EUREKA, AGAIN! K–2

SCIENCE ACTIVITIES AND STORIES

DONNA FARLAND-SMITH
JULIE THOMAS

NSTApress
National Science Teachers Association

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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.

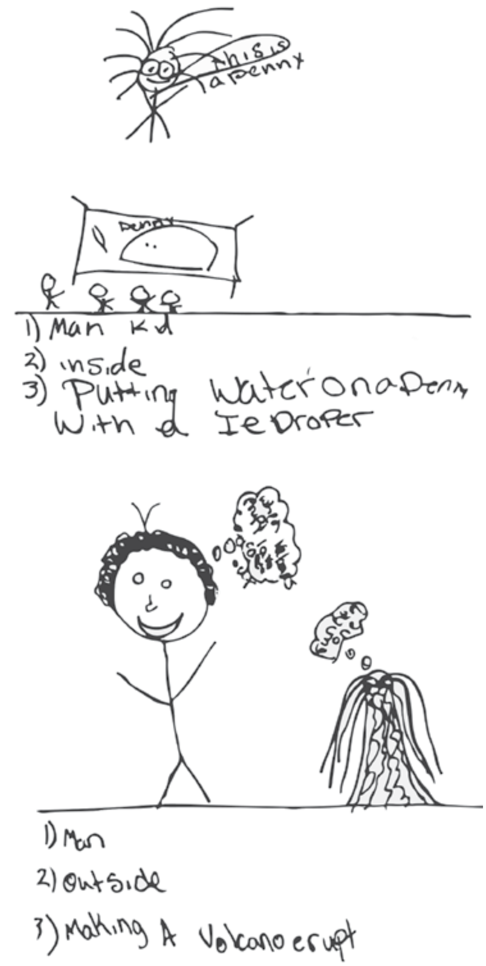
Connect science lessons to science and engineering careers. Think about linking science lessons to real-world career applications (e.g., when and why scientists or engineers measure things). This purposeful addition will illuminate children's observations of scientists and engineers' work and help motivate 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).

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Dedication

This book is dedicated to my budding young scientists, Leo and Luke.
—Donna Farland-Smith

This book is dedicated to my most supportive husband, who has helped me brainstorm, craft, and edit these ideas and lessons from the very beginning.
—Julie Thomas

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About the Authors

Donna Farland-Smith has over a decade of experience in the classroom and previously taught science in all grades K–12. She currently serves as an associate professor of science education in The School of Teaching and Learning at The Ohio State University-Mansfield. Her areas of expertise include teacher education, students' perceptions of science and scientists, and encouraging girls to explore science and engineering fields. Along with several book chapters and many articles about science education, Farland-Smith has written and published four books that inspire children to understand and appreciate scientists and their work: *Jungle Jane* (Authentic Perceptions Press, 2002), *It Takes Two: The Story of the Watson and Crick Team* (Authentic Perceptions Press, 2002), and *The Simple Truth About Scientists* (Authentic Perceptions Press, 2002). Farland-Smith received a BA in elementary education, a BA in natural science, an MA in science education, and an EdD in mathematics and science education from the University of Massachusetts-Lowell. In 2017, she published the book *Many Hands, One Vision: 20 Principles That Built a Children's Museum and Revitalized a Downtown Community* (CreateSpace), which tells about her experience founding The Little Buckeye Children's Museum in Mansfield, Ohio. She is the mom of two young scientists.

Julie Thomas is an experienced elementary classroom teacher and elementary gifted-program coordinator. Now a research professor of science education in the College of Education and Human Sciences at the University of Nebraska-Lincoln, Thomas focuses her efforts on elementary science for teachers *and* their students. She has led both state-funded and federally funded projects and has published research about children's science learning and teacher professional development. Thomas's accomplishments include collaborative efforts such as No Duck Left Behind, a partnership with waterfowl biologists to promote wetland education efforts and Engineering Is Everywhere (E2), a partnership with a materials engineer to develop a time-efficient model for STEM career education. Throughout her teaching career, Thomas has been active in professional associations such as the School Science and Mathematics Association, for which she is a past executive director; the National Science Teachers Association, for which she has authored articles in the journal *Science and Children* and has served on the Awards Committee and Nominations Committee; and the Council for Elementary Children International, for which she is a past president.

SCIENTISTS AND ENGINEERS ARE

CATALYSTS

Learning About **Isatou Ceesay**

Catalyst (n.): a person or event that quickly causes change or action

Lesson: Engineering a Solution

Description

In this lesson, students test different types of plastics for strength and create a new design just as Isatou Ceesay did with the families in her community.

Objectives

Students will consider being a catalyst as the character trait that helped Isatou Ceesay do something about the quality of her environment and create new uses for old plastic bags.

- In the Play portion of the lesson, students will arrange plastic bags from strongest to weakest based on their observations and predictions.
- Students will hear the story *One Plastic Bag: Isatou Ceesay and the Recycling Women of The Gambia* by Miranda Paul and discuss how it relates to the character trait of being a catalyst.
- In the Explore portion of the lesson, students will keep a running tally of how many bags they use at their house in a week. Students will observe several items that can be made from plastic bags.
- In the Discuss portion, students will observe several items that can be made from plastic bags and attempt to make a new item from the materials.

Learning Outcomes

Students will (1) discuss what being a catalyst means and why being a catalyst is an important trait for scientists and engineers and (2) ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

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
K-2-ETS1-3: Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	• Students analyze data from testing plastic bags and design a new tool from the plastic using the data collected.
Science and Engineering Practice	**Connections to Activity**
Constructing Explanations and Designing Solutions	• Students construct a new design from plastic bag strips that will solve a problem they have identified.
Disciplinary Core Idea	**Connections to Activity**
ESS3.C. Human Impacts on Earth Systems Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	• Students will learn about and observe different types of plastic bags in a fair test. They will consider how one plastic versus another would best solve a problem.
Crosscutting Concept	**Connections to Activity**
Structure and Function	• The structure and function of the plastic bag affects the new design.

Overview

In this lesson, students learn how one woman addressed the overwhelming challenge of cleaning up garbage and plastic debris in the form of plastic bags in her community in The Gambia, West Africa. By reading the featured book, students will learn that men and women from all backgrounds choose careers as scientists. The character trait of being a catalyst refers to Isatou Ceesay's determination to solve the problem she encountered in her community. Students will share their

Isatou Ceesay

ideas about scientists as engineers and will discuss how problems are solved. Students will explore multiple solutions for recycling plastic bags and learn why Isatou Ceesay decided to recycle plastic bags and transform her community.

Materials

You will need a copy of the featured book *One Plastic Bag: Isatou Ceesay and the Recycling Women of The Gambia* by Miranda Paul (2015). For each small group (or the class as a whole), you will need approximately 50 plastic bags from grocery stores (send the letter on p. 193 home with students, asking parents to help them collect plastic bags to bring to class). You will need three different kinds of bags (resealable plastic bags, trash bags, and store bags) to test the strength of each in the Explore portion of the lesson.

Safety Notes

(1) Remind students not to place the plastic bags over their heads or mouths during the activity. (2) Use caution when working with scissors or sharps—these can cut or puncture skin.

Setting the Context

Play

Ask students if they have ever noticed that not all plastic bags are alike. There are some that we put our groceries in, some that we put our trash in (trash bags), and some that we put our sandwiches in (resealable plastic bags). Ask students what other kinds of plastic bags they can think of. Discuss these observations with the entire class and make a list in the classroom of the different types of plastic bags. Bring in samples for students to observe, and have the class work together to line up the bags from strongest to weakest. *(Teacher Note: Plastics are used for all sorts of purposes in our lives today. The scientists that study and make new plastics are called engineers [chemical engineers]. Plastics are often used because they are less expensive to make and more durable than other materials, but they are not always good for the environment if they are not disposed of properly or if they are overused, as students will learn from the story you read.)*

Guided Reading

Students will be learning about Isatou Ceesay and her attempt to solve a problem and clean up her community. Find The Gambia on a map and explain to students that it is part of West Africa. Introduce the book by holding up the cover and asking, *What do you think this story is about?* Read the story aloud.

1. **Pages 1–5:** What clues in the first few pages tell you that this story does not take place in America? *(Teacher Note: Some students may notice Isatou's clothing, which is traditional African clothing, or the fact that she carries a basket on her head. If students notice her carrying a basket on her head, you might ask,* Why would she carry a basket on her head? *[If people are carrying loads long distance, it makes it easier if they carry these loads on their heads.] Other students might notice a goat being near Isatou. A goat is not uncommon, but having a goat at your house may seem strange to some students.)*

2. **Pages 5–9:** Isatou is carrying fruit back home in her basket and the basket breaks. What does she notice floating around outside? Why do people seem to let their bags float away? *She notices plastic bags in different colors either floating in the wind or piled up in the dirt. They become part of the scenery until she decides to do something about them as a grown woman.*

3. **Pages 12–14:** The plastic bags tossed out into the open caused many problems for the villagers and the animals. Name at least two problems caused by the piles of plastic bags all around Isatou's village. *One problem was the smell of dirty trash. Animals such as goats would scavenge for food, and they risked eating the bags and dying. Mosquitoes also swarmed near the trash piles.*

4. **Pages 15–17:** Isatou asked her friends one important question that began a positive change in behavior. What was that question? And how did this question solve a problem? *The question Isatou asked was* What can we do? *Isatou and her friends began problem solving to find solutions. They began to wash the bags and then laid them out on the clothesline. Isatou's sister was crocheting as the bags were drying, and they came up with the idea to make "thread" from the bags hanging on the clothesline.*

5. **Pages 20–26:** Isatou teaches the other women to crochet by candlelight, and they design a purse. How did the people in the village react to the women "who believed they were doing something good by crocheting the plastic"? *Some people laughed at the women. Some people said they were dirty for working with those old, ripped, and stinky plastic bags. But many people also wanted to pay for the purse, and Isatou soon had enough money for a new goat. The new plastic purses she engineered not only brought her financial wealth—but also did something very important: They reduced the amount of trash and rubble in the streets.*

Making Sense

Explore

In the story, the plastic bags are able to be recycled and used in a different way because of the plastic they were made from. The bags, once cut and woven together, are actually stronger than before. In this portion of the lesson, students will explore the properties of plastic.

THE *HOW* OF THE EXPLORE

Select three types of plastic bags for students to experiment with. Ask them to record their predictions in the prediction portion of Table 7.2 (p. 191). Ask students to develop a way to test these ideas. Discuss how a "fair test" is conducted. *(Teacher Note: A "fair test" controls for variables and uses a number of trials. For example, I typically ask my students to identify what will be the thing that is different in testing the strength of the plastic bags. The one thing that will be different is the type of plastic bag to be tested. This is the variable. Then I ask students how many times scientists do experiments—for example, do they just do them once and get an answer? Most students are aware that a scientist must test something more than once to arrive at a conclusion that will be respected by the science community. Usually we arrive at a "three and done" rule for testing any* *kind of science experiment. We end by asking the students if they think this is fair or not because we are trying to conduct a "fair test.")* In this portion of the lesson, students will also have to determine the size of the plastic bag to test. For example, a trash bag is much larger than a plastic bag from the store, so how can they make three different bags the same size, and how can you make this lesson about the material versus the size of the bag? Select an appropriate amount of weight to test. Books are usually readily available and easy to manage with younger children. Gather students around and test out the number of books each piece of plastic can hold before breaking. Have students design a new product from the bags if time allows.

Figure 7.2

A Purse Made From Recycled Plastic Bags

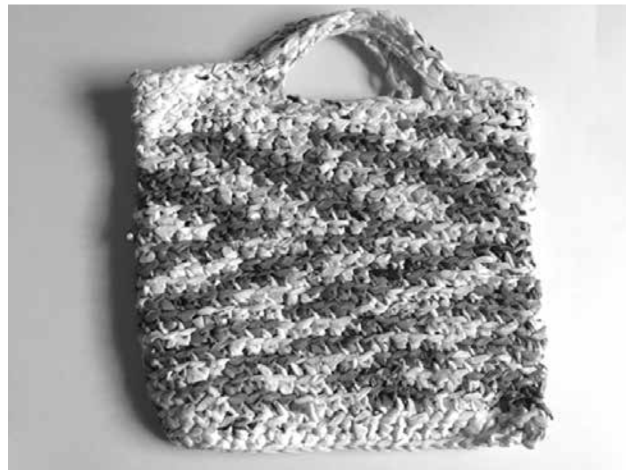
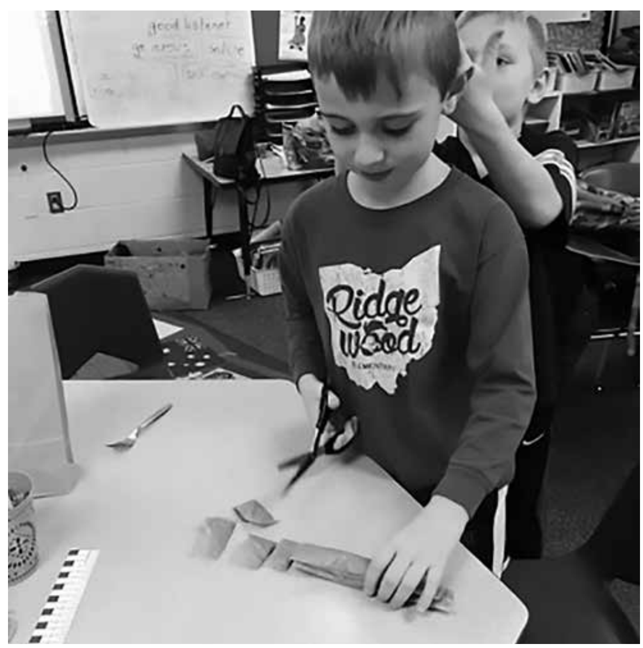


Figure 7.3

Trim the Handles Off the Bag

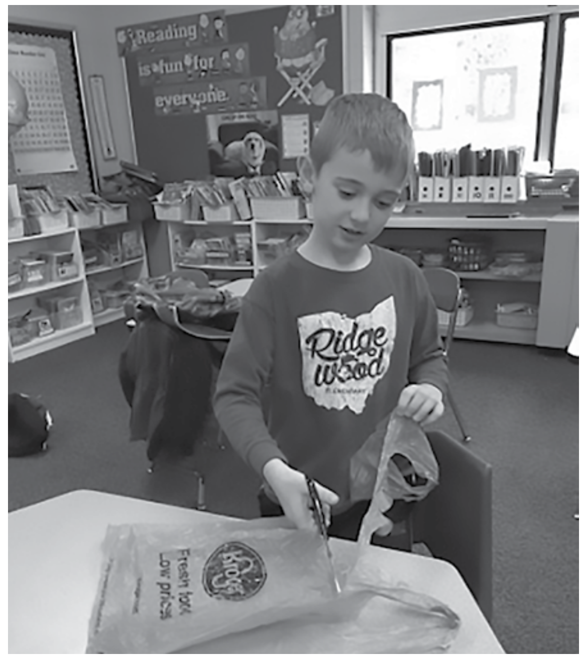


THE *WHY* OF THE EXPLORE

In the featured book, the plastic bags are able to be recycled and used in a different way because of the plastic they were made from. The bags, once cut and woven together, are actually stronger than before. In this portion of the lesson, students will explore different ways plastic bags can be recycled and will be challenged to make a new creation from recycled plastic parts. *(Teacher Note: There are many items that can be made from plastic bags, including flowers* [www.sillysimpleliving.com/2012/01/17/use-plastic-bags-to-make-your-own-flowers]*, shoes, and coats. You may want to share some websites with students, such as "12 Amazing Things Made from Plastic Bags"* [www.oddee.com/item_97040.aspx]*).* You may have an example to show your students (see Figure 7.2 for an example of a purse). You can also easily make a jump rope. Challenge students to create a new item from recycled bags. Begin by cutting off the top of a recycled bag (Figure 7.3) and then cutting the remaining bag into 1-in. circular strips (see Figure 7.4) . This will take some preparation on your part, and child or parent volunteers could be very helpful.

Figure 7.4

Fold the Remainder of the Bag into a 1-in. Strip and Then Cut



Discuss

Hand out the plastic bags students have brought to school and allow students to imagine, create, and design items however they wish. Ask them to bring items into class and share these with other students once they have created a new item from an old bag as a way to solve a problem. Students should receive a checklist about asking questions, making observations, and gathering information about a situation people want to change to define a simple problem that can be solved by developing a new or improved object or tool (see p. 194).

Table 7.2

Data Collection Log for the Engineering a Solution Activity

		Size		Strength Test
Plastic Type	**Prediction**	**Length**	**Width**	**Books**
Plastic A: Grocery Store Bag				
Plastic B: Trash Bag				
Plastic C: Resealable Plastic Bag				

Note: A larger version of this table is available at *www.nsta.org/EurekaAgain*.

Evaluate

Summative evaluation of this lesson will include assessment of students' understanding of (1) the character trait of being a catalyst and (2) how to ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Figure 7.5

Weaving From Plastic Bags to Make a Jump Rope

CHARACTER TRAIT

Encourage students to answer the following questions:

1. If Isatou Ceesay had not developed a solution for her village, how might it look today? *Her village may still have trash bags all around if no one motivated and inspired others to clean up the trash. Of course, someone might have eventually thought to pick up plastic bags, but would they have thought of using the bags in such a creative way for financial gain? Isatou Ceesay was the catalyst who envisioned and initiated this engineering feat before anyone else did. (Teacher Note: The point here is to review Isatou Ceesay's effort to help her village and do something about the plastic bags when others just looked the other way. It is important that children understand that the change started with her.)*

2. Why is being a catalyst an important character trait for scientists and engineers? *Oftentimes, people see problems but no solution, so they don't try to make the world a better place. Isatou Ceesay saw the problem and developed a solution on her own. This character trait reinforces the idea that one person can make a difference for many others.*

CONTENT

Once the class has completed their new designs, evaluate these according to the graphic organizer on asking questions, making observations, and gathering information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. A new design from a recycled bag should accompany students' journal illustrations. A model of the jump rope they created in class might look like the one shown in Figure 7.5.

LETTER TO PARENTS

Dear Parents,

We have started investigating plastic in class, and students are learning how one woman, Isatou Ceesay, addressed the overwhelming challenge of cleaning up garbage—especially plastic bags—in The Gambia, West Africa. In the book *One Plastic Bag: Isatou Ceesay and the Recycling Women of The Gambia* by Miranda Paul (2015), Ceesay discovers that these bags are able to be recycled and used as purses and in many other ways because of the plastic they are made from. Once cut and woven together, the purses are actually stronger than when they were simply plastic bags!
In our classroom lesson related to this book, we will discuss the properties of plastic. Students will explore multiple solutions for recycling plastic bags and learn why Ceesay decided to recycle plastic bags and transform her community.

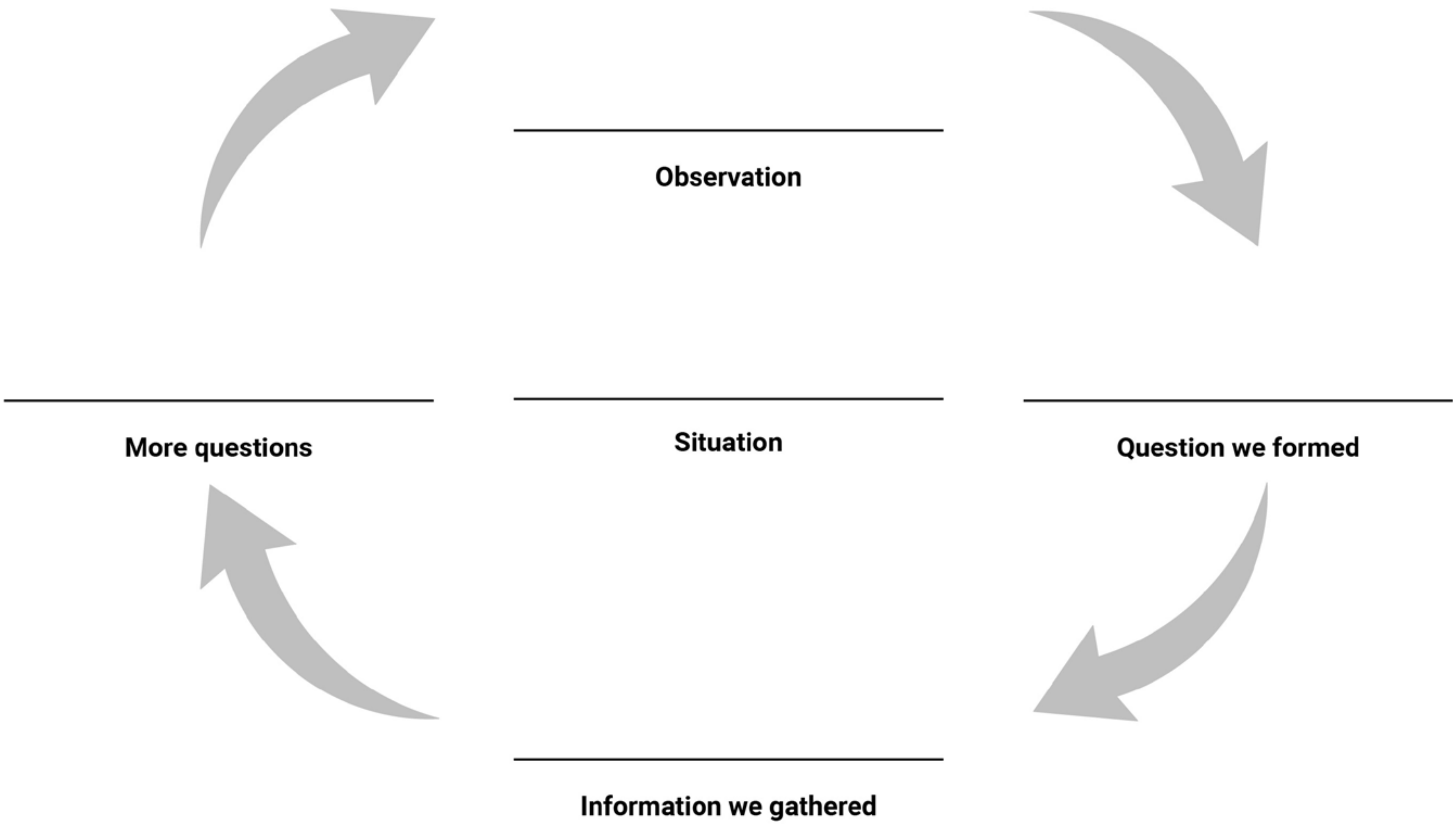
Please collect as many plastic grocery bags as possible for your child to bring into class. We will use them to create new products, just like Ceesay did. Over the next several weeks, be sure to discuss with your child what he or she is learning about plastic and how humans can impact the environment.

Thank you,

____

Name: ______________________________

GRAPHIC ORGANIZER



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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

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