Knowing Science

3-DIMENSIONAL TEACHING & LEARNING

GRADE 4

Literacy Guide

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Literacy Guide

Written by

Jennifer Baxter

Lesley Quattrone

Editors

Dario Capasso, Ph.D.

Sarah McGinnis

Knowing Science, LLC - Armonk, NY USA
www.knowingscience.com

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Introduction

Introduction to the *Knowing Science*® Literacy Guide

Elementary science instruction today features teachers introducing students to the investigative practices of "real" scientists to answer their questions about the natural world. Why do objects move or stop moving? Why do earthquakes happen? Why do baby mammals look like smaller versions of their parents?

When students generate inquiries about the natural world, they embark on a journey to find the answers. They make observations, read books, or search the Internet for relevant information. They plan investigations, make predictions, and suggest answers. They perform experiments, accumulate and analyze data, and communicate their findings to others orally and/or in writing. Introducing students to these genuine scientific procedures during their formative years encourages critical thinking and excitement about science.

Evidence suggests that children learn science best in the context of an interdisciplinary approach. It is clear that mathematics and science are inextricably linked, but the important role literacy plays in the study of science has received less attention. When children engage in science content as one of the contexts for developing literacy skills, they not only become well informed about science; they also develop proficient reading, writing, and speaking skills. Student scientists, just like professional scientists, must possess good reading and communication skills in order to conduct research and share the results effectively.

The *Knowing Science* program employs both fiction and nonfiction to assist in developing students' understanding of science. Most young children have a strong concept of story. In kindergarten, children's literature (which sometimes adds fact to fiction) motivates students to follow a story line and at the same time acquire important information and concepts. In first and second grade, fiction still plays a role in understanding science concepts, but nonfiction science trade books (NOT textbooks) assume growing importance as sources of accurate information about various topics. Nonfiction titles help students learn facts about a topic through text, photographs, charts, maps, and the visual presentation of data.

Integrating literacy—reading, writing, and speaking—into the study of science is one of the strengths of the *Knowing Science* program. For those seeking to incorporate literacy into the teaching of science, the *Knowing Science Literacy Guide* suggests how to embed literacy into the content of *Knowing Science* units.

Using the Knowing Science® Literacy Guide

For Grades 4 and 5, selected lessons in the *Knowing Science* Teacher's Manual have corresponding literature recommendations in the *Knowing Science* Literacy Guide. Each unit includes a list of recommended titles, as well as their authors and Lexile ratings. A brief synopsis for each book is included to help you determine how to incorporate the books into the science lessons.

Tips & Tricks: Integrating Science with Literacy

There are many good reasons to include science literature as part of a balanced literacy program. The most important reason is that to teach science well, *science must be done and not just read about*. Effective science teaching requires students to actively engage in experiences that are relevant and applicable to their daily lives.

Reading and responding to quality science literature supports science learning. It leads to better comprehension and retention of science concepts. Students are able to transfer topic-specific information from one instructional setting to another (from science to literacy and literacy to science). Additionally, skills needed for understanding and responding to science texts (or any informational text) are applicable to other subject areas and not limited to use only during literacy time.

Comprehension skills required to read informational text are different from the skills required to read narrative text. This is because informational text tends to include many details in a small amount of writing, both at the sentence level and at the paragraph level. Therefore, to understand the author's message, informational text needs to be read more slowly. Repeated readings may be necessary in order to fully extract the meaning from the text.

Students benefit from actively reading nonfiction text. This requires frequent stops to ask questions (*What did I just read? What details were included? What do I want to know more about?*) and to react (*Wow – that just got my attention!*). Active reading also involves making connections – to self and personal experiences; to other texts, movies, or videos on the same topic; and to events in the world.

Text features may give as much if not more information than written text. If informational reading is new to students, they may have seen text features before but may not know why or how they are used. Arranging a "text feature hunt" is an easy way to introduce students to features such as:

- Table of contents, glossary, index
- Main heading (title) and subheadings or chapter titles
- Special print: **boldface**, *italics*, or highlighted
- Bulleted lists of information
- Diagrams: illustrations labeled to show parts
- Captions: usually a sentence or two that describes an image
- Text box, inset box, or call out: to define vocabulary or "fun facts"
- Illustrations such as photographs and drawings
- Other graphics: graphs, charts, tables, maps, timelines, Venn diagrams

Informational text is organized differently from narrative text. It may be structured in any of several ways, depending on the author's purpose. Here is a

list of text structures, along with uses and examples of signal words featured in each type of text:

Description	Uses topic-specific vocabulary and details to create a mental image for the reader *first of all; an example is; such as; also*
Comparison	Discusses similarities and differences between two objects or ideas *same; both; different; unlike; similar to; also*
Sequence, Order, or Procedural	List of events that have occurred or should occur in a set order *first; next; then; last; finally; after that; before that; numbered list*
Cause and Effect (Before and After)	What causes an event and the resulting change *because of; before; after; since; as a result of; however*
Problem and Solution	A problem or task to be solved is described along with possible solutions *problem; task; issue; answer; possible; solution; try*
Fact and Opinion	The author states a claim and then gives detailed reasons to support the claim *one reason is; another reason is; finally*

When writing responses to informational text, have students answer questions in complete sentences, using topic-specific vocabulary from the question. This strategy is sometimes referred to as "TTQA" or **T**urn **T**he **Q**uestion **A**round. For example:

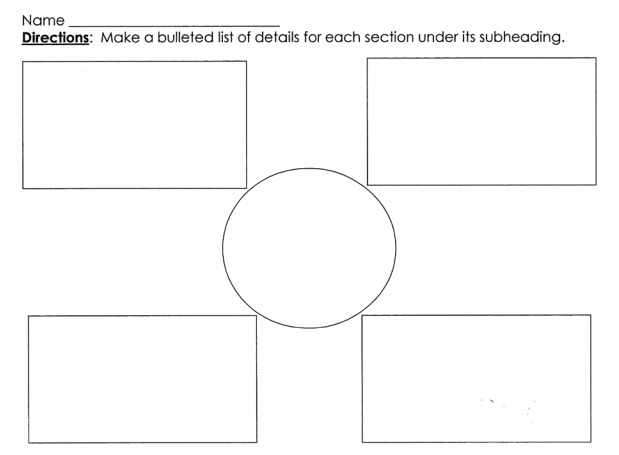
Question: How do *all food chains begin*?
Answer: *All food chains begin* with energy from the Sun.

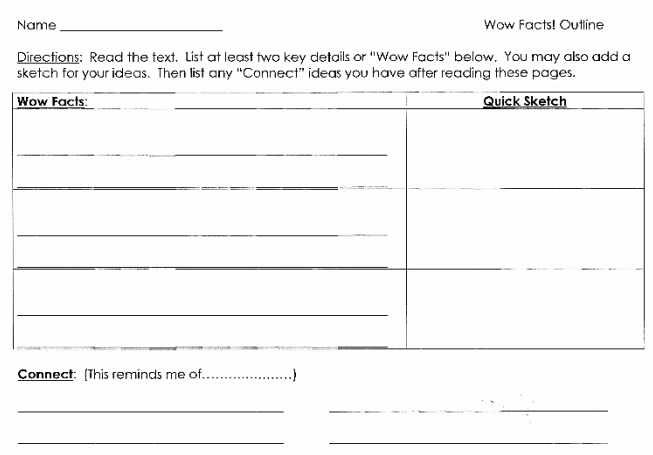
Written responses should mirror the specific type of text structure (description, comparison, procedural, cause/effect, problem/solution or fact/opinion). Responses should include signal words that are characteristic to each type of text. For example:

Question: How are solids *different* than liquids?
Answer: Solids have their own shape, *but* liquids take the shape of their container. They *both* take up space and have mass.

Guided reading groups may take several forms, depending on the needs of your specific class and available resources. One approach is using *leveled readers*. When using leveled readers, the books will all cover the same topic but will be at

different reading levels. Questions written specifically for each title may be used. If that is not possible, use a generalized graphic organizer for each title, such as the ones shown below:


Name _____
Directions: Make a bulleted list of details for each section under its subheading.


Name _____ Wow Facts! Outline

Directions: Read the text. List at least two key details or "Wow Facts" below. You may also add a sketch for your ideas. Then list any "Connect" ideas you have after reading these pages.

Wow Facts:	Quick Sketch

Connect: (This reminds me of.....)

Another approach is to use the *same book* and same set of questions. Different levels of support can be provided for each ability group. One group will need little support, one will need moderate support, and one will need a greater amount of direct support and instruction. Questions may be modified as needed to meet the needs of each group. The number of questions and required length of responses may be adjusted for each ability level. Challenge or bonus questions may be provided for groups or individuals that finish early.

A third approach is *parallel reading*. Each group reads a different subtopic of a main idea or topic. For example, when studying natural disasters, one group might read about volcanoes, another about earthquakes, and a third about tsunamis. A general graphic organizer or parallel questions may be used. Parallel questions ask for the same information, but specific answers vary. For example:

- What causes the natural disaster?
- What happens to surrounding areas during the disaster?

Integrating science literature into a balanced literacy program benefits students in many ways. It promotes better retention of knowledge, and it encourages development and transference of skills across subject areas. Any time a student finds a connection between multiple segments of learning, the result is always a better-quality learning experience.

PHYSICAL SCIENCE

UNIT 1: ENERGY

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.2 Energy and Motion	***Energy Makes Things Happen***	Kimberly Brubaker Bradley	AD 500L
	Energy on Earth	Rebecca Motil / Newbridge Educational	880L (GRL T)
1.4 Producing Electrical Energy	***Electricity: Bulbs, Batteries, and Sparks***	Darlene R. Stille	IG 650L
	Bridging the Energy Gap	Andrew Langley	NC 770L
	Endangered Energy	Rani Iyer	860L
	Going Green	David Armentrout	940L
	Electricity	Richard Spilsbury, Louise Spilsbury	1050L
	Let's Think About Sustainable Energy	Vic Parker	1080L

SYNOPSES

Energy Makes Things Happen
Kimberly Brubaker Bradley

Did you know that energy comes from the food you eat? From the sun and wind? From fuel and heat?

You get energy every time you eat. You transfer energy to other things every time you play baseball. In this book, you can find out all the ways you and everyone on earth need energy to make things happen.

Energy on Earth
Rebecca Motil / Newbridge Educational

Explore the sources, forms and uses of energy in our world. Students will learn about the different forms of energy, how energy can be converted from one type to another, how energy can be measured, and how it can be conserved.

Electricity: Bulbs, Batteries, and Sparks
Darlene R. Stille

Find out how electricity and power work. Learn more about electric currents and circuits, and nature's role in generating power.

Bridging the Energy Gap
Andrew Langley

This book shows how we are too reliant on a finite resource, fossil fuels, for our energy and to make many of the products we use. What are the alternatives, and will they be able to meet future demand?

Endangered Energy: Investigating the Scarcity of Fossil Fuels
Rani Iyer

Fossil Fuels are an important part of the Earth. Humans have come to rely on them as a source of energy. What exactly are fossil fuels? How does our dependence on them harm the environment? What are alternate sources of energy and how do we reverse the damage we've already done? Endangered Energy answers these questions by engaging readers with lively text, graphic features, and stunning photography. Readers will discover why fossil fuels matter to them and the part they play in protecting them.

Going Green
David Armentrout

Eco-friendly energy is explained. The most current information is provided while establishing the understanding that it does not take much to make the world a better place.

Electricity
Richard Spilsbury, Louise Spilsbury

We depend on electricity in nearly every facet of our daily lives. But what exactly is electricity, how do we generate it, and how can we use it? This book explores the phenomenon that keeps the modern world up and running.

Let's Think About Sustainable Energy
Vic Parker

This book helps children to develop critical thinking and debating skills. It examines the topic of sustainable energy in a lively and accessible way. Information is presented to help readers deliberate, debate, and decide for themselves. The book looks at the importance of sustainable energy, the pros and cons of different methods, and how sustainable energy is likely to develop in the future.

UNIT 2: WAVES

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by brief synopses for each book, to help you gauge how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
2.1 Amplitude and Wavelength	***What Are Waves?***	Heather Hudak	770L
	The Science of Sound Waves	Robin Johnson	800L
2.2 How We See	***The Science of Light Waves***	Robin Johnson	810L
2.3 Using Waves to Transfer Information	***Waves and Information Transfer***	Heather Hudak	850L

SYNOPSES

What Are Waves?
Heather Hudak

This exciting title introduces readers to the concept of a wave and the patterns and properties common to both light and sound waves. Clear text and detailed diagrams combine to demonstrate the cause-and-effect relationships involved in the properties of amplitude, wavelength, and frequency. A link to interactive activities online plus an activity in the book allow readers to explore key concepts close up by creating their own wave models.

The Science of Sound Waves
Robin Johnson

This engaging book describes the properties of sound waves, how they move, and the way our ears catch them. Readers will learn how sound waves travel through different mediums and be amazed by the different ways sound waves are used in real life, such as for communication with animals and deep-sea exploration. A link to interactive activities online plus an activity in the book allow readers to experiment with sound waves to achieve different sounds.

The Science of Light Waves
Robin Johnson

This engaging book describes the properties of light waves, how they move, and the way our eyes receive them. Readers will learn that we see an object when light reflects from its surface and into the eye. A link to interactive activities online plus an activity in the book allow readers to create models that explore how to redirect and block the path a light wave travels.

Waves and Information Transfer
Heather Hudak

In this fascinating title, readers explore how light and sound waves transfer information. From telescopes that extend our sense of sight to satellites that help us communicate across large distances, patterns of waves transfer information in many ways. A link to interactive activities online plus an activity in the book allow readers to use what they have learned about waves to engineer wave patterns that communicate across distances.

LIFE SCIENCE

UNIT 1: STRUCTURE AND FUNCTION

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 Animal Classification	***What is the Animal Kingdom?***	Bobbie Kalman	770L GRL O
1.2 Physical Structures, Survival, and Crayfish	***The Life Cycle of a Crayfish***	Bobbie Kalman/ Rebecca Sjonger	860L GRL N
1.3 Plant Structures and Survival	***The ABCs of Plants***	Bobbie Kalman	610L GRL N
1.4 Plant and Animal Seasonal Responses	***What is Hibernation?*** ***What is Migration?***	John Crossingham Bobbie Kalman John Crossingham Bobbie Kalman	920L GRL O 890L GRL O

SYNOPSES

What is the Animal Kingdom?
Bobbie Kalman

All creatures, including insects, mammals, and fish, are classified and described from simple animals like sponges to the larger brained mammals such as humans. Young readers will learn:
- all the basics of kingdoms and species that form an important foundation for the study of biology
- the threat to habitats by illegal hunting, human development, and pollution
- how readers can help prevent their destruction

The Life Cycle of a Crayfish
Bobbie Kalman

Crayfish can be found in rivers and streams across North America, yet relatively little has been written about them. The Life Cycle of a Crayfish provides children with a wealth of information about this interesting animal, such as where it lives and how it reproduces. Other topics include
• the different species of crayfish
• the different stages of a crayfish's life
• how a mother crayfish cares for her eggs
• how crayfish find food and defend themselves

The ABCs of Plants
Bobbie Kalman

Children will love learning about plants and plant parts. Beautiful photographs and artwork in this spectacular ABC book help teach children to identify various plants and find similar examples in their own communities.

What is Hibernation?
John Crossingham and Bobbie Kalman

Hibernation is one of nature's greatest miracles, allowing animals to sleep through periods of extreme cold (and heat). From the tundra to the desert, this ability enables animals to live in some of Earth's harshest climates. Full-color photographs and vivid text combine to give children a view of the many different ways that animals "sleep it off." Highlights include:
• how an animal's body uses fat to survive and even wake itself up
• how an animal finds and prepares its den for hibernation
• animals that estivate, or hibernate to escape heat
• animals that give birth and care for their young during hibernation

What is Migration?
John Crossingham and Bobbie Kalman

When most people think of migration, they think of birds flying south to escape the cold winter—but many other animals migrate for many different reasons. From whales and deer to butterflies and eels, animals migrate to breed, feed, stay warm, find water, and even fall asleep! In each case, animals follow paths that have been passed on for generations helping their species survive. Children will be amazed by:
• the Arctic tern—a bird that travels from the Arctic to Antarctic
• the journey of the salmon, swimming against river currents to lay its eggs
• the lemming, whose mass migration can include thousands of animals
• the Canada goose, whose unique "V" flight pattern makes the trip easier

EARTH AND SPACE SCIENCE

UNIT 1: EARTH'S LAYERS

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 Earth's Layers	***The Restless Earth***	Melvin Berger	900L GRL T
1.2 Pangaea	***Fossils***	Richard and Louise Spilsbury	1030L GRL T
1.3 Soil	***Soil***	Richard and Louise Spilsbury	1030L GRL S
1.4 Weathering and Erosion	***Erosion: Changing Earth's Surface***	Robin Koontz	620L GRL N
1.5 Earth Features	***Mapping the Land and Weather***	Melanie Waldron	860L GRL O
1.6 Natural Disasters	***Anatomy of a Volcanic Eruption***	Richard and Louise Spilsbury	690L GRL T
	Sweeping Tsunamis	Richard and Louise Spilsbury	1030L GRL Q
	Violent Volcanoes	Richard and Louise Spilsbury	930L GRL Q
	Shattering Earthquakes	Richard and Louise Spilsbury	930L GRL Q

SYNOPSES

The Restless Earth
Melvin Berger

Here is an exciting introduction to volcanoes, earthquakes, glaciers, wind, water, and other forces that leave their marks on our planet.

Fossils
Richard and Louise Spilsbury

Fossils looks at how fossils can form, are preserved, and sometimes discovered.

Soil
Richard and Louise Spilsbury

Soil looks at how different types of soil form, change, erode, and are used around the world.

Erosion: Changing Earth's Surface
Robin Koontz

Did you know that rain, waves, wind, snow, and ice can change the shape of Earth's surface? They can create valleys, sea stacks, caves, and rock arches. Learn about the natural forces of erosion and how they shape the land.

Mapping the Land and Weather
Melanie Waldron

Maps are essential tools for understanding the world around us. Learning to read maps - both printed and online - is a core skill that forms the basis of social studies. This book explores the different ways that maps can be used to show natural features and processes.

Anatomy of a Volcanic Eruption
Amie Jane Leavitt

As destroyers of cities and creators of islands, volcanoes are as unique as they are destructive. Whether they spew thick ash or pack heavy lava flows, their eruptions are always a force to be reckoned with. Explore the explosive workings of volcanoes, the techniques scientists use to study them, and how people live in the shadows of these explosive landforms.

Sweeping Tsunamis
Richard and Louise Spilsbury

Volcanic eruptions, landslides, and underwater earthquakes can all cause tsunamis, deadly waves that can go unnoticed in the open water until the waves get close to shore. In this book that discusses the causes of tsunamis, you'll also learn how tsunamis are formed, what type of damage they do, and where some of the worst tsunamis in history occurred.

Violent Volcanoes
Richard and Louise Spilsbury

Awesome and powerful, volcanic eruptions have wiped out towns and civilizations throughout history. Learn what causes volcanic eruptions and how scientists monitor these amazing events in order to warn people before disaster strikes.

Shattering Earthquakes
Richard and Louise Spilsbury

Scientists estimate that each year there are several million earthquakes throughout the world. Some are so small that they are never detected. Others are so large that they set off a chain of aftershocks and tsunamis. Read about these terrifying events to learn what causes them and how scientists detect them.