Activities inspired by children’s literature

Will It Sink or Will It Float?

By Christine Anne Royce

Children may experience sinking and floating in various ways: playing with bathtub toys, throwing rocks in a pond, or watching boats. However, to more fully develop the concept, students need to go beyond observing what sinks and what floats and identify objects’ properties. This issue’s selected trade books and accompanying activities help students investigate the concept of sinking and floating in more depth.

This Issue’s Trade Books

What Floats in a Moat?
By Lynnee Berry
Illustrated by Matthew Cordell
ISBN: 978-1-4169-9763-4
Grades K–4

Synopsis
Archie and Skinny are attempting to deliver barrels of buttermilk to the queen when they encounter a moat that must be crossed in order to make the delivery. Rather than taking the drawbridge, “This is a time for science,” Archie explains, and the two undertake a series of trials to determine if a barrel sinks or floats.

Things That Float and Things That Don’t
By David A. Adler
Illustrated by Anna Raff
Grades 2–5

Synopsis
This 2014 Outstanding Science Trade Book addresses the question of which things float and which things don’t. Through the text and recommendations for activities to try, the reader is introduced to key concepts and the accompanying terminology.

Curricular Connections

Children in early childhood or elementary classrooms should be able to “plan and conduct an investigation to describe and classify different kinds of materials by their observable properties” (performance expectation 2-PS1-1; NGSS Lead States 2013, p. 16). This initial ability to make observations will assist the students in making decisions that allow them to “analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose,” which in the case of the first investigation would be to identify what else Archie the goat could use to float across the moat (performance expectation 2-PS1-2; NGSS Lead States 2013, p. 16).

In Things That Float and Things That Don’t additional information related to the topic of density is provided. While calculating density is not done at the K–5 level within the Next Generation Science Standards, students are asked to continue to “make observations and measurements to identify materials based on their properties” (performance expectation 5-PS1-3; NGSS Lead States 2013, p. 43), which is done through participation in the series of activities and discussions. Students in grades 3–5 are also Developing and Using Models (crosscutting concept) as they design and test their boats to determine which will float.

The big idea of floating and sinking is investigated throughout the story narratives and help students to understand that “different properties are suited to different purposes” (disciplinary core idea PS1.A; NGSS Lead States 2013, p. 16). In both investigations, students are also developing an understanding of the crosscutting concept of Cause and Effect as they engage in conducting “simple tests can be designed to gather evidence to support or refute student ideas about causes” (NGSS Lead States 2013, p. 16).

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Grades K–2: Would It Float in the Moat?

Purpose

Through prediction, observation, and testing, students develop a list of characteristics for objects that floated in water and objects that sank in water.

Engage

Show the cover of the book *What Floats in a Moat?* to the class and ask them to make predictions about common items that would answer the title question. Record the items on a piece of chart paper or the board in order to return to the predictions later in the lesson (CC ELA Connection: Writing Standards K–5 – Text Types and Purposes). Begin reading the story to the class and stop on page 3 where Archie explains, “This is no time for a drawbridge. This is time for science!” and pose the following questions to the class to engage them in a discussion:

- What is the problem that Archie and Skinny must overcome? What does Archie want to do to cross the moat? What does Skinny want to do? What would Archie need to do in order to use “science” to solve his problem? These questions will allow the students to first identify the problem (how to cross the moat), recognize one solution to that problem (using the drawbridge), and identify that Archie will need to plan and carry out an investigation in order to solve his problem using science (CC ELA Connection: Reading Standards for Informational Text K–5 – Key Ideas and Details).

After the discussion, continue to read the story to the students and ask them to comment on what the characters were doing for each launch attempt (changing the amount of buttermilk in the barrel). When you arrive at the end of the story, emphasize the phrase, “This is time for discoveries,” which Archie tells the queen. Ask students to think about what they already know about sinking and floating objects and return to the list they created before reading the book. Have them explain why they think something will sink or float in the moat as you create a list of possible reasons on the board. If any of the objects are objects that they will be testing in the Explore section, circle them.

Explore

Tell the students that this is a time for discoveries and they will test what floats just like Archie and Skinny. Using one of the tubs of water object and an object that students will not be testing, model for the students how they will test each object. An example item that can be used is a metal key. Students should first make predictions whether the object will sink or float. After testing the object, model how students should record their observation on the student data sheet (CC ELA Connection: Speaking and Listening Standards K–5 – Presentation of Knowledge and Ideas). Provide each group of students with the materials needed and ask them to make predictions about and test each object.

Explain

Students will find that some objects do not float to the top and do not sink to the bottom. Conduct a conversation about the definition of floating and sinking (CC ELA Connection: Language Standards – Vocabulary Acquisition and Use). For example, in *What Floats in a Moat?* the empty barrel and the half-empty barrel both floated. However, one did not displace as much water and did not “sink” as far as the half-empty barrel. For the purposes of this lesson, any object that does not drop to the bottom of the container will be said to float, and any object that drops to the bottom of the water tub will be said to sink. This is important because there may be some objects that will “flink,” which means they will be below the water line in totality but still not on the bottom of the container due to density. After students have discussed what is meant by floating and sinking, return to modeling the activity for the students using a talk aloud. Students explain what they have learned about objects while the teacher interjects terms that will help build meaning.

Elaborate

After the students have had the opportunity to test the objects, ask them to separate the objects into two piles—objects that floated and ones that sank—and to then make observations about the two piles. What are common characteristics of the objects in each pile? Many students will

Materials

- *What Floats in a Moat?*
- Per group:
  - Half-filled plastic bins of water (the 8 gallon totes work well for this activity)
  - 8–10 items for students to test (such as marbles, wood blocks, apples, empty plastic bottles with cap, paper clips, golf balls, toy matchbox cars, rocks, pumice stones, fishing sinkers, plastic floating toys, Ping Pong ball, craft sticks, sheet of aluminum foil, ball of aluminum foil, student data sheet, one large metal key, and chart paper)
make generalizations about the objects, such as wooden objects tend to float and metal objects tend to sink, which is appropriate for this age level. One statement that may be made and is partially correct is “heavier objects sink” and “light objects float.” The weight of an object is only one of the factors associated with sinking or floating. Return to the different parts in the book where Skinny is trying to launch each barrel and have the students observe the illustrations where Skinny is attempting to launch the full barrel, the empty barrel, and the half-full barrel. What do they notice about these attempts? The illustrations clearly show that Skinny has a harder time moving the full barrel because of the weight and the empty barrel is much easier (CC ELA Connection: Reading Standards for Informational Text K–5 – Key Ideas and Details).

These illustrations along with guiding questions such as, “Do you think all of the barrels are heavy?” Most students will indicate that they get lighter as the buttermilk is removed. State, “But two barrels floated, one that was empty and one that was half full, so do you think there could be something else besides the weight of an object that helps things float or sink?” Most students will answer “yes” but be unable to explain what that aspect may be which is acceptable at this level. If necessary, refocus the student discussion on the similarities of objects that floated and the similarities of objects that sank.

Evaluate

After students have had a chance to discuss the items they tested, return to the original predictions about what would float in a moat to determine if the circled items were predicted correctly or incorrectly. Based on their observations after the investigation, would they change any of their original predictions that weren’t tested? Have them select one item and explain their reasoning for changing their prediction on the student data sheet (CC ELA Connection: Writing Standards K–5 – Text Types and Purposes). An additional way to evaluate students’ understanding related to observations would be to allow them to make predictions and test those through online interactive games. There are several websites (see NSTA Connection) that allow young children to predict and test if an object will sink or float.
Grades 3–5: Building a Boat to Float

Purpose

Students will understand how density affects whether or not an object sinks or floats and that water can be displaced.

Engage

Begin by reading the first two pages of *Things That Float and Things That Don’t* to the class and pose the following question to them—Why would a small pebble sink but not a boat full of people? Accept all possible answers and evaluate the students’ understanding of objects floating and sinking. If students do not have a basic understanding of floating and sinking, you may want to adapt the K–2 activity and begin with that (a recommendation the book makes as well). After a discussion, continue to read the rest of the story to the students, stopping at each point and posing the questions that are investigated in the text before giving away the answer. At each of the following questions, ask the students to make predictions about what would happen and record their answers on the board.

- **Page 4:** Would a penny sink or float? What about a half-filled plastic bottle? Explain your answer.
- **Page 7:** Will a piece of aluminum foil that is crushed into a loose ball sink or float? What if it was made into a very tight ball?
- **Page 11:** Does an apple float?
- **Page 13:** Does clay float?

Finish reading the story to the students. Once students have had an opportunity to be introduced to the word density, which for this lesson is simply the weight of something relative to its size, ask them to consider very big things that are very light (like a balloon) or very small things that are very heavy (like nuts and bolts) to help foster their understanding (CC ELA Connection: Language Standards – Vocabulary Acquisition and Use). Continue reading the rest of the story to the students and inform them that they will be returning to conduct several of the activities to test their predictions and learn more about a factor that helps things float.

Explore

The following activities can be conducted over several days. The first series of activities that students should do is return to the questions that were asked in the Engage section and test their predictions. These basic investigations will help refresh students’ understanding that some objects float and some objects sink. Review the predictions made (CC ELA Connection: Reading Standards for Informational Texts K–5 – Key Ideas and Details). The second activity involves asking students to predict and then test whether the half-stick of clay they have will sink or float, and explain their reasoning. Some students

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**Materials**

- Modeling clay (½ stick or about 2 oz. per student) Dry clay can be a respiratory health hazard. Check the material safety data sheet to ensure safe handling and cleanup.
- Per group:
  - Clear plastic container for water
  - 50 marbles
  - Nonpermanent marker
  - Plastic soda bottle
  - Foil
  - Pennies
may remember that the book explains that based on the shape of the clay it can sink or float (CC ELA Connection: Reading Standards for Informational Texts K–5 – Integration of Knowledge and Details). Challenge the students to change the shape of the clay into something that will float. Allow the students time to create a shape, test it, and then modify the shape. After a discussion that incorporates the concept that water can be displaced, allow them to test their predictions. Guiding questions at this point would include: Do all boats displace water at the same rate? (No, boat design is a factor. This can be observed by marking the side of the container with a marker before placing the boat in and after. The water level will rise slightly, similar to when you get into a bathtub.) What would happen if you added marbles to the boat? (The boat would displace more water and more of the boat would be beneath the surface of the water.) Do you think too many marbles could sink the boat? Allow the students to try these different actions after you pose the questions. This will provide students with the opportunity to continue making observations of objects’ properties.

**Explain**

After students have had the opportunity to develop a shape, engage them in a discussion that describes the shapes that floated. While many different shapes of boats or containers can be made, only the clay that has a basic boat shape will float. For example, flat sheets of clay will sink, as will long ropes of clay. The boat shape will float based on the reasoning given in the story: “The boat encloses air. The density of the boat and the air it encloses is less than the density of the water.” Now that students have their clay boats built, ask them to make observations about how the boat is floating and reread pages 15–16 to the students, introducing the word *displacement* (CC ELA Connection: Language Standards – Vocabulary Acquisition and Use). Ask them to describe what they observe and predict what will happen if they add additional objects to the boat. Their responses should be supported with an explanation of density and displacement.

**Elaborate**

Review the fact that boats can float because of the shape of the boat that contains air (review p.18 if necessary) (CC ELA Connection: Reading Standards for Informational Texts K–5 – Integration of Knowledge and Details) and challenge them to their next task—to build a boat using aluminum foil that will hold the most pennies without sinking. Ask the students to explain what happened to the ball of aluminum foil in the demonstration earlier in the lesson (the tighter the ball, the more dense it was and it sank) and to consider that in their boat design. Give each pair of students the same size piece of aluminum foil and ask them to design a boat and then test the boat by adding pennies one at a time until the boat begins to take on water and sink.

**Evaluate**

Return to the terms *density* and *displacement*. Ask students to use their boats and explain why the stick of clay would sink but their boat would float. What happened to the water? How is this similar to what happened when using the aluminum foil? Ask the students to explain their reasoning through a sketch and explanation on their student data sheet (see NSTA Connection; CC ELA Connection: Writing Standards K–5 – Text Types and Purposes).

**References**


Connecting to the Standards

**Standard 2-PS1 Matter and Its Interactions**

**Performance Expectations:**
2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

**Science and Engineering Practices:**
Planning and Carrying Out Investigations
Analyzing and Interpreting Data

**Disciplinary Core Idea:**
PS1.A Structure and Properties of Matter

**Crosscutting Concept:**
Cause and Effect

**NGSS Table:** 2-PS1 Matter and Its Interactions
www.nextgenscience.org/2ps1-matter-interactions

**Standard 5-PS1 Matter and Its Interaction**

**Performance Expectation:**
5-PS1-3 Make observations and measurements to identify materials based on their properties.

**Science and Engineering Practices:**
Planning and Carrying Out Investigations
Developing and Using Models

**Disciplinary Core Idea:**
PS1-A Structure and Properties of Matter

**Crosscutting Concept:**
Cause and Effect

**NGSS Table:** 5-PS1 Matter and Its Interactions
www.nextgenscience.org/5ps1-matter-interactions

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Connecting to the Common Core

This section provides the Common Core for English Language Arts and/or Mathematics standards addressed in this column to allow for crosscurricular planning and integration. The standards state that students should be able to do the following at grade level.

**English/Language Arts**

**Reading Standards for Informational Texts K–5:**
Integration of Knowledge and Ideas
- Grade 3: “Use information gained from illustrations and the words in a text to demonstrate understanding of the text.”

**Reading Standards for Informational Texts K–5:** Key Ideas and Details
- Grade 1: “Ask and answer questions about key details in the text.”
- Grade 4: “Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.”

**Writing Standards K–5:**
Text Types and Purposes
- Grade 4: “Write informative/explanatory texts to examine a topic and convey ideas and information clearly.”

**Writing Standards K–5:**
Research to Build and Present Knowledge
- Grade 1: “With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.”

**Language Standards:**
Vocabulary Acquisition and Use
- All grade levels: “Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade [appropriate] reading and content.”

**Speaking and Listening Standards K–5:**
Presentation of Knowledge and Ideas
- Kindergarten: “Add drawings or other visual displays to descriptions as desired to provide additional details.”
- Grade 1: “Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.”

Furthermore the Common Core for ELA provide a standard related to the Range of Text Types for K–5 where it indicates that students in K–5 should apply the Reading standards to a wide range of texts to include informational science books.

Common Core State Standards Initiative
www.corestandards.org/the-standards

**NSTA Connection**
Visit www.nsta.org/SC1407 for additional resources and the student data sheets.