the most pennies?
- Can you think of any challenges your boat may face when you start adding the pennies?
 - Some challenges might be: The boat will become too heavy on one end and tip; the boat may get so heavy that the sides sink below the water line; or the sides of the boat may have openings that allow in water.
- What makes a boat float?
 - This is a good question to answer with a small activity using the supplies you already have out. Take a piece of tin foil and ball it up tightly (really tightly!); then drop it into your water container. It will sink right to the bottom! Next, take the tinfoil ball out of the water, open it up, and flatten it out. Put the flattened foil back into the water. Now, it will float!
 - Ask your learner why the flattened tinfoil floats, but the balled-up tinfoil sank.

Build that boat!

- Give your learner a piece of tinfoil approximately 1 foot square.
 - It's important to start with limited materials, because this promotes creativity and ingenuity. One square foot of tinfoil is all that is needed to make a boat that will float.
 - If learners want more materials they can always add some later; they will make multiple boats.
- Learners will form their tinfoil into a boat, place it into the water container and test to see if it floats.
- If the first boat floats, then learners should start adding pennies until the boat either sinks or they get to 100 pennies.
 - If the boat cannot hold 100 pennies, learners should note in their science journal what went wrong and then attempt a redesign.
 - If the first boat sinks, go back to the drawing board and redesign the boat.

- Sink/Float design/redesign can go on for as long as the learner is interested in the process.

Tip: Try imposing some other rules on your learners to see how creative they can be while still staying within the bounds of the activity.

Some suggested rules:

- Boats must have a bottom and sides.
- Boats must be open on top.
- Pennies must be dropped into the boat from a specific height
- Boats must have four sides.
- Boats must have three sides.

If your learners need some visual instruction, check out this great video from Brooklyn Boatworks. Are you up for their [Penny Boat Challenge?](#)

Pipe Cleaner Sailors

Learners may want to make sailors or other characters to crew their tinfoil boat. Pipe cleaners are a good material to use for this, but anything that you have on hand, from colorful paper to toothpicks, can be put into service. If your learner has a little doll or figurine they want to put in their boat, encourage them!

This instructable has some easy-to-follow instructions: [Basic Pipe-cleaner Stick-figure](#)



Final Thoughts

When your learners are done, have them help you clean up the water, tinfoil bits, and pennies. After everything is clean, ask your learners to write down in their science journal what worked, and what didn't. Use the questions below as writing prompts.

- What boat design worked the best today?
 - Why do you think it worked the best?
- What boat design worked the worst today?
 - Why don't you think it worked?



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- What do you think you learned about sinking and floating today?
- What would you like to do next?

Next Generation Science Standards

2-PS-2 Matter and Its Interactions

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

K-2-ETS1-2 Engineering Design

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps its function as needed to solve a given problem.

K-2-ETS1-3 Engineering Design

Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

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