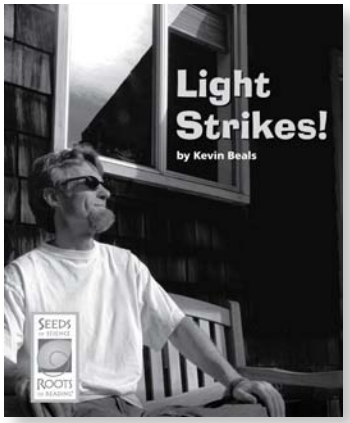
Strategy Guide

Teaching Scientific Explanation Writing

with *Light Strikes!* 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 scientific explanations with the *Seeds of Science/Roots of Reading*® book *Light Strikes!*

Book Summary

Light Strikes! shows light interactions in real-life situations. Readers are invited to look at ordinary scenes and observe how light interacts with materials, sometimes in unexpected ways. The book introduces important, fundamental concepts about light interactions, such as reflection (light bouncing off a material), absorption (light energy that is taken in by a material), and transmission (light passing through a material). Because the author uses common experiences to convey these concepts, readers are introduced to them in accessible ways. This accessible exposure helps readers to more easily understand three specific ways light interacts with materials.

About This Book

Reading Level
Guided Reading Level*: O

Key Vocabulary
absorb, block, evidence, interact, reflect, transmit

Text Features
bold print, glossary, headings/subheadings, labels, photographs

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

Science Background

When light interacts with a material, it can be reflected, absorbed, or transmitted. In most cases, some combination of these interactions occurs. For example, a clear window transmits most light, but it also absorbs and reflects a small amount of light. Characteristics such as the degree of opacity of a material affect how much light is transmitted; some materials, such as bricks or metal, do not transmit light at all. Light that is not transmitted through a material is blocked. When light is blocked, it is reflected and absorbed. When light reflects off a material, it bounces off it without penetrating its surface. Finally, all materials absorb light. When light is absorbed, it stops traveling along its path. In fact, it stops being light energy and is converted into a different form of energy. The most common energy transformation that results from the absorption of light is thermal energy, such as when sunlight warms your arm. Absorbed light can also be converted into electrical energy (when light strikes a solar cell) or into chemical energy (through photosynthesis). Different materials interact with light in different ways, and the properties of a material affect how it interacts with light.

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 that 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 book, but rather requires multiple pieces of evidence to answer. For example, for a book 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 to answer it. Distribute a few sticky notes to each student and ask them to place the sticky notes in the book whenever they find evidence. (You could also use the Evidence for a Scientific Explanation copymaster, included with this guide, for this purpose.) You may want to point out that evidence can also be gained through photographs or illustrations.
- 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 experience as well as from the text.
- Explain that after scientists have gathered enough evidence, they may write a scientific explanation. (Refer to the box on this page for characteristics of scientific explanations.) 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 suggest into a paragraph. Write the evidence sentences after the claim. Reread the paragraph and add any transitions or other elements to make the writing more clear.
- When students are comfortable with the structure of a scientific explanation, have them write explanations about other science topics in a more independent fashion.

Teaching Scientific Explanation Writing with *Light Strikes!*

Light Strikes! introduces students to how light interacts with materials. Everyday examples offer evidence of these interactions.

Getting Ready

1. Make a copy of the Evidence for a Scientific Explanation copymaster for each student.
2. Prepare a chart listing the characteristics of a scientific explanation. (See the box on the previous page.)

During Class

1. Introduce *Light Strikes!* and explain that this book offers evidence about how light interacts with different materials.
2. Read *Light Strikes!* in a way that is consistent with your classroom routines, giving students as much independence as possible.
3. After reading, briefly discuss the main ideas in the text to ensure that students understand the important concepts about light presented in the book.
4. Direct students to reread page 15. Then, turn to page 16 and ask students to think about the first question on the page, "Is my hand blocking light?" Explain that they will now read the book a second time to search for evidence to answer this question.
5. Distribute sticky notes to each student and give them a few minutes to mark places in the book where they find evidence that relates to the question. Remind students that evidence can also be gained from photographs. Ask students to share their evidence and discuss how it answers the question.
6. Explain that scientists make claims, or statements that answer questions, based on evidence. Guide the class to make a claim that answers the question, based on the evidence. [A hand can block light.] Explain that students will use the evidence they gathered to support this claim.
7. Have students share the evidence they found. As each student shares, prompt the class to decide if the evidence supports the claim. Ask students for clarification and additional evidence as needed. For example, if a student says, "A person can block light with his hand" [Page 4.], ask the student how she knows the light is being blocked. [There is a shadow, page 5.] Continue discussing evidence until the group reaches a consensus that the claim is true.
8. Distribute the Evidence for a Scientific Explanation student sheets and tell students that they will now gather evidence for another question. Ask students to record a new question (such as "Can someone's hand reflect light?") at the top of the sheet. Then, ask students to move their sticky notes to places in the book where they find evidence for this question.
9. Invite students to think about the evidence they found and make a claim that answers the question. Have students record their claims in the center box on their student sheets. Then, ask students to record notes about their evidence in the boxes connected to the main idea. Students can also add evidence they have from everyday experiences.
10. After students have recorded their evidence, tell them they will use these notes to write a scientific explanation. Present the Characteristics of a Scientific Explanation chart and encourage students to refer to it as they write.
11. Explain that a written scientific explanation begins with a claim. On a separate sheet of paper, have students write their claims as the first sentence of their paragraphs. (Alternatively, do this as a shared writing activity on chart paper.)
12. Have students use their notes to create the remaining sentences in their paragraphs. Tell them to be sure all their evidence supports their claims.

Independent Extension

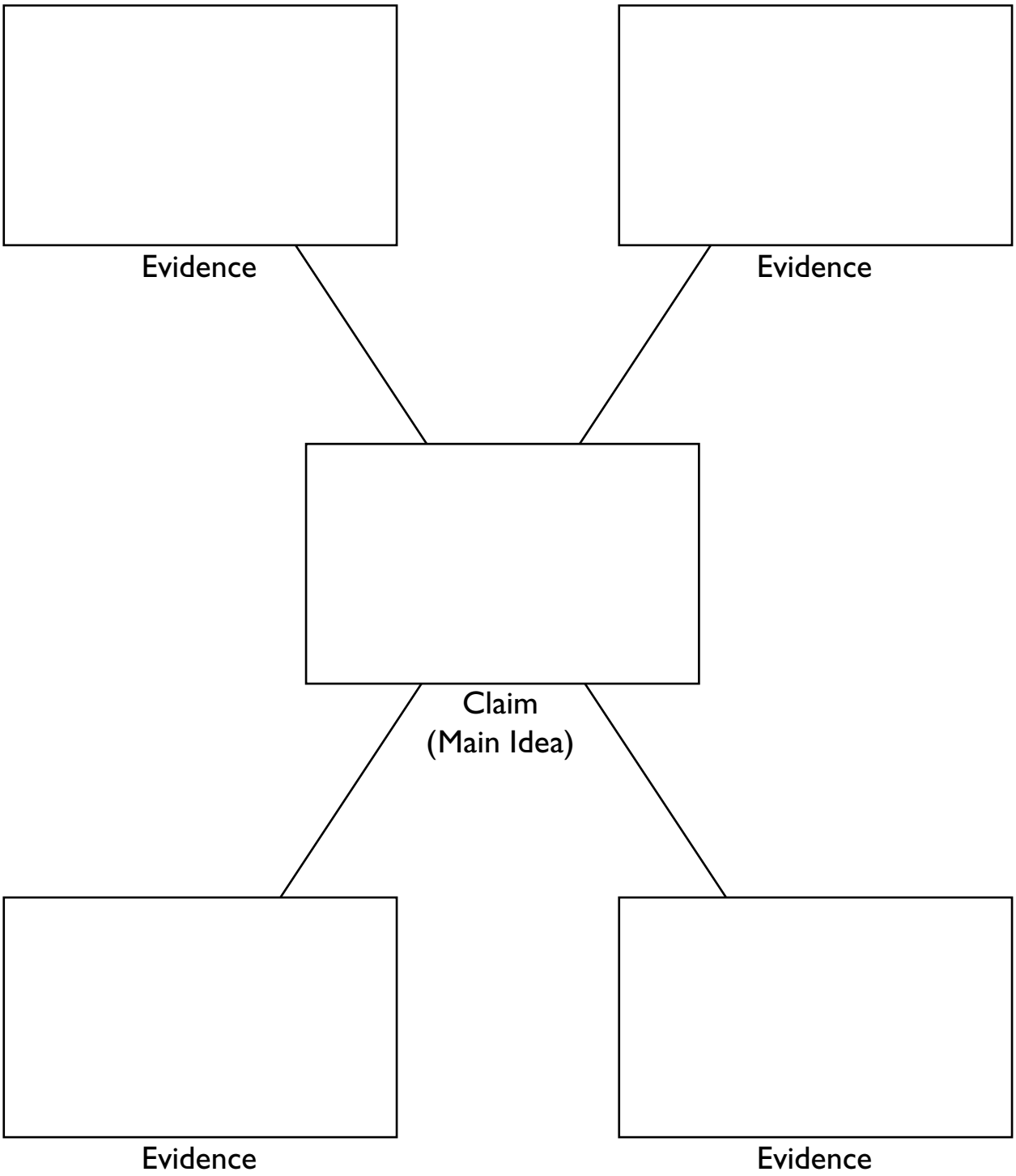
Pose a new question: "Do all materials transmit light?" Have students read *Light Strikes!* to gather evidence, and then write a claim to answer the question. Have partners share their claims and discuss how they arrived at them through considering the evidence.

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 3–4

Eighteen 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. Nine *Weather and Water* student books and strategy guides will be available in late 2009.

Digestion and Body Systems	
Strategy	**Student Book**
Analyzing Part-to-Whole Relationships	*Systems*
Teaching About the Nature and Practices of Science	*Secrets of the Stomach*
Teaching 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?*
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 and Practices of Science	*Evidence from the Past*
Light Energy	
Strategy	**Student Book**
Teaching About Idioms	*Can You See in the Dark?*
Teaching Summary Writing	*The Speed of Light*
Teaching About the Nature and Practices of Science	*Why Do Scientists Disagree?*
Using Discourse Routines with Science Texts	*I See What You Mean*
Searching for Information in Science Texts	*Handbook of Light Interactions*
Teaching Scientific Explanation Writing	*Light Strikes!*
Teaching Vocabulary with Science Texts	*Cameras, Eyes, and Glasses*
Teaching Concept Mapping	*It's All Energy*
Interpreting Visual Representations	*Sunlight and Showers*

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**

***Light Energy* 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**.

1327057 ***Light Strikes!* Strategy Guide**

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Delta Education
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ISBN: 978-1-60395-946-9
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