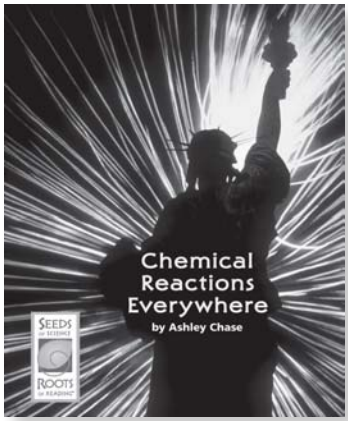
Strategy Guide

Teaching Scientific Explanation Writing

with *Chemical Reactions Everywhere* from *Seeds of Science/Roots of Reading*®



Introduction

This strategy guide introduces an approach for teaching students how to make scientific explanations based on evidence. Making evidence-based explanations enables students to communicate ideas about the natural world in the same way that scientists do. This guide includes an introductory section about scientific explanations, a description of how to teach this strategy with many science texts, and a plan for teaching students about writing scientific explanations with the *Seeds of Science/Roots of Reading*® book *Chemical Reactions Everywhere*.

Book Summary

Chemical Reactions Everywhere demonstrates that chemical reactions happen all around us, not just in science labs. The book explains that everything in the world is made of chemical substances with distinct properties and that during a chemical reaction, these substances change to produce new substances. To illustrate these concepts, the book describes 12 chemical reactions that can be observed in everyday life, such as an apple turning brown or fireworks exploding. Readers learn that color change, temperature change, or the production of gas, heat, light, or electricity can all be evidence that a chemical reaction has occurred. After reading *Chemical Reactions Everywhere*, readers may see ordinary events in a new way.

About This Book

Reading Level
Guided Reading Level*: R

Key Vocabulary
chemical reaction, evidence, observe, property, substance

Text Features
bold print, captions, glossary, headings, labels, photographs, subheadings, table of contents

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

Science Background

Chemical reactions happen all around us all the time. A bicycle rusting, a candle burning, or muffins rising are familiar examples of chemical reactions. A chemical reaction occurs when substances change to form new substances. In some chemical reactions, two or more substances may combine to form a new substance (for example, when iron and oxygen combine to form iron oxide, commonly known as rust). A chemical reaction can also occur when a single substance changes to become one or more new substances (for example, hydrogen peroxide breaks down into water and oxygen). It can sometimes be difficult to tell if a chemical reaction has occurred. Chemists look for observable evidence of a chemical reaction. Color change can be evidence of a chemical reaction. A color change, however, is not always evidence of a chemical reaction (for example, when two colors of paint are mixed together). A change in temperature can also be evidence of a chemical reaction. All chemical reactions either take in energy or give off energy, and this results in a change in temperature. Some chemical reactions release energy in the form of light. Sometimes, a gas is produced in a chemical reaction. All these changes can be observable evidence that a chemical reaction has taken place.

About Scientific Explanations

Scientists make explanations to communicate what they have discovered in their investigations. A scientific explanation communicates a scientist's claim about some aspect of the natural world, as well as the evidence and reasoning that support that claim. Because the purpose of a scientific explanation is to share ideas with an audience—which could be an audience of other scientists or of interested lay people—scientists must consider how to make their explanations clear and convincing. Learning the characteristics of a scientific explanation familiarizes students with how to use evidence to support their ideas and communicate these ideas in a clear way.

Teaching Scientific Explanation Writing

The following guidelines can be used to teach students how to search for evidence and write a scientific explanation using information found in many science texts.

- Select a text that examines one scientific concept in some depth and offers evidence that scientists might use to explain the concept. Choose topics that are not too narrow or too broad (good examples include magnets, erosion, or humidity).
- Before the lesson, formulate a question about the topic that is supported by the text. Ideally, the question should be one that is not answered in any single passage in the text, but rather requires multiple pieces of evidence to answer. For example, for a text that explains humidity, you could offer the question "Is humidity different in different places?"
- Tell students that evidence is central to science. When scientists study the natural world, they collect evidence to support their ideas; they do not just provide opinions.
- Explain to students that the text they will read introduces a concept about which scientists have collected evidence in order to explain what it is or how it works.
- Explain that after scientists collect evidence, they share their ideas with others by making scientific explanations. Scientific explanations communicate evidence and ideas to others.

Characteristics of a Scientific Explanation

A scientific explanation...

- begins with a claim that answers a question.
- includes evidence to support the claim.
- includes evidence from more than one source.
- uses transitions between ideas.
- explains ideas so that others in the scientific community can understand them.

- Tell students that they should think about the question you asked as they read and try to find evidence to help them answer it. Distribute a few sticky notes to each student and ask them to place the sticky notes in the text whenever they find evidence. (You could also use the Evidence for a Scientific Explanation copymaster, included in this guide, for this purpose.) You may want to point out that photographs and illustrations can be sources of evidence.
- After reading, ask students to share the evidence they collected that addresses the question. As students share, discuss how the evidence they found helps answer the question. Make note of this evidence on the board. If applicable, ask students to provide evidence from their experiences as well as from the text.
- Explain that after scientists have gathered enough evidence, they may write a scientific explanation. A scientific explanation begins with a claim that answers a question. The claim is based on the evidence that was collected. Have students construct a claim that directly answers the question you posed. Record this claim on the board.
- Continue writing the explanation by having students help you turn the evidence they suggested into a paragraph. Write the evidence sentences after the claim. Reread the paragraph and add any transition words or other elements to make the writing clearer.
- When students are comfortable with the structure of a scientific explanation, have them write explanations about other science topics. (Refer to the box on this page for characteristics of a scientific explanation.)

Teaching Scientific Explanation Writing with *Chemical Reactions Everywhere*

Getting Ready

1. Make a copy of the Evidence for a Scientific Explanation copymaster for each student.
2. Prepare a Characteristics of a Scientific Explanation chart, using the example on the previous page.

During Class

1. Introduce *Chemical Reactions Everywhere* and explain that this book describes several familiar examples of chemical reactions.
2. Read the book in a way that is consistent with your classroom routines, giving students as much independence as possible.
3. After reading, discuss the word *evidence* (clues that help explain something or answer a question). Direct students to reread page 8 and identify evidence of chemical reactions. [Color or temperature change, producing a gas, giving off light or heat.]
4. Ask students to examine the before-and-after photographs on pages 22–23 and identify which photographs show chemical reactions. [A burning log; roasted marshmallows; bananas turning brown; a white powder mixed with a clear liquid; a rusty nail.]
5. Focus students' attention on the photograph of the burning log and demonstrate how to find evidence in the book that explains why this is a chemical reaction. [Page 13: the burning log gives off light and heat, just like a candle.]
6. Invite students to identify additional evidence that the burning log is a chemical reaction. [Page 8: color change can be evidence of a chemical reaction, many chemical reactions give off light or heat; page 19: the log appears to change color, just as bread does when toasted.]
7. Tell students that scientists use evidence to write scientific explanations. Present the Characteristics of a Scientific Explanation chart and discuss it with the class.
8. Guide students to generate a claim about the burning log based on the evidence that they gathered. [A log burning is a chemical reaction.] Tell students that they will now gather evidence to support a claim that answers a question about a different reaction.
9. Distribute the Evidence for a Scientific Explanation student sheets. Write "Does a chemical reaction happen when...?" on the board. Then, ask students to choose a chemical reaction shown on pages 22–23 and use this to complete the question (e.g., *Does a chemical reaction happen when bananas turn brown?*). Have students record their questions at the top of their student sheets.
10. Direct students to reread the book to locate evidence related to their questions. (You may wish to remind students that evidence can also be found in photographs.) Encourage students to include one piece of evidence from their everyday experiences, if they can. Have students record each piece of evidence in one of the boxes on their student sheets.
11. Invite students to think about the evidence they found and write a claim that directly states the answer to their questions. Have students record their claims in the center box on their student sheets.
12. Explain that a written scientific explanation paragraph begins with the claim as the main idea. On a separate sheet of paper, have students write their claims. Then, ask students to use their notes to write one supporting sentence for each piece of evidence they found.
13. When students finish writing, have them read their paragraphs aloud to a partner. Students should suggest ways to improve their partners' scientific explanations using the Characteristics of a Scientific Explanation chart. Have partners work together to revise their explanations, as needed.

Independent Extension

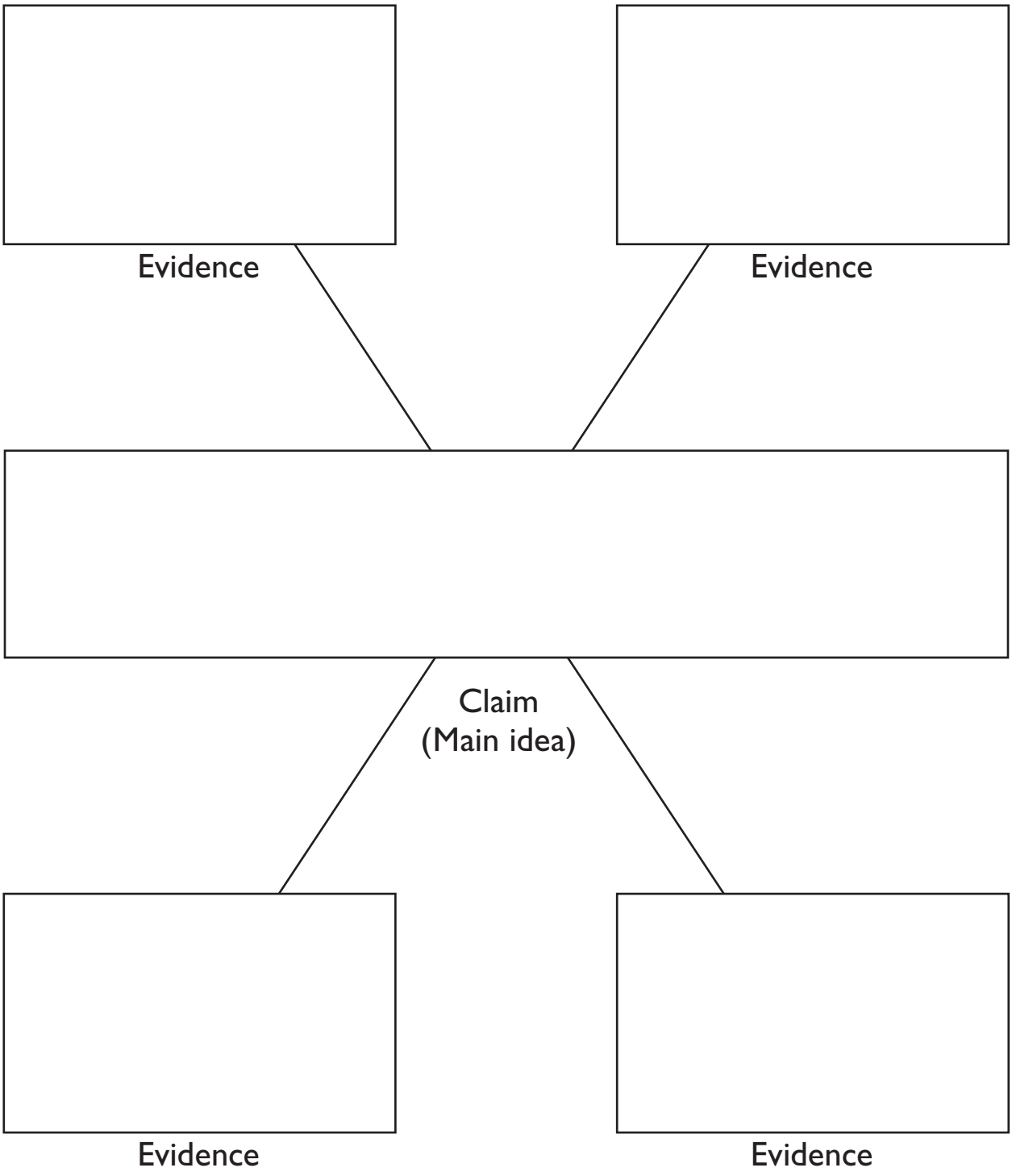
Write the following claim on the board: "A chemical reaction happens when red, yellow, and blue paints are mixed together." Have students discuss this claim with a partner and find evidence in *Chemical Reactions Everywhere* to support or refute it.

Name _____ **Date** _____

Evidence for a Scientific Explanation

Title of Book: _____

Question: _____



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 Grades 4–5

Nine engaging student books are now available from *Models of Matter* and *Chemical Changes*, each with a corresponding strategy guide. The books are part of the *Seeds of Science/Roots of Reading*® curriculum program described on page 6. Eighteen student books from the remaining grade 4–5 units (*Planets and Moons* and *Aquatic Ecosystems*) are currently in development and will be available in spring and summer 2010.

Chemical Changes	
Strategy	**Student Book**
Teaching Scientific Explanation Writing	*Chemical Reactions Everywhere*
Posing Investigation Questions	*Handbook of Chemical Investigations*
Teaching Text Structure	*What Happens to the Atoms?*
Teaching Procedural Writing	*Bursting Bubbles: The Story of an Improved Investigation*
Promoting Word Consciousness	*Communicating Chemistry*
Models of Matter	
Strategy	**Student Book**
Teaching Summary Writing	*Made of Matter*
Using Roundtable Discussions	*Break It Down: How Scientists Separate Mixtures*
Interpreting Visual Representations	*Phase Change at Extremes*
Teaching About How Scientists Make Inferences	*Science You Can't See*

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.deltaeducation.com**

***Chemical Changes* 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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