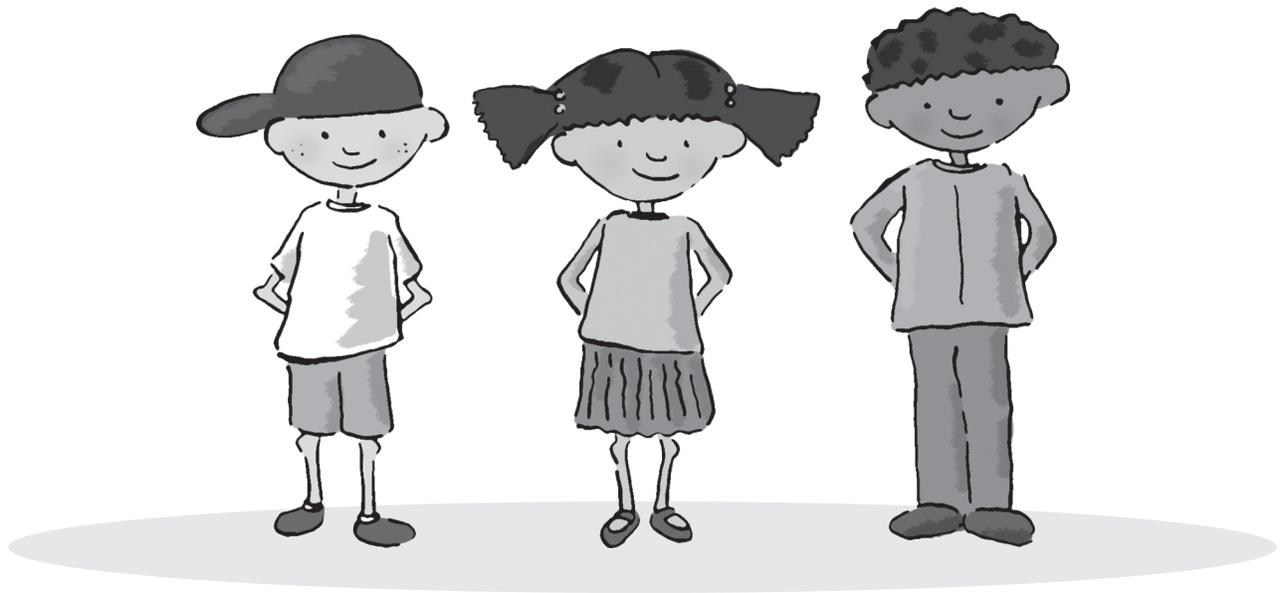


Elementary GLOBE



Teacher Implementation Guide

An overview of the resources and background necessary to implement
Elementary GLOBE in K-4 classrooms

Becca Hatheway and Lisa S. Gardiner



www.globe.gov/elementaryglobe



About Elementary GLOBE

Elementary GLOBE was designed to help elementary teachers (i.e., grades K-4) integrate Earth system science topics into their curriculum as they teach literacy skills to students. This suite of instructional materials includes seven modules. Each module contains a science-based storybook and learning activities that support the science content addressed in the storybooks. The seven science content feature topics include air quality and the colors of the sky, climate, clouds, Earth as a system, seasonal change, soil, and surface water in rivers and streams.

Storybooks:

Elementary GLOBE Modules

Air Quality	Earth System
Climate	Seasons
Clouds	Soil
	Water

Each *Elementary GLOBE* storybook is a fictional story about characters that explore an aspect of Earth system science in a location where they can make observations of the environment.

Characters: Each storybook features the “GLOBE Kids” as they explore and investigate the natural world. These characters, Anita, Simon, and Dennis, have traits that students can relate to when they are reading the books in the *Elementary GLOBE* series. The three GLOBE Kids have different personalities and strengths, and each brings diverse and valuable skills and interests to their science investigations.

Location: The stories are set in North American ecosystems. Most of the books aren't set in a specific location, though *The Mystery of the Missing Hummingbirds* storybook is set in Pennsylvania, providing an accurate location for the ruby-throated hummingbird habitat. *What in the World Is Happening to Our Climate?* is set in the Boston area before the characters depart on their worldwide adventure. The soil types in *The Scoop on Soils* are representative of those found in pine forests, meadows, and gardens in the Mid-Atlantic states

Learning Activities:

Each storybook typically has three companion learning activities that further explore the science content while helping students develop science and engineering practices. The materials necessary to conduct these learning activities are inexpensive and easy to find. All of the learning activities have been field tested in classrooms across the United States.

Teacher's Notes and Glossary:

Teacher's Notes and a Glossary are included in the back of each storybook. The Teacher's Notes provide basic science background information pertaining to each storybook topic. Teachers are strongly encouraged to read the Teacher's Notes prior to using the materials in their classroom. The Glossary in each book is designed to help teachers explain terms in the story narratives to their students. Each learning activity also contains Teacher's Notes that teachers should read before doing the activity with students.

Using Elementary GLOBE with Different Grade Levels:

There is a wide range in both the cognitive development and the skills and abilities of students in the K-4 age range. Kindergarten and 1st grade teachers will use *Elementary GLOBE* very differently than will those teaching 3rd and 4th grade. *Elementary GLOBE* learning activities contain suggestions, where possible, about how to implement with students at different grade levels. Each of the storybooks and learning activities were field tested and reviewed by teachers in the K-4 grade span. Much of the information contained in the Teacher's Implementation Guide is based on feedback and input from these teachers.

About this Guide

The *Elementary GLOBE* Teacher's Implementation Guide includes an overview of the resources and background necessary to implement *Elementary GLOBE* in K-4 classrooms including overviews/discussion of:

- Connections to Literacy
- The Importance of Science Journals
- Science Inquiry in the Elementary Classroom
- Connections to Other Areas of the Curriculum
- Classroom Implementation
- Appendix A: An Overview of *Elementary GLOBE* Materials
- Appendix B: Alignment with Educational Standards



Elementary GLOBE: Correlations to Education Standards

The *Elementary GLOBE* materials have been correlated to the Next Generation Science Standards, National Geography Standards, Common Core Mathematics, and Common Core English Language Arts. Appendix B lists these correlations. Note that Appendix B lists only the standards that are addressed by *Elementary GLOBE* learning materials. Depending on your district or state requirements, you may want to correlate the *Elementary GLOBE* materials to your own grade-level standards, including science, math, geography, and literacy.

Connections to Literacy

Literacy is the ability to read and write at a specified age. In addition to literacy skills, *Elementary GLOBE* also helps young students learn how to do science and learn science content using the storybooks as supporting content for the hands-on activities. The storybooks and learning activities include interdisciplinary materials that facilitate reading, writing, and science content comprehension.

Below are descriptions of practices that field-test teachers and consultants working on the project identified as helpful for teachers implementing *Elementary GLOBE*. Teacher expertise in language arts instruction, and their ability to make connections between *Elementary GLOBE* materials and other language arts resources, are important tools for ensuring that literacy connections are strong.

Science and Literacy

Science and literacy complement each other well in K-4 classrooms. For example, the skills that students utilize in an inquiry-based science program and the skills that students utilize for literacy activities are remarkably similar (Thier, 2002). Behaviors and skills for students in both science and language arts include the ability to:

- note details
- compare and contrast
- predict
- sequence events

- link cause and effect
- distinguish fact from opinions
- link words with precise meanings
- make inferences
- draw conclusions

Additionally, we know that students are better able to develop reading, writing, and communication skills when the content is relevant to their lives. Science can strengthen literacy skills by providing meaning and context. Literacy skills strengthen science learning by providing students the means to focus and clarify their ideas, conclusions, inferences, and procedures. *Elementary GLOBE* connects science content with language arts and can provide the opportunity for students to further their literacy skills while learning ideas about science.

The *Elementary GLOBE* storybooks are not intended to be science textbooks or nonfiction instructional readers. They combine engaging fictional stories with real science content featuring three elementary-aged children who investigate aspects of their environment. The GLOBE Kids (Anita, Simon, and Dennis) model science inquiry skills by posing questions, making observations, collecting data, collaborating, and coming to conclusions. They read, write, record, and orally communicate during the course of their investigations. In short, students will explore the natural world with Simon, Dennis, and Anita while enhancing their literacy skills.

Vocabulary Development

The *Elementary GLOBE* storybooks and learning activities can help students develop both receptive vocabulary (words that they can understand when read or heard) and expressive vocabulary (words that they can use themselves). At the primary level, it is appropriate to read the books out loud to students, taking the time to discuss the new vocabulary words in a context that makes them understandable. Based on recommendations from *Elementary GLOBE* field testers, certain higher-level vocabulary words were included to stretch the vocabulary provided, helping students learn the meaning of words that enrich their scientific knowledge. The illustrations in *Elementary GLOBE* storybooks help students visualize new information being presented through colorful depictions of the GLOBE Kids doing science.



The following strategies can be useful in developing students' vocabulary:

- **Word Wall/Anchor Charts:** Before reading the *Elementary GLOBE* storybooks or working through one of the learning activities with students, list key vocabulary words on the board or on a piece of chart paper. Introduce these words to students, using a student-friendly definition and sharing an illustration of the word with these vocabulary words that aid in direct vocabulary instruction (Marzano, 2004). When reviewing the words on the chart, provide a description, explanation, or example of the terms and have students use their science journal to describe the meaning of the terms in their own words and pictures. Encourage students to refer to this word wall or anchor chart when they read the storybooks, write in their journals, or record information on the Student Activity Sheets. Through the learning activities, students will have opportunities to discuss terms with one another and use the terms in context.
- **Instructional Read-Aloud:** Doing an instructional read-aloud allows teachers to model reading strategies that will help students develop a deeper



understanding of the big ideas being presented in the story. Students benefit from being involved in vocabulary review, interactive “turn and talk” discussions with peers, intentional questioning about big ideas from the teacher, listening to their teacher “think aloud” when using reading strategies and making connections, as well as using oral communication in listening and verbalizing their

thoughts to others. The following easy-to-follow sequence can be used as a template for planning an instructional read-aloud:

1. Pre-read the book.
2. Highlight vocabulary chosen for instruction.
3. Determine the big idea(s) to emphasize for deeper meaning.
4. Select illustrations for more observation time to enhance the understanding of concepts.
5. Develop open-ended questions that will support discussion toward the understanding of big ideas.
6. Decide when to engage students in “turn and talks” to support thoughtful discussion (making sure that the flow of the book is still kept intact).
7. Model your thoughts. For example, using sentences that begin:
 - “This part reminds me of when...”
 - “I noticed that...”
 - “I was wondering about _____, but now I understand _____.”
8. After reading the story, support deeper conversations in the direction of the big ideas by using the learning activities provided.

Story Sensemaking

Taking time to help students make sense of the story and its meaning, and to make connections between the story and their prior knowledge is an important part of reading comprehension. The storybooks provide opportunities for improvement in understanding, remembering, and communicating to others the content of the storybooks.

After reading the storybooks, students will be able to make several different kinds of connections:

- **Text-to-Self Connections** occur when readers link the text to their past experience or background knowledge.
- **Text-to-Text Connections** occur when readers recognize connections from one book to another. After reading more than one of the storybooks, students might be able to identify an action or event from a previous *Elementary GLOBE* storybook that relates to the current book. In addition, students can make a connection between one of the storybooks and another book about the same subject. Ask students specific questions that will help them make these connections.



- **Text-to-World Connections** occur when readers connect the text to events or issues in the real world. Because the *Elementary GLOBE* storybooks are based on realistic science content, connections can be made between the storybooks and students' local environment (e.g., animal migration, seasonal changes, clouds, etc.).



The Importance of Science Journals

In *Elementary GLOBE* storybooks, kids write and draw in their science journals as they investigate the world around them. This is a model for how elementary students can use science journals as they make observations of the natural world. Keeping a science journal provides a place for students to record information and helps focus observations of nature. Student journals allow for literacy connections in science curriculum by encouraging students to write and draw as a means of communicating their thoughts and observations.

The Student Activity Sheets found in the *Elementary GLOBE* learning activities are designed to guide and focus student observations of the different parts of the Earth system, while also helping students build skills by documenting science observations. Student Activity Sheets can be used individually or made into a notebook or journal. With more advanced students, these activity sheets can be added to a journal with blank pages where students have space to record additional information in a more freeform way.

Using a journal to describe observations of nature can help children feel more a part of the world (Leslie, 2010). It is important to note that it isn't necessary to visit a far-off wilderness area to make observations

of the Earth system. Observations of the changing seasons, clouds, and the colors of the sky can be made from a playground. Observations of soils can be made at the edge of the schoolyard, in a school garden, or soil can be brought to school from a nearby area. This variety of journaling can be combined with other existing strategies for using science notebooks and other graphic organizers such as foldables.

Helping students cultivate environmental observation skills is an important first step towards participating in the larger GLOBE Program. Collecting and reporting data about aspects of their local environment, creating research projects to help answer environmental questions, and comparing data with observations made by students all over the world are all part of the GLOBE Program. Some of the activities of the larger GLOBE Program (including science protocols and learning activities, which can be found at globe.gov) can be a good fit for elementary students, such as making daily air temperature measurements, identifying clouds, and documenting the timing of spring budburst or the change in leaf color in the fall.

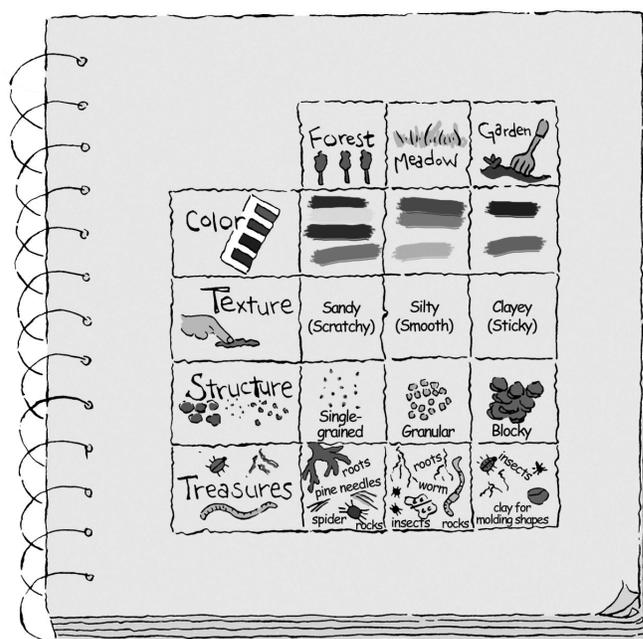


Figure 1. Example of a science journal page from *The Scoop on Soils*.



Science Inquiry in the Elementary School Classroom

Stories That Share How Kids Can Be Scientists

According to the National Research Council Framework (2012), in order for students to fully understand science concepts, they must engage in the practices of inquiry to gain experience with how science ideas are developed and refined. Essentially, when students have experiences being scientists they can better understand science content. The Science and Engineering Practices of the Next Generation Science Standards (NGSS) highlight ways students can experience being scientists (see Figure 2).

Elementary GLOBE storybooks, as fictional stories about real science, provide examples of how students can be scientists. Through the stories, the GLOBE Kids act like young scientists in order to better understand their world. Listed in Figure 2 are examples of how the NGSS

Science and Engineering Practices are addressed in the *Elementary GLOBE* storybook narratives. When reading a storybook, help your students make the connection between a practice used in the storybook and a recent classroom or local environmental example with which they are familiar.



Asking questions

In *What's Up in the Atmosphere: Exploring Colors in the Sky*, the kids discover that sometimes a cloudless sky looks white and other times it looks blue. Anita gushes to Ms. Patel, "Now we have a scientific question and we need your help!"

Developing and using models

In *What in the World is Happening to Our Climate?*, the kids refer to a model that they made in class to explore how ice melting in water (like sea ice) doesn't raise sea level while ice melting above the water does raise sea level.

Planning and carrying out investigations

In *Discoveries at Willow Creek*, the kids notice that the creek looks much different during their spring field trip than it did in the fall. They investigate, comparing their observations from the fall with observations from the spring.

Analyzing and interpreting data

In *The Scoop on Soils*, Simon makes a chart to compare observations of the soil (such as color, structure, roots, and critters) from the three holes that Scoop the dog dug in different environments.

Using mathematics and computational thinking

In *Discoveries at Willow Creek*, the kids make quantitative measurements to describe the creek. They take water temperature and measure the time it takes a stick to travel downstream in a segment of the creek.

Constructing explanations

In *The Mystery of the Missing Hummingbirds*, the kids look at charts of their observations and explain that the hummingbirds could stay in their location only at times of the year when they had enough food and shelter.

Engaging in argument from evidence

In *All About Earth: Our World on Stage*, during the class play, the kids each make a case for why their part of the Earth is most important and how it's connected in the Earth system.

Obtaining, evaluating, and communicating information

In *What in the World is Happening to Our Climate?*, kids attending the virtual science fair where they present what they've learned about climate change and how to stop it, and obtain information from other students about climate solutions.

Figure 2. *Elementary GLOBE* storybooks provide examples of how students can be young scientists. This figure provides an example of how NGSS Science and Engineering Practices appear in *Elementary GLOBE* storybooks.



"I like how it was able to get the students thinking on different aspects of cause and effect."

- Elementary GLOBE field test teacher

Hands-on Science Experiences for Students

The classroom activities within each module make the science inquiry and NGSS Science and Engineering Practices highlighted in the *Elementary GLOBE* storybook real and relevant. Activities give students hands-on experience with science content related to NGSS Disciplinary Core Ideas and Crosscutting Concepts while allowing students to gain experience with Science and Engineering Practices. In Appendix B, classroom activities are listed with the correlating NGSS Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts as well as Common Core ELA and Math and National Geography standards.

Name Juliana

Date 11-1-05

Weather sunny, chilly, and breezy

Clothing long sleeve shirt, pants, and a hat

Big Picture View
Write or draw your observations here.

Trees were everywhere.
Some trees had only a few leaves.
I saw tall grass growing by the trees.
A lot of trees were very tall.

Figure 3. Example of a completed Student Activity Sheet of student observations.

Connections to Other Areas of the Curriculum

While *Elementary GLOBE* modules were developed primarily to help students understand Earth system science concepts and the process of scientific inquiry, the storybooks and classroom activities also support other topics in the elementary curriculum including literacy, the arts, geography, engineering, and mathematics. The "Connections to Literacy" section in this document discusses how the *Elementary GLOBE* resources connect to language arts instruction. In addition to these cross-curricular connections, the characters that are scientists in the storybooks help students learn about possible career paths, and the GLOBE Kids model these behaviors in acting as young scientists.

Arts: The connections between science and art often involve visual description of scientific processes (through drawings, for example) or observations of the natural world (such as identifying colors, shapes, and patterns in nature). Thus, it's natural for elementary students to utilize art skills as they learn about science concepts through *Elementary GLOBE* resources. For example in the Color of the Seasons activity (Seasons module) students focus their observations of nature on the colors that they can find in their local landscape. In the Sky Observers activity (Air Quality module), students explore the color of the sky, learning that the sky can be many colors, not only one shade of blue. Additionally, throughout the *Elementary GLOBE* activities, students use drawing as a way of communicating their observations of the environment. Performing arts are also represented in the Earth System module. In the *All About Earth* storybook, the characters develop a play and accompanying song about the Earth system, and then in the Earth System Play activity, students create their own play about this topic.

Geography: Earth system science is connected to physical geography because geography affects the climate, weather, soils, seasons, and water resources in a location. While many *Elementary GLOBE* storybooks were developed to be independent of geography, allowing students to envision that the story could have taken place where they live, a couple of storybooks



have strong ties to geographic locations. Geography plays a central role in the storybooks *What in the World Is Happening to Our Climate?* and *The Mystery of the Missing Hummingbirds*. The former explores climate at different latitudes, and the impacts of climate change in different locations. The latter explores migration patterns and seasons at different latitudes. In these two storybooks, simple maps are provided to allow students to make connections to geography.

Engineering: There are numerous connections between engineering and Earth system science. For example, scientists rely on instruments developed by engineers and scientists and engineers often work together to design solutions to environmental problems. The Next Generation Science Standards outlines two practices geared toward engineering: defining problems and designing solutions. In *Elementary GLOBE* learning activities, students are encouraged to explore engineering practices. In the *Honing in on Hummingbirds* activity (Seasons module), students design a hummingbird model to be the same weight as a real hummingbird. In the *Seashores on the Move* activity (Climate module), students define a problem (that sea level rise threatens areas of the coast) and design ways to keep people who live in a hypothetical coastal community safe. In the *We're All Part of the Solution* activity (Climate module), students brainstorm ideas for helping to address climate change.

Math: Earth system science and environmental observations rely on math in terms of measurements collected to quantitatively describe the observations. The elementary grades, when students are learning math skills such as basic calculations and graphing, are an excellent time to utilize math skills while learning science concepts. For example, in the *Weather Adds Up to Climate* activity (Climate module), students make simple bar graphs to describe their weather over a month and compare bar charts for different months' weather. In the *Measure Up* activity (Water module), students explore how to make nonstandard and standard linear measurements. In the *Up in the Air* activity (Air quality module), students are introduced to the concept of random sampling.

Careers: One of the goals of the Next Generation Science Standards (NGSS) is to encourage the

development of educational resources that stimulate students' interests in science and prepare them for careers in STEM fields. Exposing students to STEM careers and informing them about the knowledge and skills needed to succeed in these disciplines will give students an understanding of career opportunities that are open to them as well as pathways to pursue these careers. In *Discoveries at Willow Creek*, Hannah demonstrates how she uses tools to conduct science research and has the students use the same tools in their investigations of the creek, modeling the process of science that she employs in her work. In *What in the World Is Happening to Our Climate?*, both Dr. Sanchez and Dr. Goma share the ways they explore Earth's climate and encourage the GLOBE Kids to be a part of their research. The teachers in these storybooks, and especially Ms. Patel, also model a career path for students, helping connect learners with science and ways to explore the environment.

Classroom Implementation

Implementing *Elementary GLOBE* is relatively easy as it is a very flexible series of materials. Some teachers integrate only one storybook into their existing curriculum. Others integrate the entire series throughout the school year. Each storybook and set of learning activities are designed as stand-alone resources. Teachers may want to collaborate with other K-4 teachers in their building or district to





determine where the materials are best aligned in their curriculum.

In determining the best fit for each storybook content area, keep in mind that some of the learning activities can be revisited during the school year as students will be exploring changes over time. It may be interesting to save completed Student Activity Sheets and journals, then repeat the activity, and return to the original work to have students compare and contrast the changes they find. Another option that builds a comparison over time is saving students' work from a prior year(s) and having current students compare their work to former students' observations.

Reading sessions can be broken up and interspersed with discussion. Referring back to the storybooks after completing some of the learning activities helps to make connections between what the characters did in the story and what your students are experiencing and can solidify student learning. The characters in the storybooks often model what students are doing in the learning activities, so it is useful to make this connection.

The learning activities can be used in a variety of ways to support student learning and the acquisition of science and engineering practices. Each of the supporting learning activities was designed to be used after reading the book.

Brainstorm ideas with colleagues about how best to arrange stations, student teams, and assessment ideas for each module. In addition to assessing knowledge gain, measuring the ability to do specific skills or outcomes at the end of each learning activity is one way to assess student achievement.

"[Elementary GLOBE] is by far the most authentic method that I know of to welcome these young scientists into learning about the world around them."

- Michael Jabot, GLOBE Partner

References Cited:

Leslie, C.W. (2010) *The Nature Connection: An Outdoor Workbook*. Storey Publishing.

Marzano, R. J. (2004). *Building background knowledge for academic achievement: Research on what works in schools*. ASCD.

Thier, M. (2002). *The New Science Literacy: Using Language Skills to Help Students Learn Science*. Heinemann.

The 2017 Teacher's Implementation Guide Credits

Text by:

Becca Hatheway, *UCAR Center for Science Education*
Lisa S. Gardiner, *UCAR Center for Science Education*

Illustrations:

Lisa S. Gardiner

Reviews:

Tina Harte, *SSAI*
Jessica Taylor, *NASA Langley*
Julie Malmberg, *GLOBE Implementation Office*
John Ristvey, *UCAR Center for Science Education*
Kerry Zarlengo, *Jefferson County Public Schools (CO)*

Copyediting:

Renee Minaya, *UCAR Center for Science Education*

Layout and Design:

Lisa S. Gardiner, *UCAR Center for Science Education*

This guide benefited from GLOBE community input, submitted to the authors in January and February 2017.

Last update: September 15, 2017



Appendix A. An Overview of *Elementary GLOBE* Materials

Title	Instructional Resources	Connections
AIR QUALITY MODULE		
What's Up in the Atmosphere: Exploring Colors in the Sky Storybook	The GLOBE Kids investigate the colors in the sky to determine why the sky isn't always blue. They learn about aerosols and gases that affect air quality, and discover the importance of monitoring air quality because of its effect on human health.	Arts
Sky Observers Activity	Students describe and report observations of sky color and conditions in the atmosphere.	
Why (Not) So Blue? Activity	Students learn that aerosols in the atmosphere have an effect on sky conditions, including sky color and visibility.	
See the Light Activity	Students use prisms to explore the properties of light, and understand properties of light and how this affects colors in the sky.	
Up in the Air Activity	Students collect aerosol samples and understand that aerosols are particulates in the atmosphere that impact air quality.	Math
CLIMATE MODULE		
What in the World Is Happening to Our Climate? Storybook	The GLOBE Kids take a science adventure with Anita's dad and learn that climate change affects the whole wide world, from the tropics to the poles. With the help of their teacher, Ms. Patel, they find ways to help solve the problem.	Geography Engineering Careers
Weather Adds Up to Climate Activity	Students describe and report weather and learn how weather patterns over a long period of time are used to describe the climate of a location.	Math
Seashores on the Move Activity	Students build and use a model to explore how sea level rise can affect coastal communities and environments.	Engineering Geography Arts
We're All Part of the Solution! Activity	Students describe how humans are contributing to climate change and how we can take action to solve this problem.	Engineering



Appendix A (continued). An Overview of *Elementary GLOBE* Materials

CLOUDS MODULE

<i>Do You Know That Clouds Have Names?</i> Storybook	The GLOBE Kids share information about the different cloud types by acting out analogies related to cloud shapes.	
Cloud Fun Activity	Students describe the shape and appearance of cumulus clouds. They will be able to describe what kind of weather is associated with cumulus clouds.	
Cloudscape Activity	Students identify cloud types using cloud classification names.	Arts
To Spread or Not to Spread Activity	Students identify the three types of contrails.	Arts

EARTH SYSTEM MODULE

<i>All About Earth: Our World on Stage</i> Storybook	The GLOBE Kids are excited to perform a play about the parts of the Earth system, including the Sun, water, air, soil, and living things. However, they argue about which part is most important and should have the lead role in the play. As the GLOBE Kids work through the components, they come to understand that each role is important and connected to other parts of the system.	Arts
Earth System in a Bottle Activity	Students conduct an experiment that tests what plants need in terms of water, sunlight, and soil.	
We're All Connected Activity	Students explain how the Earth's processes and components are interconnected.	
Earth System Play Activity	Students demonstrate their knowledge of how water, air, soil, and living things interact in the Earth system.	Arts

SEASONS MODULE

<i>The Mystery of the Missing Hummingbirds</i> Storybook	The GLOBE Kids wonder why ruby-throated hummingbirds have stopped visiting their school garden. They conduct an investigation, learning more about the needs of the hummingbirds, the seasonal changes where they live, and the environment in Costa Rica, where the hummingbirds spend the winter.	Geography
All Year Long Activity	Students describe the seasonal changes in a local habitat by making detailed observations, recording data, comparing, and sharing information with others.	
The Colors of the Seasons Activity	Students explain how colors in nature relate to their local environment and to seasonal changes within that environment.	Arts
Honing in on Hummingbirds Activity	Students conduct research related to ruby-throated hummingbirds and communicate their results using different formats.	Engineering Math



Appendix A (continued). An Overview of Elementary GLOBE Materials

SOILS MODULE

The Scoop on Soils Storybook	The GLOBE Kids are on the trail of Scoop, an eager dog who loves to dig holes in the soil. At each hole Scoop has dug, the Kids use their journals to record the soil color, texture, and structure.	
Getting to Know Soil Activity	Students describe soil texture, color, and size.	
Soil Treasure Hunt Activity	Students list things found in soil such as rocks, roots, critters, and organic materials.	
We All Need Soil! Activity	Students explain soil's function for plants and animals and the overall importance of soil science.	

WATER MODULE

Discoveries at Willow Creek Storybook	On their second visit to Willow Creek, the GLOBE Kids discover why the creek looks different from their previous visit. They make observations, take measurements, and look for critters in the water.	Geography Math Careers
Magnify That Activity	Students identify a magnifying lens, understand its purpose, and explain why object looks different when magnified.	
Measure Up Activity	Students make nonstandard and standard linear measurements.	Math
Water Wonders Activity	Students describe adaptive features of aquatic macroinvertebrates and their significance in indicating the health of freshwater ecosystems.	



Appendix B (continued). Alignment to Educational Standards: Common Core State Standards

Note: Codes to standards can be found on page 14.

	CCSS.ELA Anchor Standards										CCSS.MATH Content Standards							Geography					
	R.4	R.7	R.10	W.1	W.2	W.4	W.7	W.8	CC B.4	MD A.1	MD A.2	MD A.3	MD A.4	MD B.3	GA.1	GB.4	1	4	7	8	14	15	
AIR QUALITY MODULE																							
Storybook: What's Up in the Atmosphere	●	●	●																				
Sky Observers		●	●				●	●						●									
Why (Not) So Blue?						●	●	●															
See the Light						●	●																
Up in the Air																							
CLIMATE MODULE																							
Storybook: What in the World is ...	●	●	●														●	●	●				
Weather Adds Up to Climate				●	●	●	●	●												●	●		
Seashores on the Move	●			●	●	●	●															●	●
We're All Part of the Solution!						●	●	●															●
CLOUDS MODULE																							
Storybook: Do You Know That Clouds ...	●	●	●																				
Cloud Fun						●	●																
Cloudscape						●	●														●		
To Spread or Not to Spread								●															●
EARTH SYSTEM MODULE																							
Storybook: All About Earth: Our World...	●	●	●																				
Earth System in a Bottle						●																	
We're All Connected						●																	
Earth System Play						●																	
SEASONS MODULE																							
Storybook: The Mystery of the Missing...	●	●	●																		●		
All Year Long						●																	
The Color of the Seasons						●	●	●													●		
Honing in on Hummingbirds						●	●	●															●
SOILS MODULE																							
Storybook: The Scoop on Soils	●	●	●																				
Getting to Know Soil						●	●	●															●
Soil Treasure Hunt						●	●	●															
We All Need Soil!						●	●	●															
WATER MODULE																							
Storybook: Discoveries at Willow Creek	●	●	●																				
Magnify That																							●
Measure Up																							●
Water Wonders																							●



Appendix B (continued). Alignment to Educational Standards: Key to Codes

The standards listed are those identified in tables on pages 12 and 13.

Next Generation Science Standards

Disciplinary Core Ideas

- ESS2.A Earth Materials and Systems
- ESS2.C The Roles of Water in Earth's Surface Processes
- ESS2.D Weather and Climate
- ESS3.A Natural Resources
- ESS3.C Human Impacts on the Earth System
- PS4.A Wave Properties
- LS1.C Organization for Matter and Energy Flow in Organisms
- LS2.A Interdependent Relationships in Ecosystems
- LS4.C Adaptation
- LS4.D Biodiversity and Humans
- ETS1.A Defining and Delimiting Engineering Problems
- ETS1.B Developing Possible Solutions

Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, cycles, and conservation
6. Structure and Function
7. Stability and Change

National Geography Standards

1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information
4. The physical and human characteristics of places
7. The physical processes that shape the patterns of Earth's surface
8. The characteristics and spatial distribution of ecosystems and biomes on Earth's surface
14. How human actions modify the physical environment
15. How physical systems affect human systems

CCSS English Language Arts Anchor Standards

- CCSS.ELA-Literacy.CCRA.R.4 - Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
- CCSS.ELA-Literacy.CCRA.R.7 - Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
- CCSS.ELA-Literacy.CCRA.R.10 - Read and comprehend complex literary and informational texts independently and proficiently.
- CCSS.ELA-Literacy.CCRA.W.1 - Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
- CCSS.ELA-Literacy.CCRA.W.2 - Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
- CCSS.ELA-Literacy.CCRA.W.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-Literacy.CCRA.W.7 - Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
- CCSS.ELA-Literacy.CCRA.W.8 - Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CCSS Math Content Standards

- CCSS.MATH.CONTENT.CC.B.4 - Understand the relationship between numbers and quantities; connect counting to cardinality.
- CCSS.MATH.CONTENT.MD.A.1 - Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
- CCSS.MATH.CONTENT.MD.A.2 - Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.
- CCSS.MATH.CONTENT.MD.A.3 - Estimate lengths using units of inches, feet, centimeters, and meters.
- CCSS.MATH.CONTENT.MD.A.4 - Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.
- CCSS.MATH.CONTENT.MD.B.3 - Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.
- CCSS.MATH.CONTENT.G.A.1 - Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.
- CCSS.MATH.CONTENT.G.B.4 - Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).