Predicting and Testing the Buoyancy of Objects

STEM: Science, Technology, Engineering, Mathematics

STEM Classroom Series

The STEM Classroom Series features lessons that promote understanding of STEM content knowledge, integrate STEM with non-STEM subjects, and increase students' exposure to STEM-related career options.

About this Segment

In Mrs. Megan Madsen's kindergarten class, students predict whether different objects will sink or float, test the buoyancy of those objects, then build a boat to demonstrate their knowledge.

Application activities **(complete all that meet your goals for viewing this segment)**

A. Learn more about STEM education

1. In the table on the next page, identify the elements of effective instruction, as well as the elements of effective STEM instruction, that you observed in this lesson.

2. How could the teachers enhance or add to the elements of instruction in their lesson?

3. How could the teachers enhance or add to the elements of STEM instruction?

C. Infuse STEM principles into your own lessons

1. Apply the six questions in the "Replicate this lesson" activity to one of your own lessons.

2. Determine challenges you might face in applying these STEM concepts to your own lesson. How can you overcome these challenges?

B. Replicate this lesson

1. *What are the learning objectives you want your students to achieve?*
   How would you modify the lesson's objectives, outlined in the Lesson Plan below, for your own students and curriculum? What other objectives, if any, will you set?
2. *What content knowledge do you need to acquire or expand?*
   This activity teaches students about buoyancy and density. Which of these concepts do you need to learn more about? Visit the Resources to Support Content Knowledge links in the lesson plan section of this guidebook.
3. *How will you create the time and space to engage students in this lesson?*
   How much time will this learning activity take to plan and carry out? How can you integrate the activity into your current curriculum map?
4. *What materials and other resources do you need for this lesson?*
   What materials are needed for this lesson? See the Materials section of the lesson plan. What collaboration is necessary with administrators and other teachers?
5. *How will you assess student learning?*
   Ms. Madsen's students fill out a graphic organizer to predict whether various objects will sink or float, then test those predictions. Finally, students build and test a boat at the end of the unit. How might you assess student understanding with this work?
6. *How can you promote a STEM focus in your instruction?*
   What STEM experiences were students engaged in during this lesson (see the "Elements of Effective STEM Instruction" below)? What are some others that you could include?

Elements of Effective Instruction	Elements of Effective STEM Instruction
- High expectations for all students - Rigorous content - Authentic performance tasks - Real-time assessment adapted to student needs - Student-driven learning - Strong relationships among students and between teacher and students - Equitable, culturally relevant content and practices - Evidence of 21st century skills, e.g. critical thinking, problem solving, collaboration, creativity, communication - Technology that enhances learning - Cross-curricular (interdisciplinary) integration	*In addition to the Elements of Effective Instruction left, effective STEM instruction can include:* - Teachers who develop solid STEM-related content knowledge - Hands-on problem-solving activities that have real-world relevance - Integration of STEM into non-STEM subjects, especially art and design - Use of industry-standard software, tools, and procedures such as the engineering design cycle - Increased awareness of STEM fields and occupations, especially among underrepresented populations - Enthusiasm about further STEM-related learning - Connections between in-school and out-of-school learning opportunities - Industry and higher-ed partnerships that encourage hands-on student exploration of STEM-related careers

Sources: California Dept. of Education. (2015). Science, technology, engineering, & mathematics. Retrieved February 21st, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

President's Council of Advisors on Science and Technology (PCAST). (2010). Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for America's future. Retrieved from the Whitehouse.gov website: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf

General STEM Information and Resources

Utah STEM Action Center (n.d.). STEM Utah. Retrieved January 22, 2015, from http://stem.utah.gov/

California Department of Education (n.d.). Science, technology, engineering, and mathematics. Retrieved January 22, 2015, from http://www.cde.ca.gov/pd/ca/sc/stemintrod.asp

National Education Association. (n.d.). The 10 best STEM resources: Science, technology, engineering & mathematics resources for preK-12. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics. Retrieved March 23, 2015, from http://www.stemreports.com/wp-content/uploads/2011/06/NRC_STEM_2.pdf

PBS Teachers. (n.d.). STEM education resource center. Retrieved March 23, 2015, from http://www.pbs.org/teachers/stem/

STEM Education Coalition (n.d.). Home page. Retrieved January 22, 2015, from http://www.stemedcoalition.org/

Predicting and Testing the Buoyancy of Objects — Lesson Plan

Teacher: Megan Madsen	**Grade/Content Area**: Kindergarten Engineering
School: Neil Armstrong Academy, West Valley City, Utah	**Lesson Duration**: 60 min.

Lesson Objective(s)

Students will understand and demonstrate that objects either sink or float in relation to their density, which is referred to as buoyancy.

Key Concepts and Vocabulary

(See below for online resources that support content knowledge)

- Density
- Buoyancy
- Sink and float

Standards Addressed in the Lesson

- Recall information from experiences to answer a question.
- Compare strengths and weaknesses of two objects designed to solve the same problem.
- Demonstrate how the shape of an object helps to solve a problem.

Assessment

Students will fill out a graphic organizer predicting whether an object will sink or float, test their predictions in a lab, and then compare the results to the prediction. Using their new knowledge, students will build a boat to "transfer stranded animals from an island." The teacher will also assess student progress through observation and questioning.

Prior Knowledge and Skills

Knowledge: Students should know the difference between the terms "sink" and "float."

Skills: Students should be able to operate iPads to access a QR reader app and follow established procedures to work in a lab environment.

Materials

- *Sink or Float* graphic organizer
- iPads
- QR codes linked to images of common household items
- Common household items (Rubber bands, tin foil, paper plates, cotton balls, etc.)
- A bucket full of water
- Boat building materials (polystyrene board, tongue depressors, tape, etc.)
- Animal manipulatives
- A container of water large enough to test boats (kiddie pool, rain gutters, etc.)

Differentiating the Instruction

This task permits multiple entry points, thus facilitating track designs with a range of complexity—all of which can yield the desired student learning.

Lesson Procedures

1) Students review the terms buoyancy, sink, and float. Then complete the *Sink or Float* graphic organizer in conjunction with iPads and QR codes tied to pictures of objects that will either sink or float.

2) The class then moves to a lab, where student groups use tubs of water and the objects in question to test their predictions.

3) After the students are done testing, they then build a boat from provided materials. Students are then given toy animals with the instructions to transfer the animals, who have been stranded on an island, to safety.

4) To wrap up the lesson, boats are placed in water to test their buoyancy.

Resources to Support Content Knowledge

Discovery Science Center. (n.d.). Kindergarten lesson plan: Liquid density. Retrieved April 27, 2015, from http://www.discoverycube.org.php5-20.dfw1-1.websitetestlink.com/wp-content/uploads/2011/06/Kindergarten_Liquid-Density.pdf

FunBased Learning. (n.d.). Density lesson plans. Retrieved April 27, 2015, from http://funbasedlearning.com/lessons/density.htm

Related Video Lessons and Resources

Kindergarten: Informational writing and oviparous animals. Edivate. https://pd360.com/#resources/videos/7157

Kindergarten: Decomposing the number five. Edivate. https://pd360.com/#resources/videos/6214

Name: _____

Sink or Float

Object scanned	Prediction	Result
7.		Sink Float
8.		Sink Float
9.		Sink Float
10.		Sink Float
11.		Sink Float
12.		Sink Float