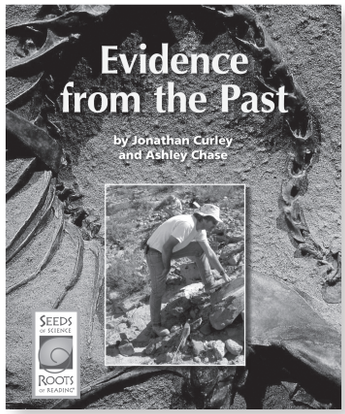
Strategy Guide

Teaching About the Nature of Science

with *Evidence from the Past* from *Seeds of Science/Roots of Reading*®



Introduction

This strategy guide introduces an approach for teaching about the nature of science. Learning about the nature of science helps students understand that science is a process for inquiring about the world. By reading this book, students learn about practices of science such as how scientists pose questions, engage in investigations, and make explanations based on evidence. This guide includes an introductory section about the nature of science, a general overview of how to teach this strategy with many science texts, and a plan for teaching about the nature of science with the *Seeds of Science/Roots of Reading*® book, *Evidence from the Past*.

Book Summary

Evidence from the Past introduces the work of Argentinean paleontologist Rodolfo Coria. Readers learn that paleontologists are scientists who study the evidence left behind by ancient species. Through learning about Dr. Coria's work, readers get a glimpse of the exciting field of paleontology as well as general insight into the nature and practices of science. Readers learn how paleontologists use evidence to make inferences about species that lived long ago. The book follows Dr. Coria as he makes claims, collects evidence, makes inferences based on the evidence, and formulates new and exciting explanations about extinct species.

About This Book

Reading Level
Guided Reading Level*: X

Key Vocabulary
investigate, inference, evidence, explanation, claim

Text Features
bold print, glossary, table of contents, text boxes, headings/subheadings, bulleted lists, photographs, captions, diagrams, labels

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

Science Background

About the Fossil Record

A fossil is any preserved evidence of a living thing such as bones, teeth, footprints, skin, etc. Fossil remains enable scientists to study extinct species. Even though the behaviors and physiology of extinct species cannot be observed, fossils provide evidence about the physical structures of life from the past. In particular, fossils formed from bones provide clues about the skeletal characteristics of extinct animals. More fossil evidence is constantly being discovered, and, thus, scientific understanding of life from the past is continually growing based on new knowledge.

About Evidence

Making explanations from evidence is the cornerstone of the scientific enterprise. Scientists gather evidence in a variety of ways, including making careful observations, conducting experiments, or taking measurements. Scientists consider the evidence they have collected in order to draw conclusions and make explanations. The more converging evidence scientists can gather, the more certain they can be about their explanations of the natural world.

About the Nature and Practices of Science

Science is a process of continuous inquiry that yields new understandings about the natural world. Learning about the nature of science helps students understand how knowledge is developed by the scientific community. This understanding helps students see that science is not a collection of facts but rather a process of discovery. Learning about the work that scientists do (the practices of science) allows students the opportunity to see valuable habits of mind (such as posing questions and critically evaluating evidence) modeled for them. Discussing how science is conducted encourages students to emulate the practices of scientists when they engage in scientific investigations and may generate student interest in science as a career.

Practices of Science

- Investigate questions or problems.
- Design new things or make models.
- Make predictions or inferences.
- Make comparisons.
- Build on the work of other scientists.
- Work with other scientists.
- Make observations and collect data.
- Use specialized tools.
- Organize and analyze data.
- Use evidence to make claims.
- Make and revise explanations.

Teaching About the Nature and Practices of Science

The following guidelines can be used to teach about the nature and practices of science with texts that discuss the work of real scientists or those that explore the process of scientific inquiry.

- Select an engaging science book or article that will prompt discussion about the nature and practices of science. Possibilities include biographies of scientists, interviews with scientists, or books featuring scientists who investigate a particular question or problem. Also, make copies of the What Scientists Do copymaster for each student.
- Introduce the nature and practices of science by explaining that science is a process for learning about the world. Explain that scientists have particular ways of investigating, writing, and talking. Discuss a few examples of what scientists do that might be familiar to your students. (See the box on this page for a list of examples.)
- Distribute the What Scientists Do student sheets. Highlight one well-illustrated practice from the text and model how to locate and describe an example. You might suggest that students look for key words, such as *investigate*.
- Have students read the text and make notes on their student sheets about what scientists do. Students can use the blank boxes at the bottom of the sheet to list additional practices they notice while reading. (Not all practices listed on the student sheet will appear in all texts.)
- After reading, discuss a few of the science practices students read about. As necessary, provide generalized terms for the specific practices discussed in the text. For example, if a student says that a scientist they read about uses a microscope, you can rephrase this as: *Scientists use specialized tools to help them investigate.* List these examples on a piece of chart paper. Review sections of the text that highlight these practices in order to prompt discussion.
- Pose questions to prompt further discussion about the nature and practices of science. For example, ask, “How did the scientist (gather evidence)?” “How did (gathering evidence) help this scientist answer her question?” “What are some other ways scientists gather evidence?”
- Continue adding to the list of what scientists do when students conduct hands-on science activities, read other books about scientists, or explore the practices of science in other ways. You might find it beneficial to contrast the ways that science is different from the ways professionals in other fields, such as art or history, learn about the world.

Teaching About the Nature of Science with *Evidence from the Past*

Evidence from the Past models scientific practices such as making observations, collecting data, making inferences, and using evidence to make claims.

Getting Ready

1. Make a copy of the What Scientists Do copymaster for each student.
2. Write "What Scientists Do" at the top of a piece of chart paper and post it in a visible place.

During Class

1. Explain that science is way of learning about the natural world and that scientists use specific processes and procedures to find things out. Tell students they will read a book about one kind of scientist called a paleontologist. Explain that paleontologists study living things from long ago using fossils.
2. Read *Evidence from the Past* in a way that is consistent with your classroom routines, giving students as much independence as possible. After reading, discuss the text to be sure students understand the ideas presented.
3. Distribute the What Scientists Do student sheets. Let students know that they will now read the book a second time and that they should think carefully about some things that scientists do. Let them know they will share ideas in a class discussion after reading.
4. Model how to identify the practices of science using pages 8–9 of the text. After reading the pages aloud, identify the practices of science found in this section of the text. [Gathering evidence/data.] Discuss how paleontologists search for evidence and how finding evidence is an important practice of science.
5. Direct students' attention to the "Gather evidence/data" box on their student sheets. Show students how to record a specific example of what Dr. Coria did in the space provided. [Dr. Coria studied fossil evidence.] Have students record this example from the book on their student sheets.
6. Have students continue rereading the book to identify the other practices of science listed on their student sheets. You can also encourage students to identify additional practices and list these in the blank boxes at the bottom of their student sheets.
7. Have students use their notes to engage in a class discussion. Ask, "How did Dr. Coria gather evidence?" [He looked at the shape of fossil bones.] Continue to discuss this practice by asking students, "How did gathering evidence help Dr. Coria answer his question?" and "What are some other ways scientists gather evidence?" Record students' ideas on the What Scientists Do class chart.
8. Repeat the discussion for each of the remaining practices of science listed under the "What scientists do" column (investigate, make explanations, and work with other scientists). Ask questions that prompt students to refer to the text as necessary.
9. As the class discusses each practice, record students' ideas on the What Scientists Do class chart. Help students rephrase responses to reflect the general practices of science. For example, if a student says, "Dr. Coria searched for fossil bones," guide students to relate that idea to a more general practice of science. [Scientists search for evidence.]
10. Ask for students to share any additional practices they identified from the text. Briefly discuss each one and add notes about students' ideas to the class chart.
11. At the end of the discussion, have students read over the chart and reflect on what they have learned about what scientists do.

Independent Extension

Have students reread pages 9–12 from *Evidence from the Past* and ask them to write a response to the question, "What inferences did Dr. Coria make about the dinosaurs he studied?" [He inferred the parts of the dinosaur's body that different bones were from. He inferred that the bones he found came from a sauropod. He inferred that Argentinosaurus was a sauropod.]

Name _____ Date _____

What Scientists Do

Title of book: _____

What scientists do	Example from the book
Gather evidence/data	
Investigate	
Make explanations	
Work with other scientists	

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**).

Available Student Books for Grade 3–4

Four engaging student books from *Variation and Adaptation* 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. Twenty-three student books from the remaining grade 3–4 units (*Digestion and Body Systems*, *Light Energy*, and *Weather and Water*) are currently in development and will be available in late 2009.

Variation and Adaptation	
Strategy	**Student Book**
Teaching Scientific Comparison Writing	*Blue Whales and Buttercups*
Using Discourse Circles	*The Code*
Using Visual Evidence to Make Inferences	*Mystery Mouths*
Teaching About the Nature of Science	*Evidence from the Past*
Digestion and Body Systems	
Strategy	**Student Book**
Making Sense of Visual Information	*Systems*
Teaching About the Nature of Science	*Secrets of the Stomach*
Teaching Scientific Process Description Writing	*Voyage of a Cracker*
Searching for Information in Science Texts	*Handbook of Body Systems*
Making Sense of Data in Science Texts	*What's the Diagnosis?*

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**

***Variation and Adaptation* Science and Literacy Kit**

SEEDS OF SCIENCE ROOTS OF READING®

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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