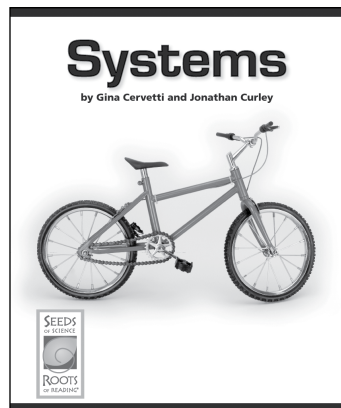


Analyzing Part-to-Whole Relationships

with *Systems*

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



Introduction

This strategy guide introduces an approach for teaching students how analyzing part-to-whole relationships enriches understanding of science texts. Part-to-whole relationships are particularly important for understanding systems, a foundational concept that spans many topics in science. This guide includes an introductory section about analyzing part-to-whole relationships, a description of how to teach this strategy with many science texts, and a plan for teaching students how to analyze part-to-whole relationships with the *Seeds of Science/Roots of Reading*[®] book *Systems*.

Book Summary

Systems uses familiar examples to show that systems are around us all the time. The example of a bicycle is used to illustrate how the parts of a system work together to perform particular functions. Several examples in the book are about the human body—how it can be seen as being made of parts (organs, such as the stomach) that make up systems (such as the digestive system) that are also part of a larger system (the human body). Throughout the book, labeled photographs, diagrams, and tables depict how a bicycle, the human body, or other systems are each groups of interacting parts that work together as a whole.

Science Background

A system can be defined as a group of parts that interact with one another. By thinking of something as a system, you can examine the interactions among parts and better understand how they work together. There is a relationship between the structure and function of the parts of a system, as well as between the structure and function of the whole system. Identifying the structure and function of each part is a useful way to analyze how systems work. Another way to better understand a system is by changing one part and observing what happens. Some systems (such as a bicycle) are discrete objects, while others are collections of seemingly separate objects (such as the Solar System). What all systems have in common is that they are made of separate parts that work together in some way. If any one part stops working or is removed, that affects the entire system. Many systems are composed of smaller systems, or subsystems. A subsystem is made of components that work together; it is also an essential part of the larger system. For example, the components of a bicycle, such as the wheels and brakes, are individual systems. The bicycle's wheels and brakes are also subsystems whose combined functions contribute to the overall function of the entire bicycle.

About This Book

Reading Level

Guided Reading Level*: N

Key Vocabulary

function, interact, structure, system

Text Features

bold print, captions, diagrams, glossary, headings/subheadings, illustrations, labels, photographs, table of contents, tables

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

About Analyzing Part-to-Whole Relationships

Analyzing part-to-whole relationships is a foundational concept in science that helps students understand the ideas presented in many science texts. A group of parts that interact in a particular way is called a system (the whole). A system can be very large, such as a community, or very small, such as an atom. Systems are made of systems within systems (called subsystems). Within a system, each part works together to perform a specific function. These parts also contribute to the function of the whole system. Determining how parts function in relation to the whole prompts students to think analytically. This is an important element of understanding the natural and social world.

Analyzing Part-to-Whole Relationships

The following guidelines can be used to teach students how to analyze part-to-whole relationships in many content-rich texts.

- Select an engaging book or article that illustrates how the parts of a system work together. Good choices in science include texts about the physical structures of humans or other organisms, the weather, the Solar System, or ecosystems.
- Explain to students that a system is made of different parts that work together for a specific purpose.
- Use a chair as an example to spark students' thinking about the idea of systems. Have students identify the parts of a chair. [Legs, seat, arms, back.] Explain that each part has a purpose that contributes to the function of the whole. [Provides a place to sit.]
- Explain that a chair is a system made of several parts and that a chair is also a part of an even bigger system—the furniture in the classroom. Have students brainstorm about other parts that belong to the classroom furniture system. [Desks, bookshelves, tables.]
- Using the Classroom System diagram at the top of this page as a guide, create a blank triangle diagram on the board. Explain that the triangle

Classroom System

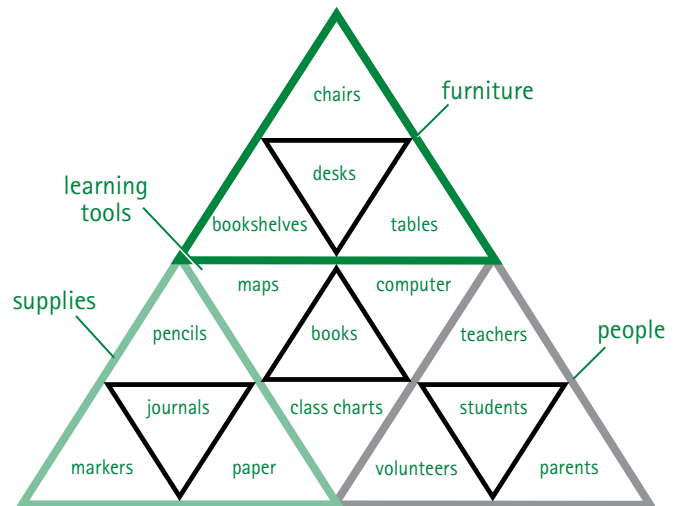
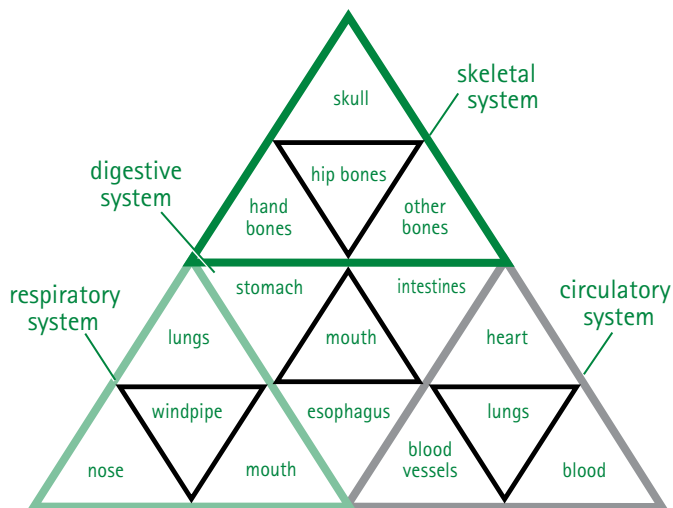


diagram will help students think about the relationships among the parts in a system. Each part is represented by one individual triangle.

- Write “chairs” in the individual triangle at the top of the main triangle. Then, in the three individual triangles below, add the classroom furniture that students brainstormed. Outline the subset of four triangles and label the subsystem to which they belong “furniture.”
- Say that the furniture subsystem is part of an even larger system—the whole classroom. Ask students to share other subsystems that make up the larger classroom system. [Supplies, learning tools, people.] With students' help, fill in the parts of each subsystem.
- Use the book you have selected to build on the classroom system example and expand students' thinking about systems. Have students read the book you selected and identify a system in the book to analyze.
- After reading, have students discuss the parts of the system they read about. You may want to use the Parts and Wholes copymaster included with this guide for students to record the parts of the system. Ask students to discuss the relationship between the parts of the system and the whole. Focus on how thinking about systems helped students understand the text.
- Use this strategy to support students' understanding of systems in other content areas. For example, triangle diagrams can be used to show relationships in social studies (e.g., government and court systems).

Human Body System



Analyzing Part-to-Whole Relationships with Systems

Getting Ready

1. Make a copy of the Parts and Wholes copymaster for each student.
2. Using the copymaster as a guide, create a blank triangle diagram on the board.

During Class

1. Introduce the book *Systems*. Tell the class that this book is about several different systems made of various parts that work together for a specific purpose.
2. Read *Systems* in a way that is consistent with your classroom routines, giving students as much independence as possible.
3. Discuss the content of the book. Emphasize that a system is a group of parts that interact, or work together, to carry out a specific purpose or function. Have students share examples of systems from the book. [Bicycle, person, guitar, dishwasher, watering system, garden, Solar System, pages 20–23.] Choose one example and discuss how the different parts of the system interact.
4. Explain that a triangle diagram shows the relationships among the parts and the whole in a system. Each part is represented by an individual triangle.
5. Model how to complete a triangle diagram by using the human body example on page 19.

Ask students to share parts that make up the body's skeleton. [Skull, hand bones, hip bones, other bones.] List these parts in individual triangles.

6. Label this group of four triangles "skeletal system." Make sure students understand that the parts in the four individual triangles make up a system. Point out that the skeletal system is a subsystem of the human body, which is a larger system.
7. Use the triangle diagram on the board to analyze other body systems and their parts. Encourage students to think about the way blood moves around the body, the system involved with eating and digesting food, and the system that allows us to breathe. Organize the parts that belong to each of these subsystems into the individual triangles. (Use the triangle diagram on this page as a guide.)
8. Have students work with a partner to identify a system in the book they can analyze (e.g., bicycle, dishwasher, garden, guitar). Have them find this system in the book and use the photographs to help them brainstorm the parts of this system.
9. Distribute a Parts and Wholes student sheet to each student. Ask students to show the relationships among the parts of the system they have chosen and the whole system. Encourage them to refer back to the book as needed. If appropriate, encourage students to group parts into subsystems within the larger diagram.
10. Conduct a whole-class discussion about parts and wholes using the systems students selected from the book. Ask the following questions: "What parts make up the whole?" "How does each part function?" "What is the function of the whole system?" "How do the parts help the system function?"

Independent Extension

Write the following questions on the board: "What would happen if one part of the system were missing?" "Would the system still function? Why or why not?" Have students either discuss these questions with a partner or respond to them in writing using the triangle diagram they filled in on their student sheets.

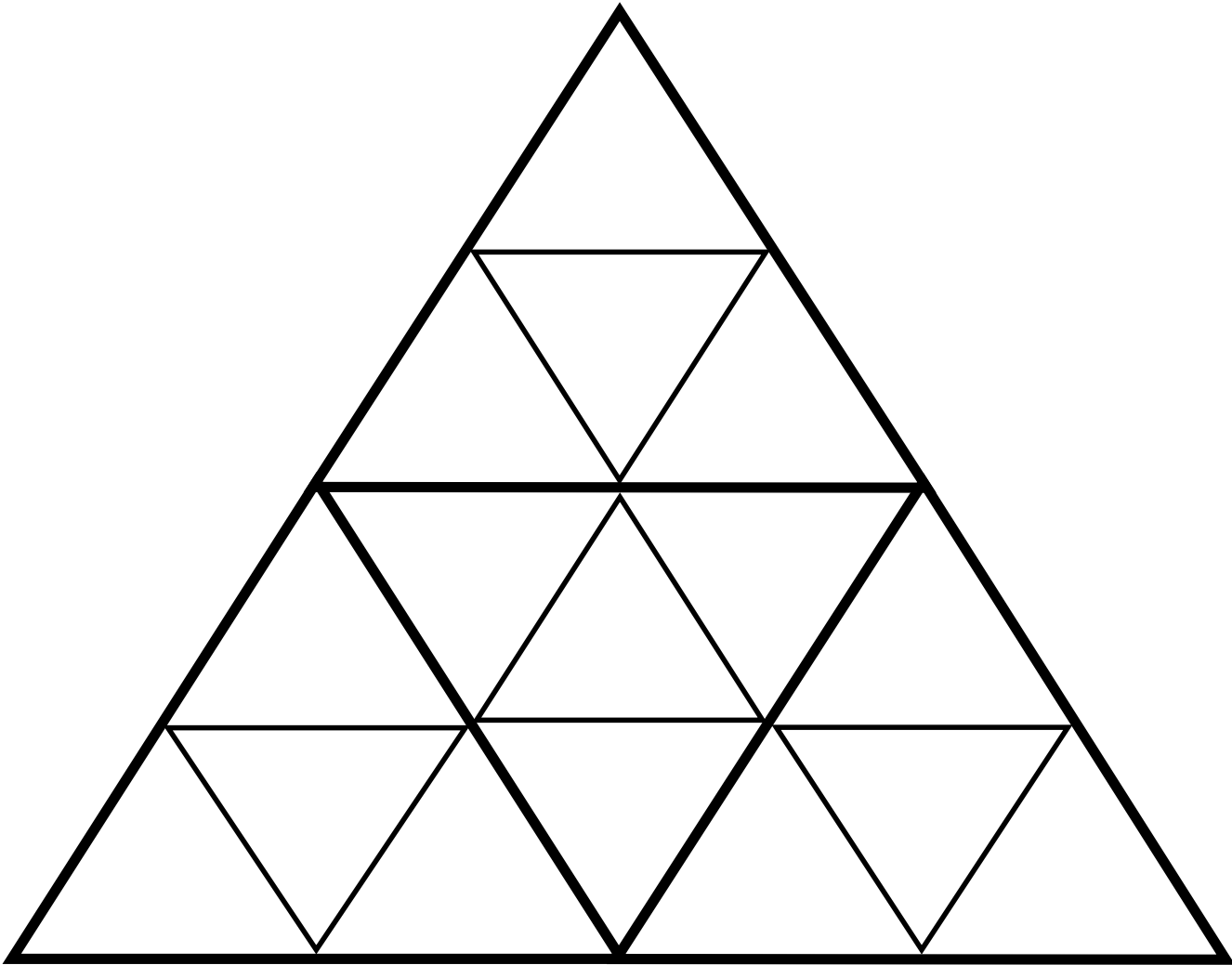
Name _____

Date _____

Parts and Wholes

Title of book: _____

(name of system)



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

Nine engaging student books are now available from *Digestion and Body Systems* and *Variation and Adaptation*, 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 3–4 units (*Weather and Water* and *Light Energy*) are currently in development and will be available in late 2009.

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



Variation and Adaptation 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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