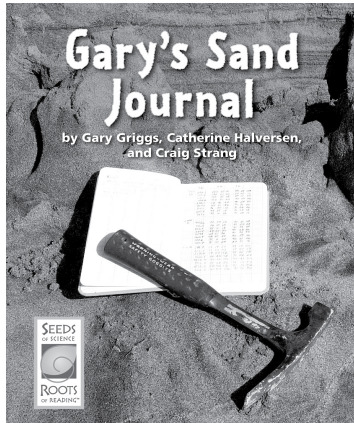


Teaching Scientific Explanations

with *Gary's Sand Journal*

from *Seeds of Science/Roots of Reading*[®]



Introduction

This strategy guide introduces an approach for teaching students to make scientific explanations based on evidence.

Making evidence-based explanations about the natural world is the fundamental purpose of science. This guide includes an introductory section about making scientific explanations, a description of how to teach this strategy with many science texts, and a plan for teaching students to make scientific explanations with the *Seeds of Science/Roots of Reading*[®] book, *Gary's Sand Journal*.

Book Summary

Gary's Sand Journal features shoreline scientist Gary Griggs explaining how he uses his observations of sand to determine its origin and composition. The first part of the book includes detailed photographs and descriptions of various kinds of sand. Readers learn that looking closely at the shape, size, and color of grains of sand can provide evidence about how old sand might be, where it comes from, and what it may be composed of. The second part of the book is a notebook, which Gary uses to record his observations of sand. In addition to learning about sand, readers learn that scientists look for evidence to support their ideas, investigate questions about the world, and record their observations, evidence, and explanations.

About This Book

Reading Level

Guided Reading Level*: P

Text Features

book description, table of contents, glossary, headings, bulleted lists, about the author, bold print, italic print, illustrations, captions, tables

*Guided Reading Levels based on the text characteristics from Fountas and Pinnell, *Matching Books to Readers*.

Science Background

About Sand

Sand comes in many different shapes, sizes, and colors. It is composed of small, broken-up pieces of different materials and is formed by erosion. Mountains, rocks, minerals, shells, coral, bones, metals, glass, and even plastic are all worn down over time into smaller and smaller particles by wind, waves, water, and other forces. The shape, size, and color of sand grains provide clues about the age of the sand, the type of beach it came from, and the material it is made of. Round grains of sand have been worn smooth over many years, while angular grains may have recently broken off from a rock or shell. If grains are very small, they probably came from an area with slow-moving water; large, fast-moving waves pick up small grains and carry them away. Black sand is often composed of lava rock.

About Scientific Explanations

As Gary points out in *Gary's Sand Journal*, scientists ask many questions. A scientific explanation aims to answer a question about the world. Explanations about where sand may have originated, such as the explanations in this book, are examples of evidence-based explanations scientists make. From their observations, scientists ask questions, find evidence to explain these questions, and generate more questions.

About Scientific Explanations

Scientific explanations tell how something in the world works or why something happens. Scientists investigate questions and construct explanations to answer them. Scientific explanations are always based on evidence. Evidence can come from firsthand experience (such as through observation and investigation) or from reading and carefully weighing the work of others who have conducted investigations themselves. A well-crafted scientific explanation seeks to tie the evidence together in a way that both answers the question at hand and provides reasons for the conclusions that are drawn based on an understanding of relevant scientific principles.

Teaching Students to Make Scientific Explanations

Learning to make explanations from evidence is essential for learning and communicating about science. Many science texts provide an opportunity for students to practice making explanations from evidence. The following guidelines can be used to teach this strategy with any content-rich text.

- Make a class chart that lists prompts, which students can use during discussions. (See the box on this page for ideas.)
- Select a science text that all students will read. Choose a section of the text that presents some information about a natural process or phenomenon (e.g., a passage that describes how clouds form or how an animal gets its food). Develop a question that will elicit an explanation and will require students to consult the text for evidence (e.g., How do clouds form? or How does an octopus get its food?). Write the question on the board.
- After students have read the text once through, introduce scientific explanations. Point out that the goal of science is to explain the natural world. Tell students that when scientists make explanations, they use evidence to tell how something works or why something happens.
- Direct students to reread the section of the text you have selected. Read the question on the board out loud to students. Ask students

Prompts for Making Scientific Explanations

- Why do you think that?
- I think this because...
- What is your evidence?
- My evidence is...

to reread the section from the text with the focus question in mind and to search for evidence that will help them answer this question.

- Discuss the text and, as a class, try to make an explanation that answers the question. Let students know that you will be asking for evidence from the book. Point out the class chart on which you have listed the prompts. You may wish to give examples of how to answer the question using the prompts “I think this because...” and “My evidence is....” Be sure to ask, “Why do you think that?” and “What is your evidence?” whenever possible.
- Have students write their explanations (their answers to the question) individually or write one together as a class. If your students write their own explanations, use the Making Scientific Explanations copymaster provided with this guide. Be sure that students provide evidence from the text in their responses.
- Repeat this procedure any time the class reads science books. Ask, “Why do you think that?” and “What is your evidence?” during discussions so students gain practice using this language. Once students have practiced making explanations from evidence during a few class discussions, ask them to meet in small groups to discuss a text. Encourage students to use the prompts with each other as they discuss.

Making Scientific Explanations with *Gary’s Sand Journal*

Gary’s Sand Journal provides a model of how one scientist uses evidence to make explanations. Gary, a shoreline scientist, explains how he makes explanations about sand based on his observations of its size, shape, and color.

Getting Ready

1. Write “What is the mystery sand composed of?” in the space provided on the Making Scientific Explanations copymaster. Make a copy for each student.
2. Make a class chart of prompts that you will use during the discussion of *Gary’s Sand Journal*. (See the box on the previous page for ideas.)

During Class

1. Explain that students will read a book about sand. While the book is about sand, it is also about the way scientists make explanations. Tell students that as they read, they should pay particular attention to the kinds of words that Gary, the shoreline scientist, uses when he looks carefully at sand.
2. Read the book in a way that is consistent with your classroom routines, giving students as much independence as possible.
3. After students become familiar with the content of the book, ask them to reread the first section (pages 4–13). Tell them that you are going to ask some questions about Gary’s explanations and the evidence he used to make those explanations. Direct students’ attention to the chart you made before class and point out that students can use the sentence frames below each question to begin their answers. Provide an example: “If Gary told us that he thought a sand was composed of lava rock, he could explain, ‘I think this sand is made of lava rock because I observed that the sand is black. My evidence is that I have also seen black sand on beaches that are near volcanoes, and I know that volcanic rock is often black.’”
4. Reread pages 14–23. As you reread the section, draw students’ attention to the way Gary uses evidence to make explanations. For each of the four different kinds of sand, ask the following:
 - What does Gary think this sand is composed of?
 - What is his evidence?
5. Ask students to turn to pages 24–25. Reread page 24 and ask students to look at the mystery sand on page 25 and make observations about its size, shape, color, etc. Record some observations on the board. [The sand has grains of different sizes.]

6. Ask students to look back through the text and discuss what these observations could be evidence of. [Sharp corners might mean this is newer sand.] Focus on one observation at a time. As students respond, make sure to emphasize the connection between what they are observing and what the observation is evidence of. [Rounded edges may be evidence of old sand.]
7. Distribute the Making Scientific Explanations copymaster to each student. Read the question written at the top: “What is the mystery sand composed of?” Tell students they will write an explanation to answer this question. Ask students to think about the observations and evidence they just collected and decide what the mystery sand is composed of. When they have made a decision, they should write a sentence in the space provided under “Explanation.” Write the sentence starter “I think the mystery sand is composed of...” on the board and encourage students to use it to write their explanation. Students may write that the mystery sand is composed of coral, bones, shells, quartz, and/or other types of rocks.
8. Ask students to write at least two pieces of evidence that support their explanation. (This can be an independent or shared writing activity.) Remind students to begin at least one of the sentences with “I think this because...” or “My evidence is....” [I think the mystery sand is made of coral, shells, and quartz. My evidence is that some of the grains are white and pink like the coral sand on page 11 and the shell sand on page 12. Some of the grains are also clear like the quartz sand on page 13.] There are many possible student responses that can be supported by observations of the sand.

Independent Extension

Write the following sentence frames on the board: “I think this sand is made of _____. It may have come from _____.” Ask students to choose one of the sands pictured on page 3. Students should reread the book to look for evidence that explains what the sand is composed of and where it came from. Ask students to complete the sentence frames for their chosen sand and then add a few sentences explaining their thinking.

Name _____ Date _____

Making Scientific Explanations

Question: _____

Explanation: _____

1. _____

2. _____

3. _____

About Strategy Guides

A six-page strategy guide is available for each *Seeds of Science / Roots of Reading*® student book. These strategies support students in becoming better readers and writers; they help students read science texts with greater understanding, learn and use new vocabulary, and discuss important ideas about the natural world and the nature of science. Many of these strategies can be used with multiple titles in the *Seeds / Roots* series. For more information, as well as for additional instructional resources, visit the *Seeds / Roots* Web site (www.seedsofscience.org/strategyguides.html).

Student Books for Grades 2–3

Twenty-seven engaging student books are now available, each with a corresponding strategy guide. The books are part of the *Seeds of Science / Roots of Reading*® curriculum program described on page 6.

Soil Habitats	
Strategy	Student Book
Using Discourse Routines with Science Texts	<i>Into the Soil</i>
Using the Cognates Strategy	<i>Walk in the Woods</i>
Connecting Science Words and Everyday Words	<i>What Are Roots?</i>
Teaching About the Nature of Science	<i>Talking with a Habitat Scientist</i>
Teaching Text Structure	<i>Handbook of Forest Floor Animals</i>
Using Text Features	<i>Earthworms Underground</i>
Taking Notes Based on Observations	<i>My Nature Notebook</i>
Making Sense of Data in Science Texts	<i>Snail Investigations</i>
Using Discourse Circles	<i>Without Soil</i>
Shoreline Science	
Strategy	Student Book
Teaching Vocabulary with Science Texts	<i>Beach Postcards</i>
Teaching Concept Mapping	<i>What Belongs on a Beach?</i>
Teaching Scientific Explanations	<i>Gary's Sand Journal</i>
Interpreting Visual Representations	<i>What's Stronger? The Forces That Cause Erosion</i>
Using Text Features	<i>What Lives on a Sandy Beach?</i>
Teaching About Multiple Meaning Words	<i>My Sea Otter Report</i>
Searching for Information in Science Texts	<i>Handbook of Sandy Beach Organisms</i>
Teaching Text Structure	<i>The Black Tide</i>
Teaching About the Nature of Science	<i>Shoreline Scientist</i>
Designing Mixtures	
Strategy	Student Book
Using Discourse Circles	<i>What If Rain Boots Were Made of Paper?</i>
Using Anticipation Guides	<i>Solving Dissolving</i>
Teaching Scientific Explanations	<i>Handbook of Interesting Ingredients</i>
Teaching Text Structure	<i>Jelly Bean Scientist</i>
Teaching About the Nature of Science	<i>Jess Makes Hair Gel</i>
Gravity and Magnetism	
Strategy	Student Book
Interpreting Visual Representations	<i>Forces</i>
Making Sense of Data in Science Texts	<i>What My Sister Taught Me About Magnets</i>
Using Anticipation Guides	<i>Gravity Is Everywhere</i>
Teaching Concept Mapping	<i>Mystery Forces</i>

Extend Learning with *Seeds of Science/Roots of Reading*™

The strategy featured in this guide is drawn from the *Seeds of Science / Roots of Reading*™ curriculum program. *Seeds / Roots* is an innovative, fully integrated science and literacy program.

The program employs a multimodal instructional model called “Do-it, Talk-it, Read-it, Write-it.” This approach provides rich and varied opportunities for students to learn science as they *investigate* through firsthand inquiry, *talk* with others about their investigations, *read* content-rich books, and *write* to record and reflect on their learning.

Take advantage of the natural synergies between science and literacy instruction.

- Improve students’ abilities to read and write in the context of science.
- Excite students with active hands-on investigation.
- Optimize instructional time by addressing goals in two subject areas at the same time.

To learn more about *Seeds of Science / Roots of Reading*™ products, pricing, and purchasing information, visit www.seedsofscience.org



Soil Habitats Science and Literacy Kit



Developed at Lawrence Hall of Science and the Graduate School of Education at the University of California at Berkeley.

Seeds of Science/Roots of Reading™ is a collaboration of a science team led by Jacqueline Barber and a literacy team led by P. David Pearson and Gina Cervetti.

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