EVEN MORE

Picture-Perfect SCIENCE Lessons, F–5

Using Children's Books to Guide Inquiry

by Emily Morgan and Karen Ansberry

Hawker Brownlow
EDUCATION

Contents

Lessons by Year

Chapter	Year	Picture Books
6	F–2	*Wemberly's Ice-Cream Star* *Why Did My Ice Pop Melt?*
7	3–5	*Toy Boat* *Captain Kidd's Crew Experiments With Sinking and Floating*
8	3–5	*The Wind Blew* *I Face the Wind*
9	3–5	*The Boy Who Harnessed the Wind* *Wind Energy: Blown Away!*
10	F–2	*What's That Sound?* *Sounds All Around*
11	F–2	*Do You Know Which Ones Will Grow?* *What's Alive?*
12	F–2	*Flip, Float, Fly: Seeds on the Move* *Who Will Plant a Tree?*
13	F–2	*Unbeatable Beaks* *Beaks!*
14	3–5	*Just Ducks!* *Ducks Don't Get Wet*
15	F–2	*Houdini the Amazing Caterpillar* *From Caterpillar to Butterfly* *The Very Hungry Caterpillar*
16	3–5	*Fossil* *Fossils Tell of Long Ago*
17	F–2	*The Three R's: Reuse, Reduce, Recycle* *Michael Recycle*
18	3–5	*Come On, Rain!* *What Will the Weather Be?*
19	3–5	*Twilight Comes Twice* *Next Time You See a Sunset*
20	3–5	*Now & Ben: The Modern Inventions of Benjamin Franklin* *Build It: Invent New Structures and Contraptions*

both the emotional and intellectual levels. They are appealing and memorable because children readily connect with the imaginative illustrations, vivid photographs, experiences and adventures of characters, engaging storylines, the fascinating information that supports them in their quest for knowledge and the warm emotions that surround the reading experience.

What characterises a picture book? We like what *Beginning Reading and Writing* says, "Picture books are unique to children's literature as they are defined by format rather than content. That is, they are books in which the illustrations are of equal importance as or more important than the text in the creation of meaning" (Strickland and Morrow 2000, p. 137). Because picture books are more likely to hold children's attention, they lend themselves to reading comprehension strategy instruction and to engaging students within an inquiry-based cycle of science instruction. "Picture books, both fiction and nonfiction, are more likely to hold our attention and engage us than reading dry, formulaic text … Engagement leads to remembering what is read, acquiring knowledge and enhancing understanding" (Harvey and Goudvis 2000, p. 46). We wrote the *Picture-Perfect Science Lessons* series so teachers can take advantage of the positive features of children's picture books by supplementing the traditional science textbook with a wide variety of high-quality fiction and nonfiction science-related picture books.

The Research

Context for Concepts

Literature gives students a context for the concepts they are exploring in the science classroom. Children's picture books, a branch of literature, have interesting storylines that can help students understand and remember concepts better than they would by using textbooks alone, which tend to present science as lists of facts to be memorised (Butzow and Butzow 2000). In addition, the colourful pictures and graphics in picture books are superior to many texts for explaining abstract ideas (Kralina 1993). As more and more content is packed into the school day and higher expectations are placed on student performance, it is critical for teachers to teach more in the same amount of time. Integrating curriculum can help accomplish this. The wide array of high-quality children's literature available can help you model reading comprehension strategies while teaching science content in a meaningful context.

More Depth of Coverage

Science textbooks can be overwhelming for many children, especially those who have reading problems. They often contain unfamiliar vocabulary and tend to cover a broad range of topics (Casteel and Isom 1994; Short and Armstrong 1993; Tyson and Woodward 1989). But fiction and nonfiction picture books tend to focus on fewer topics and give more in-depth coverage of the concepts. It can be useful to pair an engaging fiction book with a nonfiction book to round out the science content being presented.

For example, the "What Will the Weather Be?" lesson in Chapter 18 features *Come On, Rain!* a beautifully descriptive story of a little girl waiting in the sizzling heat for the impending rain. It is paired with *What Will the Weather Be?* a nonfiction book that explains how various weather instruments are used to help meteorologists predict the weather. The expressive language and illustrations in *Come On, Rain!* hook the reader, and the book *What Will the Weather Be?* presents facts and background information. Together they offer a balanced, in-depth look at how changes in weather are predicted and how they affect us.

Improved Reading and Science Skills

Research by Morrow et al. (1997) on using children's literature and literacy instruction in the science program indicated gains in science as well as literacy. Romance and Vitale (1992) found significant improvement in both science and reading scores of Year 4 students when the regular basal reading program was replaced with reading in science that correlated with the science

NST4650 • 9781760014650 • © 2017 Hawker Brownlow Education

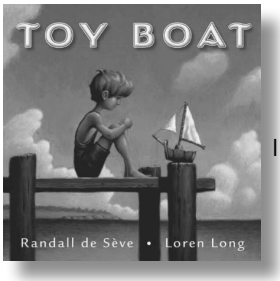
Chapter 7

Float Your Boat

Description

How does a cruise ship, made of tonnes of steel, stay afloat on the water? In this lesson, students make boats out of aluminium foil, learn how gravity and buoyancy affect boats, and apply what they have learned about these forces to come up with a foil boat design that will hold the most coins.

Suggested Year Levels: 3–5



Featured Picture Books

TITLE: ***Toy Boat***
AUTHOR: **Randall de Sève**
ILLUSTRATOR: **Loren Long**
PUBLISHER: **Philomel Books**
YEAR: **2007**
GENRE: **Story**
SUMMARY: *A toy boat gets separated from its owner and has an adventure on the high seas.*

TITLE: ***Captain Kidd's Crew Experiments With Sinking and Floating***
AUTHOR: **Mark Weakland**
ILLUSTRATOR: **Troy Cummings**
PUBLISHER: **Picture Window Books**
YEAR: **2012**
GENRE: **Narrative Information**
SUMMARY: *Tells the story of a pirate and his crew experimenting with sinking and floating. Captain Kidd explains the forces of gravity and buoyancy and how they affect boats.*

Time Needed

This lesson will take several class periods. Suggested scheduling is as follows:

Day 1: **Engage** with *Toy Boat* read-aloud, **Explore** with Float Your Boat and **Explain** with Float Your Boat Discussion

Day 2: **Explain** with *Captain Kidd's Crew Experiments With Sinking and Floating* read-aloud and **Elaborate** with A Ship for Captain Kidd

Day 3: **Evaluate** with Letter to Captain Kidd

Materials

For Float Your Boat (per group of three to five students)

- 15 cm × 15 cm piece of heavy-duty aluminium foil (1 per student)
- tub of water
- 50 coins of the same value (the smaller the better)
- paper towels

For Stop and Try It (per class)

- balloon
- tub of water
- 15 cm × 15 cm square of heavy-duty aluminium foil
- (optional) balance or scale to compare the weight of the pieces of foil

For A Ship for Captain Kidd (per group of three to five students)

- roll of heavy-duty aluminium foil
- tub of water
- metric ruler
- roll of masking tape
- scissors
- blank 7 cm × 12 cm index card
- textas
- bendable straw
- 50 coins of the same size

SAFETY

- Be careful to quickly wipe up any spilled water, oil or other liquid on the floor. This is a slip or fall hazard, which can result in a serious injury.
- When working with glassware, metre sticks, wires, projectiles, tools, straws or other solid hazards, have students use appropriate personal protective equipment (PPE), including safety glasses or goggles that meet national safety standards.
- Use caution in working with sharp items like scissors, wires, open paper clips, screwdrivers, metal pans and soft drink cans, wood and glass (including thermometers). They can cut or puncture skin.
- When working with plastic bags or balloons, remind students to keep them away from their mouths. These are potential breathing and/or choking hazards.

Student Pages

- Float Your Boat
- A Ship for Captain Kidd
- Letter to Captain Kidd

NST4650 • 9781760014650 • © 2017 Hawker Brownlow Education

Background

Students should be involved in engineering design challenges, which require the application of scientific principles. In this lesson, students are given the opportunity to do just that. In order to design a solution to an engineering challenge, students must learn some basic scientific principles that affect sinking and floating. Students learn about the forces of gravity and buoyancy as well as the relationship between buoyant force and water displacement. They then apply what they have learned by designing a foil boat that not only will float but will hold the greatest number of coins before it sinks.

Determining whether an object will sink or float depends on its density, or its weight compared with its size. If an object is more dense than the liquid or gas that it is in, it will sink. If it is less dense, it will float. This is why a cork floats and a coin sinks. A cork is less dense than water, so it floats. A coin is denser than water, so it sinks. But how does a ship made of tonnes of steel float on the water? We know that the force of gravity is pulling down on that steel, so why doesn't it end up at the bottom of the ocean? It's because of a force called buoyancy that is pushing up on the ship. Buoyancy is the force of liquid pushing upward. A steel boat is shaped so as to increase the amount of water it displaces. If it displaces enough water, then the buoyant force is large enough to keep it afloat. Another way to look at it is to include all the air contained in the boat as part of the boat. With enough air, the overall density of the boat is actually less than the density of water. In this lesson when students make boats with aluminium foil, they will see that a tight ball of aluminium foil sinks, but the same amount of foil will float if it is spread out so that it comes in contact with more water. Because the foil boat displaces more water than the small foil ball, there is more buoyant force pushing up on the boat, thus keeping it afloat.

So, there are two ways to think about floating and sinking. One way is to compare densities. This works well when determining whether certain kinds of materials will float or sink or if certain liquids will float on top of one another. But this lesson focuses on a second way to think about sinking and floating – the forces of buoyancy and gravity. Even though you can explain why a ship floats using the concept of density (the density of the ship is less than the water if you include the air inside the ship in the equation), this lesson focuses on the concept of the size and direction of the particular forces involved in floating and sinking: buoyancy and gravity, rather than density. By the end of Year 5, students should understand that objects in contact exert forces on one another but that some forces do not need to be in contact to act on an object (e.g. gravity and magnetism.) They should also learn that each force that acts on an object has a strength (magnitude) and a direction, and the motion of an object depends on the strength (magnitude) and direction of the forces acting on it.

engage

Toy Boat Read-Aloud

Show students the cover of *Toy Boat* and tell them that you are going to read the story to them twice. The first time, the purpose of the read-aloud is to hear the story and enjoy it. Read the book aloud, then *ask:*

? Is this book fiction or nonfiction? (fiction)

? How do you know? (The toy boat thinks and has feelings and real boats do not.)

Determining Importance

Tell students that you are going to read the story again, and this time you would like them to compare the different types of boats in the story – what's different about them and what's the same.

Explain that the watertight body of a ship or boat is called the *hull*, the front of the boat is called the *bow* and the back is called the *stern*. Encourage students to use this vocabulary when describing the boat shapes.

Then read the book aloud, pausing to point out the various pictures of boats; their names; sizes; and hull, bow and stern shapes. *Ask:*

? How are the different boats shaped? (Answers will vary, but students should note that they are all hollow on the inside. Some boats come to a point at the bow, some are squared off at the stern and so on.)

After reading, tell students that the author of this book, Randall de Sève, was inspired to write this story by a boat that she and her daughter made from a can, a cork, a toothpick and some white tape. Likewise, the illustrator, Loren Long, has fond memories of creating paper boats with his brothers on rainy days and following them as they floated on the puddles.

Testing the boats

Ask:

? Have you ever made a boat before?

? What kinds of materials would be good for making a toy boat? (materials that are waterproof, not too heavy and so on)

? What are most real boats made of? (steel, wood or fibreglass)

? What are boats designed to do? (carry people or things across bodies of water)

? Why do boats float? (Answers will vary according to students' preconceptions.)

explore

Float Your Boat

Give each student a Float Your Boat student page and a 15 cm × 15 cm piece of heavy-duty aluminium foil, and tell them that they will be making their own boats out of the aluminium foil. Students will be working in groups of three to five, but each student will build their own boat. When they are done constructing their boats, they can begin testing to see how many coins each boat will hold by gently placing the coins in the boat one by one until it sinks. Tell students not to count the last coin that made the boat sink. Have them record the number of coins each boat held on the student page. After every boat is tested, they should record the name of the person whose boat held the most coins in their group, draw a picture of that boat and explain why they think that boat held the most.

explain

Float Your Boat Discussion

After all groups have finished, bring the students together with their papers so they can explain what happened in their groups. *Ask:*

? What shape was the boat that held the most coins in your group? (Generally boats with a flat hull and high sides work best.)

NST4650 • 9781760014650 • © 2017 Hawker Brownlow Education