

“The Girl with a Mind for Math: The Story of Raye Montague” and How Do Boats Float?

Lesson Objectives

- **3-5-ETS1-3 Engineering Design: Planning and carrying out investigations to answer questions or test solutions to problems to include investigations that control variables and provide evidence to support explanations or design solutions.**
- **SC.5.N.2.1** Recognize and explain that science is grounded in empirical observations that are testable; explaining must always be linked with evidence.
- **MAFS.K12.MP.4.1** Identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. Analyze those relationships mathematically to draw conclusions and solve problems arising in everyday life, society, and the workplace.
- **ELA.K12.EE.4.1** Use appropriate collaborative techniques and active listening skills when engaging in discussions in a variety of situations
- **ELA.K12.EE.3.1** Make inferences to support comprehension.
- **LAFS.7.RI.3.7** Compare and contrast a text to an audio, video, or multimedia version of the text, analyzing each medium’s portrayal of the subject.

Next Generation Science Standard:

SC.5.N.2.1 Recognize and explain that science is grounded in empirical observations that are testable; explaining must always be linked with evidence.

STEM Rationale for Lesson:

3-5-ETS1-3 Engineering Design: Planning and carrying out investigations to answer questions or test solutions to problems to include investigations that control variables and provide evidence to support explanations or design solutions.

Culturally responsive connection:

I have four classes, two fifth grade (one general ed., plus ESE, the other one general ed., plus ESOL) and two fourth grade with the same set up as my fifth-grade classes. All these classes are very diverse classes; they are largely Hispanic; however, I have Asian, Hindi, Black American, and African/Portuguese students. Therefore, after reading/listening to the book, *The Girl with a Mind for Math: The Story of Raye Montague* by Julia Finely Mosca, we discussed why the treatment Raye Montague had as a female and as a black person was wrong. We imagined ourselves in her shoes. I believe that there is no better way to do this so that the students connect to the character’s real experiences. This helps us understand why teaching about racial equality and fairness matters, today, in our school, in our communities, and finally in our country.

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STEM Lesson Plan:



Materials Needed:

Provided by Teacher:

- 1 piece of aluminum, 12 in. x 12 in.
 - 2 plastic straws
 - scissors
 - 1 foot piece of tape
 - 1 tub of water to test the boats (blue coloring optional)
 - ship cargo (gram cubes for easier counting of mass)
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Activate Prior Knowledge:

1. Floating and sinking (buoyancy)
 2. Density and the density of water
 3. How large, heavy ships are able to float
 4. Review about segregation and the Civil Rights Movement in our country.
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Lesson Introduction:

1. A day before the STEM activity, I showed students a video on the book [The Girl with a Mind for Math ~ The Story of Raye Montague](#), read by a teacher. Afterwards, we talked about segregation and the Civil Rights Movement in the USA. Then, we discussed how hard must have been for a Black girl to keep her motivation and interest against odds such as the ones Raye Montague faced.
 2. The next day, the day of the STEM activity, I showed them a video titled, [“How Do Ships Float? Things Explained: Buoyancy”](#) to activate their prior knowledge on buoyancy and density, connecting those things with the fact on why huge, heavy ships float.
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Lesson Activity:

1. Before listening to the reading of the book [The Girl with a Mind for Math ~ The Story of Raye Montague](#) on YouTube, I showed the students a picture of the book cover and its title to elicit predictions about the story in the book. This also, makes the story more meaningful to the students because it connects it to their own experience or to other books they must have heard or even read.
 2. After listening to the story, the students discussed how they felt about Raye’s struggles and the unfairness of racial injustices.
 3. The following day, I showed the students a video titled, [“How Do Ships Float? Things Explained: Buoyancy”](#), before starting the STEM lab.
 4. I had students taking turns reading the instructions aloud.
 5. Students had will have 5 minutes to draw and plan their prototype individually.
 6. Then, students will have 5 more minutes to plan together, sharing their prototype to tweak, and choose their final model to build.
 7. After the 10 minutes of planning, give students the materials in a tray.
 8. Students will have 20 minutes to build a Navy ship that can hold the most cargo. We will be using gram pieces for accurate mass measurement.
 9. When the time limit is up, students will test their ships by placing them in a tub of water and seeing how much cargo it can hold before sinking.
 10. After completing the activity, have students answer the reflection questions on the worksheet.
 11. The next day, discussed reflection questions with students and graph data.
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National MagLab STEM Lesson Plan:



Lesson Assessment

1. Teacher observation on comprehension of the story that was read and following directions during the lab.
2. Completion of reflection questions and graph building.

Lesson by: Raiza Pou

Contact info: mrspou@dadeschools.net

National MagLab STEM Lesson Plan:



Name: _____

Date: _____

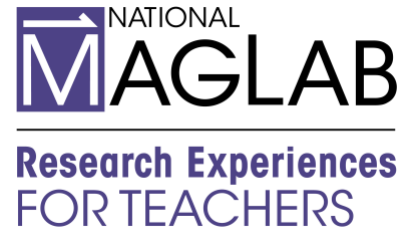
Think Like an Engineer: Take the Build a Ship Challenge!

Objective: Design and build a ship that floats and holds the most cargo.

Materials:

- 1 piece of aluminum, 12 in. x 12 in.
- 2 plastic straws
- scissors
- 1 foot piece of tape
- 1 tub of water to test the boats
- ship cargo (gram cubes)

National MagLab STEM Lesson Plan:



Dear Students,

Imagine you are engineers working for the U.S. Navy, like Raye Montague did and part of your job involves designing and testing new ships. Therefore, create a ship with the materials listed above. You will have 5 minutes to plan your design individually and 5 minutes to plan as a team. After those, 10 minutes, your team will have 20 minutes to build a ship. As you create your ship, you must design it so that it holds the most cargo. At the end of the time limit you will test your design. Good luck!

Constraints:

1. First 10 minutes will be utilized for designing. Therefore, you will plan, discuss, and draw your prototype ship.
2. Using only aluminum foil, straws, and tape, each team will build a ship that holds the most cargo possible without sinking within allotted time of 20 minutes.
3. All teams must adhere to time constraints.
4. When timer goes off, you must display “hands off” and then you will test your ship using the grams pieces. Record it.

PLAN AND DRAW YOUR DESIGN IN HERE

Did your boat float? _____

How many grams did it hold the most? _____

What strategies did you try, what worked, and what didn't work?

How can you improve your design using the same materials?
