EUREKA, AGAIN! K–2

SCIENCE ACTIVITIES AND STORIES

DONNA FARLAND-SMITH
JULIE THOMAS

NSTA press
National Science Teachers Association

Claire Reinburg, Director
Rachel Ledbetter, Managing Editor
Deborah Siegel, Associate Editor
Andrea Silen, Associate Editor
Donna Yudkin, Book Acquisitions Manager

ART AND DESIGN
Will Thomas Jr., Director
Joe Butera, Senior Graphic Designer, cover and interior design

PRINTING AND PRODUCTION
Catherine Lorrain, Director

NATIONAL SCIENCE TEACHERS ASSOCIATION
David L. Evans, Executive Director

1840 Wilson Blvd., Arlington, VA 22201
www.nsta.org/store
For customer service inquiries, please call 800-277-5300.

21 20 19 18 4 3 2 1

NSTA is committed to publishing material that promotes the best in inquiry-based science education. However, conditions of actual use may vary, and the safety procedures and practices described in this book are intended to serve only as a guide. Additional precautionary measures may be required. NSTA and the authors do not warrant or represent that the procedures and practices in this book meet any safety code or standard of federal, state, or local regulations. NSTA and the authors disclaim any liability for personal injury or damage to property arising out of or relating to the use of this book, including any of the recommendations, instructions, or materials contained therein.

Cataloging-in-Publication Data
Names: Farland-Smith, Donna, author. | Thomas, Julie, 1947- author.
Title: Eureka, again! : K-2 science activities and stories / by Donna Farland-Smith and Julie Thomas.
Description: Arlington, VA : National Science Teachers Association, [2018] | Includes index.
Identifiers: LCCN 2018019041 (print) | LCCN 2018022737 (ebook) | ISBN 9781681403175 (e-book) | ISBN 9781681403168 (print)
Subjects: LCSH: Science--Study and teaching (Elementary)--Activity programs--United States. | Next Generation Science Standards (Education)
Classification: LCC LB1585.3 (ebook) | LCC LB1585.3 .F36 2018 (print) | DDC 372.35/044--dc23
LC record available at *https://lccn.loc.gov/2018019041*

CONTENTS

CONTENTS

CONTENTS

CONTENTS

FOREWORD

Julie Thomas

Jane Goodall showed considerable interest in science and nature as a young girl. She is known for watching a chicken until she understood how the egg came out (Winter 2011) and tucking a handful of earthworms under her pillow (Goodall 1999). As Jane remembers, her mother did not scold her for bringing the soil and worms to bed. Instead, her mother took time to explain that the worms needed to be returned to the outdoors or they would die. Still today, Jane insists her mother's support greatly influenced her early thinking and lifelong passion for scientific understanding. What's important here is that Jane's mother didn't shy from teaching a young child about the relationships between organisms and their environment. The worms, of course, needed the moisture and nutrients found in soil—and some plants needed the benefit of the worms' tunneling and some animals looked to the worms as food.

Certainly, developing complex understandings of the interdependence of living things also seems a lofty goal for K–2 children. However, giving some thought to purposeful ways we can begin to deepen students' knowledge and awareness of science and engineering lays a foundation for later learning. The purpose of this foreword is to provide some insight into what research says about children's developing capacity to learn science and what teachers can do to broaden K–2 students' interests in science, engineering, and medical (SEM) careers.

Early Science Learning

Have you ever watched a toddler's playful highchair game—the one where the child repeatedly pushes a spoon over the edge of the tray and then leans over to watch the spoon hit the floor? These repeated actions (and observable feedback loops) help young children gather information about the mechanics of physical objects and help us know they develop general reasoning and problem-solving skills (i.e., underpinnings of the scientific processes) from a very young age. In fact, research tells us children are not as cognitively limited as we once thought. Rather, they bring a wealth of capabilities to the learning process (Duschl, Schweingruber, and Shouse 2007). Young children have a natural interest in science, and their reasoning abilities suggest they can benefit well from relatively complex lessons. Our challenge as teachers is to build on children's prior knowledge as we help them further understand and apply scientific knowledge.

One thing to keep in mind is that not all children experience the same early science learning opportunities. There is likely great variability across your students' prior experiences when it comes to visiting science museums, reading science books, engaging in experiments, or interacting with scientists. Teachers can help equalize opportunities for all K–2 students by exposing them to a variety of resources to help broaden their knowledge and understanding of the work of scientists and engineers and inspire SEM careers.

How Do Children Form Career Aspirations?

Curricula and assessments that are based on the *Next Generation Science Standards* (NGSS Lead States 2013) are intended to improve students' understanding of science and boost interest in science careers. Importantly, though most career awareness programs begin with middle or high school, career choices actually begin as early as kindergarten (Wahl and Blackhurst 2000) and are primarily influenced by socioeconomic status (Auger, Blackhurst, and Wahl 2005). One way to make sense of this is to think about how children first become aware of the work world via the people and places their parents know. For example, my research among elementary students with low socioeconomic status in rural Oklahoma helped explain why so many fifth graders aspired to medical careers (Hulings, Thomas, and Orona 2013). Conversations with the children helped me learn they regularly accompanied their pets and grandparents to visit the doctor—and usually went right along with them into the examination rooms. These students could tell us a lot about the tools and procedures these doctors used. One unique student, Brittney, aspired to a career in cosmetology—and she had learned what she knew by spending time in her aunt's beauty shop:

> I think [cosmetologists] need to know about science … what types of chemicals [they're] using and how to use them in the right way so they don't affect the person. So there won't be any problems. You need to know how much you need to put in their hair … and whether or not it's too much or too little. (Hulings, Thomas, and Orona 2013)

Some research reveals how children view scientists and engineers—and the kinds of experiences that influence children's drawings of scientists and engineers. Draw-a-scientist studies conclude that most students organize stereotypical views of scientists as white males and occasionally monsters who primarily work indoors (Barman 1997); even students of color are likely to draw white scientists (Finson 2002). Similarly, draw-an-engineer studies find elementary students have a limited conception of the work of engineers (i.e., they mistakenly expect engineers to be mechanics, laborers, and technicians). Chambers (1983) determined children's images of scientists usually begin to appear in when they are in second or third grade and are fully formed by the time children are in fourth or fifth grade. Clearly, the long view of elementary science education is to recognize that scientists and engineers include a broad representation of diverse males and females and encourage and inspire young children to consider SEM careers. So, given that children's home and community experiences limit children's career awareness, how can teachers expand students' career awareness via school experiences?

What Can Teachers Do?

Efforts to broaden children's knowledge and understanding of the work of scientists and engineers will help expand SEM career awareness and aspirations for all—regardless of race, gender, or socioeconomic status. These efforts can include connecting science lessons to science and engineering careers, inviting scientists and engineers to visit your classroom and talk about their work, engaging and involving parents as SEM education allies, and introducing biographies and the personal traits of scientists and engineers.

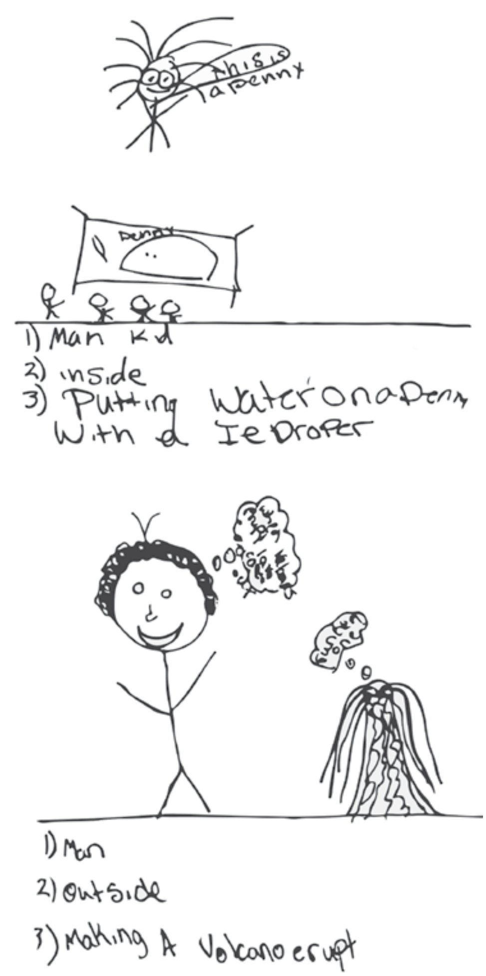
Connect science lessons to science and engineering careers. Think about linking science lessons to real-world career applications (e.g., when and why scientists or engineers measure things). This purposeful addition will illuminate children's observations of scientists and engineers' work and help motivate and inspire students' thinking about SEM careers. Figure 1 shows the importance of augmenting science lessons with conversations about how hands-on classroom activities link to the real world of SEM workers. Of course, opportunities to link lessons to the real world will grow as you become more aware of the work of scientists and engineers—but you can begin in your own community. You might choose to take photographs of these community workers yourself or simply share community news with your students. Consider sharing a photo and asking your students to think about the picture (e.g., how the conservation biologist is observing migrating monarch butterflies). You might be surprised to find real-world connections embedded in science lessons you are already using or in a little-used-section of your science textbook.

Invite scientists and engineers into your classroom. Local career role models can both share the excitement of their work and familiarize your students with the ways scientists and engineers in your area are working to make the world a better place. Certainly, nothing can approximate the personal opportunity to meet an SEM professional. Think about looking to medical groups, engineering societies or firms, universities, or city and state agencies (e.g., transportation and city planning, utilities, recycling, or waste management departments)—even students' parents and families—to recruit enthusiastic SEM professionals. Endeavor to reflect diversity in the workforce (e.g., females, varied ethnic and racial backgrounds) with these classroom guests and to represent a variety of fields and disciplines.

You might also think about the possibility of bringing in virtual classroom guests. There is an ever-increasing number of internet sites designed to demystify the work of scientists and engineers and otherwise encourage SEM career aspirations. My absolute favorite among these is PBS's The

Figure 1

Science Lesson Misconceptions



Some children's drawings of scientists show us how science lessons can confuse students' thinking about the work of scientists. Scientists do not actually use an eyedropper to count how many water drops fit on a penny (a common lesson to teach about water properties) but scientists do follow similar practices to observe phenomena. For example, scientists may not build model volcanoes to watch them erupt but they might build model volcanoes to understand or explain how and when they erupt. Classroom conversations can help deter these misconceptions.

Secret Life of Scientists and Engineers website (*www.pbs.org/wgbh/nova/secretlife*), which is appropriate for people of all ages. Two distinct features of this website are suitable for use with early elementary students: video clips of scientists and engineers telling about their "secret lives" and explaining how their unique passion relates to their work (*www.pbs.org/wgbh/nova/blogs/secretlife/teachers/#video*) and teaching tips that offer ideas about how to incorporate the scientists' stories into your teaching (*www.pbs.org/wgbh/nova/blogs/secretlife/teachers/#teachers*).

At the very least, these scientists and engineers will help you and your students break down stereotypes about who can aspire to an SEM career. The video clips bring young SEM researchers to life and introduce them via a surprising secret life that fuels their work, and vice versa. Some of the inspiring researchers featured on the website include the following:

- Bisi Ezerioha (*www.pbs.org/wgbh/nova/blogs/secretlife/engineering/bisi-ezerioha*) is a high-performance engineer and drag racer. As an engineer, he creates fire-breathing automotive beasts for the track and the street. As a drag racer, he sets speed records but "drives like a grandma" when off the race track.
- Cheri Blauwet (*www.pbs.org/wgbh/nova/blogs/secretlife/blogposts/cheri-blauwet*) is a medical doctor and an accomplished athlete. As a doctor, she specializes in sports medicine and, as a champion wheelchair racer, she earned a gold medal in the Athens games.
- Kathy Reichs (*www.pbs.org/wgbh/nova/blogs/secretlife/anthropology/kathy-reichs*) is a forensic anthropologist and a TV hero. As a scientist, she studies remains to solve real-life crime mysteries and, in the TV world, she was a producer and writer for the series "Bones," which is based on her novels.

Include parents. One way to expand your students' science learning opportunities is to also teach parents and guardians. Are you thinking this idea is "out there" or beyond the call of duty? Well, parent education programming helps parents appreciate what you are teaching and why it makes a difference. Research suggests that parents who "get the message" support the teacher and encourage school learning opportunities (Weiss et al. 2009).

Your parent education efforts could be as simple as regular science feature stories in a school newsletter or on a classroom website. The "work" here might be as simple as posting pictures and stories about the science goings-on in your classroom or alerting parents to science learning opportunities in the community (e.g., programs at a nearby museum or community library). Another easy way to educate parents is to invite them to help (e.g., manage materials) when you plan an engineering design activity with your students. Consider creating some at-home science learning opportunities such as literature-linked science activities from *More Picture-Perfect Science Lessons* (Ansberry and Morgan 2007) to encourage children to explore bubble fluid recipes and bubble wand shapes with their families.

You might also consider organizing parent learning through creative workshops, social gatherings, or content-focused event nights. Family night events—informal, interactive activities—can be a great way to engage family members as engineering teams to imagine, plan, create, and improve together. Smetana et al. (2012) encourage us to think broadly about family—not only parents and grandparents but also siblings, caregivers, and neighbors, too. As these educators learned, multigenerational family units particularly enjoy working together at these events.

When it comes to organizing family learning events, a guidebook titled *Family Engineering* (Jackson et al. 2011) is particularly useful for both novice and experienced planners. This guide, modeled after the popular book *Family Math* (Stenmark, Thompson, and Cossey 1986), provides excellent details about how and why to organize a family engineer event—from how to put together the planning committee, to choosing the location, to developing volunteer roles, agenda guides, and sample room layouts. *Family Engineering* includes two types of event formats (opener activities and engineering challenges); lists of simple, inexpensive materials (e.g., plastic cups, brads, and craft sticks); and step-by-step directions. *Opener activities* are self-directed tabletop activities families can engage in at their own pace and *engineering challenges* are more in-depth activities that introduce a variety of engineering fields and engage families in the processes of engineering. One especially nice feature is the organization of the two-sided tabletop activity directions. One side provides a leading question and activity guide while the other side provides an explanation or *engineering connection*. Having organized several family engineering events using this guidebook, we can attest to how easily diverse audiences are drawn in to these activities and engage in thinking and problem-solving challenges as family units.

Introduce biographies and the personal traits of scientists. *Eureka, Again!* presents a series of science lessons linked to biographical books about the accomplishments and early interests and inclinations of famous scientists and engineers. Here, a focus on specific character traits helps us understand how the human dimension of such traits both encourages and supports SEM career choices. One book, *Me … Jane* (McDonnell 2011), introduces Jane Goodall as a young girl whose favorite toy was a stuffed chimpanzee. Jane's career as primatologist began with backyard observations of birds and squirrels. She set her mind to observing animals in Africa when she was 10 years old. As a scientist, Jane showed her observant nature in the discovery of chimpanzees' ability to make and use tools. Another of the books, *Shark Lady* (Keating 2017), tells the story of Eugenie Clark, a young shark lover whose zoology career began with reading about sharks in the library and studying fish in school. As a scientist, Eugenie demonstrated her *fearless* nature when she dove into the open ocean and proved herself "smart enough to be a scientist and brave enough to explore the oceans" (p. 21).

These biographies can help your students realize they possess some of these same character traits and can become scientists and engineers themselves. After all, famous scientists and engineers were once young children who began with a particular disposition or character trait, found a passion, and became famous adults. It just makes sense that explicit focus on character traits (while reading a story and doing a science activity to learn more about a scientist or engineer) will help students understand more about potential SEM career choices. Such explicit connections may be a necessary component to the National Science Foundation's (2008) mission to broaden SEM participation among diverse populations by providing "for the discovery and nurturing of talent wherever it may be found" (p. iii).

References

Ansberry, K., and E. Morgan. 2007. *More picture-perfect science lessons: Using children's books to guide inquiry, K–4*. Arlington, VA: NSTA Press.

Auger, R. W., A. E. Blackhurst, and K. H. Wahl. 2005. The development of elementary-aged children's career aspirations and expectations. *Professional School Counseling* 8 (4): 322–330.

Barman, C. R. 1997. Students' views of scientists and science: Results from a national study. *Science and Children* 35 (1): 18–24.

Chambers, D. W. 1983. Stereotypic images of the scientist: The draw-a-scientist test. *Science Education* 67 (2): 255–265.

Duschl, R. A., H. A. Schweingruber, and A. W. Shouse, eds. 2007. *Taking science to school: Learning and teaching science in grades K–8*. Washington, DC: National Academies Press.

Finson, K. D. 2002. Drawing a scientist: What we do and do not know after fifty years of drawings. *School Science and Mathematics* 102 (7): 335–345.

Goodall, J. 1999. *Reason for hope: A spiritual journey*. New York: Warner Books.

Hulings, M., J. Thomas, and C. Orona. 2013. Influences on 5th grade students' images of scientists and career aspirations. Paper presented at the annual conference of the Association for Science Teacher Educators, Charleston, SC.

Jackson, M., D. Heil, J. Chadde, and N. Hutzler. 2011. *Family engineering*. Portland, OR: Foundation for Family Science and Engineering.

Keating, J. 2017. *Shark lady: The true story of how Eugenie Clark became the ocean's most fearless scientist*. Naperville, IL: Sourcebooks Jabberwocky.

McDonnell, P. 2011. *Me … Jane*. New York: Little, Brown and Company.

National Science Foundation (NSF). 2008. *Broadening participation at the National Science Foundation: A framework for action*. Washington, DC: NSF.

NGSS Lead States. 2013. *Next Generation Science Standards: For states, by states.* Washington, DC: National Academies Press. *www.nextgenscience.org/next-generation-science-standards.*

Smetana, L. K., J. C. Schumaker, W. S. Goldfien, and C. Nelson. 2012. Family style engineering. *Science and Children* 50 (4): 67–71.

Stenmark, J. K., V. Thompson, and R. Cossey. 1986. *Family math*. Berkeley, CA: Lawrence Hall of Science.

Wahl, K. H., and A. Blackhurst. 2000. Factors affecting the occupational and educational aspirations of children and adolescents. *Professional School Counseling* 3 (5): 367–374.

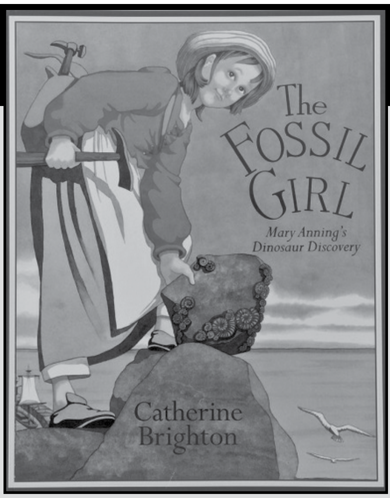
Weiss, H. B., S. M. Bouffard, B. L. Bridglall, and E. W. Gordon. 2009. *Reframing family involvement in education: Supporting families to support educational equity*. Equity Matters: Research Review, Brief No. 5, The Campaign for Educational Equity, Teachers College, Columbia University, New York.

Winter, J. 2011. *The watcher: Jane Goodall's life with the chimps*. New York: Schwartz & Wade.

SCIENTISTS AND ENGINEERS ARE

CURIOUS

Learning About Mary Anning



Curious (adj.): having a desire to learn or know more about something or someone

Lesson: Fossil Fun

Description

In this lesson, students will learn about the history of Earth through the discovery of fossils.

Objectives

Students will consider how the curious character trait refers to Mary Anning's ability to find and identify fossils.

- In the Play portion of the lesson, students will complete a KWL chart.
- Students will hear the story *The Fossil Girl: Mary Anning's Dinosaur Discovery* by Catherine Brighton and discuss how it relates to the word *curious* as a character trait.
- In the Explore portion of the lesson, students will make a trace fossil.
- In the Discuss portion of the lesson, students will compare fast and slow changes as processes that shape Earth.

Learning Outcomes

Students will (1) discuss what being curious means and why being curious is an important trait for scientists and engineers and (2) distinguish between fast and slow changes that shape Earth.

Connections to the *NGSS*

The following sections make one set of connections between the instruction outlined in this lesson and the *NGSS.* Other valid connections are likely; however, not all possibilities are listed.

Performance Expectation	Connections to Activity
2-ESS1-1: Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	• Students watch videos of fast and slow changes.
Science and Engineering Practice	**Connections to Activity**
Analyzing and Interpreting Data	• Students analyze what makes a fast change and what makes a slow change.
Disciplinary Core Idea	**Connections to Activity**
ESS1.C: The History of Planet Earth Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.	• Students make a fossil that represents a slow change.
Crosscutting Concept	**Connections to Activity**
Stability and Change	• In the KWL chart at the end of the lesson, students are able to articulate examples of fast and slow changes.

Overview

In this lesson, students learn how one curious person used mathematical thinking to estimate the size of an ichthyosaur. Mary Anning used scientific methods to collect objects that she called "curiosities." By reading the featured book, students will learn that men and women from all backgrounds choose careers as scientists. The trait of being curious refers to Mary Anning's unique desire to find objects (fossils) and attempt to estimate their size by solving mathematical problems. As a young girl who discovered the first complete ichthyosaur, Mary astonished the scientific world of her time with evidence that Earth is millions of years old. Mary lived in a time when scientists were working on a new idea—that the world was much older than they had always thought. Mary's discoveries helped provide the evidence that scientists needed to support their new ideas. Mary went on to be highly regarded

Mary Anning

as a fossil expert, finding two complete plesiosaurs and the first ever pterodactyl. Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.

Materials

You will need a copy of the featured book *The Fossil Girl: Mary Anning's Dinosaur Discovery* by Catherine Brighton (1999). Individual students will need an empty (and cleaned out) 6-oz milk carton, a craft stick, an object for fossil prints (e.g., leaves, grasses, shells), and safety goggles. The teacher will need a package of plaster of paris, an old bucket to mix the plaster of paris in, water (as much as described in the directions for the plaster of paris), and petroleum jelly in a tube.

Safety Notes

(1) Remind all students that personal protective equipment should be worn during the setup, hands-on, and takedown segments of the activity. (2) Use caution when handling sticks—these can be sharp and can puncture or cut skin. (3) Wash hands with soap and water upon completing this activity.

Setting the Context

Predict

Have the class create a KWL chart about the age of Earth (see Table 5.2). In this approach, students document their learning with what they Know (K), what they Want to know about the age of Earth (W), and what they have Learned about the age of Earth (L). To begin, focus only on the K and W sections (what students know about the history of Earth and what they want to know) as an introduction to this lesson; students will fill in the Learn (L) section during the Explain phase. Keep this chart in a central location that is visible throughout the lesson so that students can fill in the KWL chart during and after the lesson.

Guided Reading

Students will be learning about Mary Anning, a woman who found evidence that changed scientists' ideas about the age of Earth. Students will learn that Mary was especially curious by reading *The Fossil Girl: Mary Anning's Dinosaur Discovery.* Introduce the book by asking, *Can you find the person on the front cover? What does it look like is happening on the front cover?* Read the story aloud. Encourage students to notice and think about the challenges Mary Anning faced as a woman who enjoyed finding "curiosities."

The following questions may be used to guide children's attention to detail as you read. (Page numbers reference unnumbered book pages, beginning with the title page as page 1.)

Table 5.2

Sample KWL Chart

What Do We *Know* About the Age of Earth?	What Do We *Want* to Know About the Age of Earth?	What Have We *Learned* About the Age of Earth?
• Earth is old, but we are not sure how scientists know this. • Volcanoes and earthquakes are on Earth.	• How do scientists know exactly how old Earth is? • What makes a volcano erupt? • What makes an earthquake happen?	• We've learned that sometimes Earth changes quickly and sometimes it changes slowly. • Fossils document slow changes on Earth.

1. **Pages 1–5:** Mary Anning and her brother Joe were forced to collect fossils after their father died to help her mother keep her curiosity shop open. One evening, all their curiosities were swept away. How did the Annings lose all their curiosities? *A bad storm came through their house, and a flood washed all the curiosities away.*

2. **Pages 6–9:** One of Mary's curiosities was the biggest they had ever seen. How did Mary and her brother use math to estimate the size of the curiosities? *They were able to estimate the size by examining the size of the creature's head. They used their arms to estimate the size of the creature to be 20 ft. or more.*

3. **Pages 10–14:** Mary looked in a book called *Strange Creatures of the World.* She asked herself questions—Is it a giraffe? A gorilla? How did Mary figure out what the name of the creature was? *Henry Henley, the lord of the manor, came by and told her that it was not a gorilla or a giraffe but an ichthyosaur (a type of dinosaur). The age of the dinosaur gave scientists clues about the age of Earth.*

4. **Pages 14–16:** The ichthyosaur was on the side of a cliff. How did Mary solve the problem of digging up (excavating) the dinosaur on the side of the cliff? *Mary brought flowers to a family friend, Mr. Arkwright, and asked him if he would build her a tower up the cliff. He was intrigued, so he said yes.*

5. **Pages 17–20:** How did Mary and Joe make money from finding the dinosaur? *They were able to charge one penny for locals to climb the tower Mr. Awkright had built to see the ichthyosaur. This gave them enough money to buy a warm meal. Eventually they would sell the fossil to Henry Henley and make a profit.*

Making Sense

Explore

In this lesson, students will explore how Earth, over time, slowly changes. One process for creating fossils involves shells, bones, and plant materials that leave an impression in mud or in a bed of sand. The organic materials decay, but the impression is preserved and then slowly hardens into rock. *(Teacher Note: Fossils can also be created by the very slow decay of things such as flesh or skin. These fossils help scientists determine the types of plants or animals that lived in a location [and whether they lived on land or in water]. There are four types of fossils: molds, casts, trace fossils, and true-form fossils. In this lesson, you will focus on trace fossils [i.e., fossils formed by a plant or animal in soft clay or silt that is buried by silt over time and preserved] as an example of a "slow" change on Earth.)* This Explore phase will last for approximately two days.

THE *HOW* OF THE EXPLORE

On the first day, make sure that all desks being used for the work area are covered with newspaper or scrap paper. Hand out one cleaned-out milk carton (or wax paper cups) to each student. Have students trim the sides so about half the original carton remains. *(Teacher Note: Depending on the age of the students, you may want to do this for them.)* Mix the plaster of paris and then have students come up to the work area and fill their milk cartons halfway. Let the plaster sit for five to eight minutes. During this time, ask students to select an object with which they can create a trace fossil. This object, once selected, will need to be covered in petroleum jelly so it does not adhere to the plaster. Once the plaster appears to be solidifying, instruct students to gently press their fossil object into the plaster and leave it there for 24 hours. The second day, students will use their craft sticks to pry out their fossil object (this is why the petroleum jelly is important) and see the shape it leaves behind (see Figure 5.7).

Figure 5.7

Sample Dinosaur Fossil Using a Milk Carton and Plaster of Paris

THE *WHY* OF THE EXPLORE

I have never met a class that did not love doing this activity because, unlike so many science experiments, it produces something they can take home and keep for as long as they want. Although the fossil print will be a relatively fast change, be sure to mention how fossils are an example of slow changes on Earth. Students are asked to predict (and analyze) what the fossil will look like in a few days.

Discuss

Although these fossils will only take about 24 hours to set, it is important that you take the time to discuss slow changes on Earth over time and discuss fast changes on Earth during the Discuss portion of the lesson. Ask students if these fossils are formed quickly or slowly in nature. You should explicitly state that you have just made a replica in this lesson but that it would take many, many years for a fossil to form in real life. Ask students to think about fast changes on Earth. *(Teacher Note: Students can more easily identify fast changes once they have a frame of reference for the "slow" changes [fossils]. For example, children may be able to identify a landslide as an example of a fast change. National Geographic has a video called "Landslides 101"* [https://video.nationalgeographic.com/video/landslides]. *By watching this video, students can see a fast change on Earth. Have students watch "Earthquakes 101" from National Geographic* [https://video.nationalgeographic.com/video/101-videos/earthquake-101] *and ask* *them to decide what kind of change an earthquake is (fast or slow). You can also discuss "Volcanoes 101" from National Geographic* [https://video.nationalgeographic.com/video/101-videos/volcanoes-101] *with students.)*

As a class, decide which changes are fast and which changes are slow. Revisit the KWL chart from the beginning of the lesson by answering the following questions:

1. What is our prior knowledge about the age of Earth? (K)
2. What do we still wonder about? (W)
3. What have we learned? (L)

Evaluate

Summative evaluation of this lesson will include assessment of students' understanding of (1) the character trait of being curious and (2) the relationship between fast and slow changes on Earth.

CHARACTER TRAIT

1. Why is being curious an important character trait for scientists to have?
   Being curious allows scientists to generate new ideas from ordinary experiences. For example, Mary Anning loved to question and wonder about things.
2. Describe a time when you were curious.

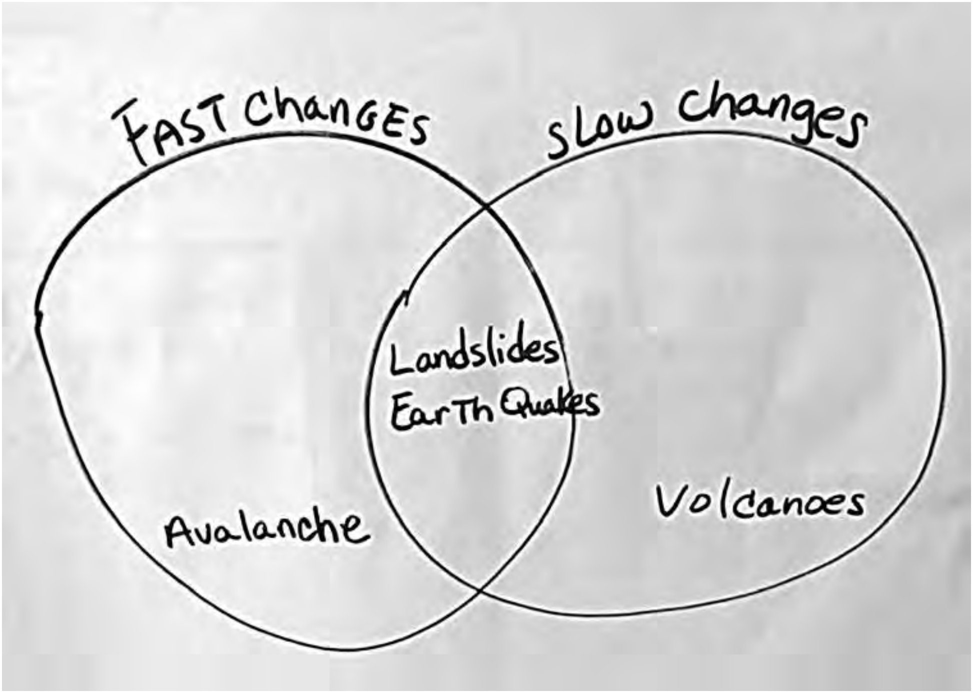
Ask students to work in groups to tell each other about a time when they were curious and to discuss their experiences as a class.

CONTENT

Evaluate the class's responses on the KWL chart. To evaluate how well students understand the fast and slow changes of Earth over time, have them complete a Venn diagram (see Figure 5.8, p. 130) that includes examples of fast and slow changes from the resources (National Geographic videos) and the fossil lesson. Label one side *Fast* and one side *Slow.* How can students quantify a fast change? How would they quantify a slow change? *(Teacher Note: Earthquakes occur as a result of a sudden release of stored energy. This energy builds up over a long period of time. Therefore, earthquakes are both slow and fast changes in Earth's shape, and it would be most appropriate to list this in the middle of the Venn diagram. Landslides [the movement of a mass of rock, earth, or debris down a slope] can occur anywhere. Sometimes they are caused by human activities such as deforestation and construction. Landslides can move quickly or slowly. In terms of this lesson and comparing this change with fossil creation, landslides move quickly. Therefore, these quantitative comparisons are relative, just to give students an idea about Earth and how it can change quickly or slowly. Volcanoes would be a slow* *change and evolve slowly over many years.)* Evaluate the Venn diagram for correct responses (see Figure 5.8).

Figure 5.8

Venn Diagram of Fast and Slow Changes of Earth



Index

Page numbers printed in **bold** type indicate tables, figures, or illustrations.

EUREKA, AGAIN!

K–2 SCIENCE ACTIVITIES AND STORIES

"*Eureka, Again!* offers a rich suite of science lessons expressly developed to involve and inform young learners. This book features an innovative use of age-appropriate, hands-on activities linked to the lives and experiences of actual scientists and engineers and is designed to engage students in learning a wide range of science content and process skills. Simply put, this resource and its grade 3–5 companion have the potential to transform science teaching and learning in the elementary grades."

—William F. McComas, Parks Family Professor of Science Education, University of Arkansas

It's never too early to put a human face on science and engineering! Research shows that a child's ideas about how scientists and engineers look and what they do start to form in the earliest grades. Teachers can help students understand that everyone can do science by introducing inquiry activities in the primary grades. Like its best-selling counterpart for grades 3–5, *Eureka, Again! K–2 Science Activities and Stories* evokes Archimedes's famous cry. That's because it helps children make discoveries of their own about who scientists and engineers are and what they do. The book is so engaging and easy to use that it will become a resource you'll be excited to teach with every year.

Eureka, Again! is appealing because of its lively lessons, which are grounded in 27 children's trade books. Some of the biographies feature famous individuals, such as Rachel Carson and George Washington Carver. Others are not as well known, such as paleontologist Mary Anning and recycler Isatou Ceesay. All of their stories will help students see scientists and engineers not as stereotypes in lab coats but as real people whose success grows out of their life experiences and character traits. They may even inspire children to consider STEM-related careers.

Each chapter is designed to do the following:

- **Focus on science and engineering practices.** These include asking questions and defining problems, planning and carrying out investigations, and analyzing and interpreting data.
- **Bring the processes to life** through the trade books and related lessons. You'll introduce a skill-building, inquiry-based investigation while highlighting the scientists' and engineers' work and the character traits that helped each succeed. You can teach one lesson or all three from each chapter—whatever will enrich your curriculum the most.
- **Be easy to use.** In addition to supporting the *Next Generation Science Standards*, each chapter uses a learning-cycle format and begins with a personal story from the authors that provides valuable insights into teaching this exciting grade range.

Authors Donna Farland-Smith and Julie Thomas point out one other big benefit that makes *Eureka, Again!* a resource you'll keep coming back to. "We like to think of this book as a way to invite scientists and engineers into your classroom," they write, "without the hassle of finding and scheduling guest speakers."

Grades K–2

NSTApress
National Science Teachers Association

PB423X2
ISBN: 978-1-68140-316-8

9 781681 403168