Acting Like Rain

PreK students engage in science talk and head outside to build Earth science knowledge and process skills.

By Kathryn Baldwin and Allison Wilson

"I'm testing the grass," "I'm testing a toy," "I'm testing my hair." These are just three examples of science talk from preK students enrolled in a summer science class. These preK students were asked to predict what they thought would happen as they "rained" on various playground surfaces outside. Many students ran immediately to familiar parts of the playground, eager to test their favorite playground features. Some students focused on artificial structures, some focused on more natural components of the playground. Regardless of what they chose, all focused on practices, such as asking questions, planning investigations, and using models, helping these preK students to transition to the practices of the *Next Generation Science Standards* (*NGSS*).

Having high-quality early childhood education programs that prepare children for success in school and later years continues to be an ever increasing national priority. While the *NGSS* do not provide standards for preschool, there are ample opportunities to use the Standards as a guide to prepare students for later science experiences. The science methods and early childhood professors at our university discussed extrapolating from the *NGSS* to link to national early childhood content standards such as the *Head Start Early Learning Outcomes* (U.S. Department of Health and Human Services 2015). This would allow for preK teachers to meet their standards while also supporting the transition at kindergarten to use of the *NGSS*. When one of us was asked to teach a science lesson for a local preschool class, we identified an opportunity to align both sets of standards into an Earth science lesson for a preK classroom. We examined the *NGSS* kindergarten standards and compared it to Head Start. In this comparison, we noticed that the *Head Start Early Learning Outcomes* differed from the *NGSS* in that they do not focus on specific content (e.g.,

TABLE 1.

PreK guidelines to support K-ESS2 Earth's Systems.

Head Start Early Learning Outcomes (Preschool by 60 months)	**Next Generation Science Standards**	**Connections to Classroom Activity** Students:
Scientific Reasoning	**Science and Engineering Practices**	
Goal P-SCI 1. Child observes and describes observable phenomena. Goal P-SCI 2. Child engages in scientific talk. Goal P-SCI 4. Child asks a question, gathers information, and makes predictions. Goal P-SCI 5. Child plans and conducts investigations and experiments. Goal P-SCI 6. Child analyzes results, draws conclusions, and communicates results.	Planning and Carrying Out Investigations Analyzing and Interpreting Data	• Predict what will happen when water touches different surfaces. • Describe water observations. • Conduct/carry out water investigation. • Use tools to collect and interpret data. • Communicate results.
	Disciplinary Core Idea	
No equivalent	ESS2.D: Weather and Climate. Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time.	• Identify rain as a type of weather. • Identify that rain is water. • Compare the effects of rain on different surfaces.
	Crosscutting Concepts	
Goal P-SCI 3. Child compares and categorizes observable patterns.	Patterns	• Identify and describe patterns of water behavior on surfaces in nature. • Use a chart to sort observations of water behavior on surfaces.

weather); instead, they focus on scientific reasoning, which could support the *NGSS* science and engineering practices and crosscutting concepts in later grades.

We used DCI ESS2.D Weather and Climate as a guide to provide a pre-*NGSS* experience about water/weather. We wanted students to be able to apply the Scientific Reasoning Goals of Head Start. The Scientific Reasoning Goals align with the *NGSS* science and engineering practices such as Planning and Carrying Out Investigations and Analyzing and Interpreting Data (Table 1). We then used a Learning Cycle approach (Bybee et. al. 2006) to outline our lesson about water.

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Children test their predictions on tree rounds.

Shared Book Reading

In addition to the *NGSS*, we wanted to use shared book reading as a way to engage students in science talk about the day's topic. Shared book reading provides structured guidance for intentional opportunities to talk before, during, and after book reading. Strategies include use of the following: open-ended questions to build background knowledge, reinforcement of target content vocabulary words, use of text to make predictions, and use of target vocabulary words to extend knowledge based on connections to the real world. *Shared book reading* has been identified as an evidence-based practice leading to positive outcomes most notably related to language development and content-related vocabulary and knowledge (What Works Clearinghouse 2015).

We recognized the opportunity to use shared book reading strategies for engaging science content knowledge and addressing standards across content disciplines through an integrated lesson plan. Using the book as a hook, we were able to bridge the Early Childhood Literacy Standards while supporting the *Common Core State Standards* (*CCSS*) in later grades (Table 2, p. 33) in a manner similar to our comparison of Head Start's Scientific Reasoning to the *NGSS* science and engineering practices (Table 1).

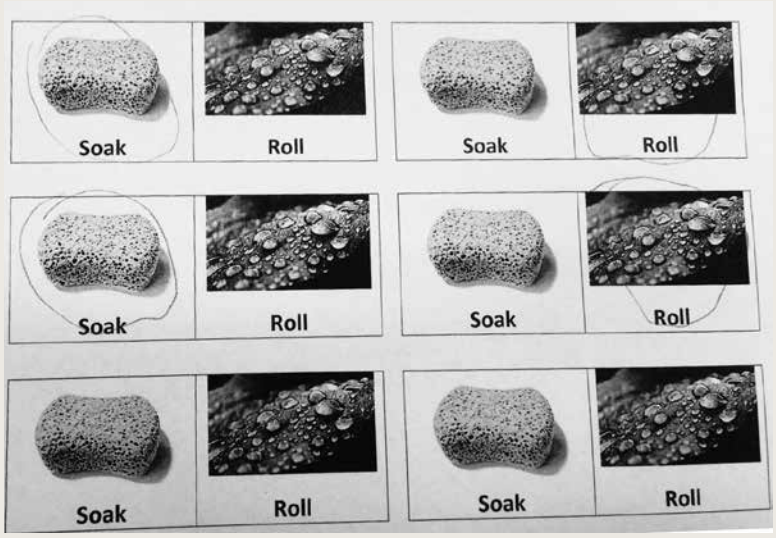
A student selects his hair as a surface to test.

Engage

We began the lesson by stating that we were about to embark on a science adventure about a type of weather. We introduced the book *Raindrops Roll* by April Pulley Sayre (2015) by reading the title and author. While showing the cover of the book, we asked, "What do you think this book is about?" We wanted to focus on the word *predict* as it would be used later in the lesson. We restated student responses using the term *predict* (e.g., Logan *predicts* the book will be about leaves and rain). After reading each page, we paused for a few moments to allow students to view and comment on the photographs and text. We restated student responses and then expanded on those responses, prompting another opportunity for the student to reflect and respond. A few prompts were intentionally embedded

FIGURE 1.

Data collection sheet.



in the story to align with the *Head Start Early Learning Outcomes for Literacy* and the *CCSS* (Table 2). For example, on one page the story says, "they magnify." We ask the students, "What is magnify?" The students responded with, "It makes things bigger," and one student added, "like a magnifying glass." *Magnify* was another word that we wanted to revisit in our investigation.

After reading the book, we asked the students a series of guided questions, such as: *Based on the book, what type of weather do you think we will be investigating today?* (Students' response: rain), *in the story, what were some things that were rained on?* (Students' responses: birds, trees, leaves, bugs), and *what did the rain do?* (Students' responses: makes mud, thuds, drops, magnify, moisten). Lastly we asked, *is rain the type of weather we have today?* (Students' response: no.) We intentionally picked this activity for a day where it was not raining so that we could also model how scientists work and to practice using tools. However, this activity could be modified for authentic rain or revisited, allowing students to compare and contrast experiences.

The types of surfaces that were most commonly tested were concrete steps, brick pavers, gravel, grass, plants from the vegetable garden, tree rounds, and plastic play structures (such as the slide on the playground).

Explore

Before going outside, we told the students, "We might have to pretend to be the rain today. Scientists use tools like these all the time (droppers, water cups, and a hand lens). What do you think these tools might help us to do?"

We handed out the student supplies, which included water droppers, water cups, hand lens, clipboard, pencil, and student sheet. Since we were only using water, no safety glasses were necessary. The types of surfaces that were most commonly tested were concrete steps, brick pavers, gravel, grass, plants from the vegetable garden, tree rounds, and plastic play structures (such as the slide on the playground). We gave the students a range on the playground in which they had to remain so that we could ensure safe testing practices.

We explained the outdoor investigation procedure while using the following teaching strategies as an opportunity to reinforce scientific language and inquiry:

A student tests his prediction on a plastic playground toy.

TABLE 2.

Connections between Head Start and Common Core State Standards.

Head Start Early Learning Outcomes (Preschool by 60 months)	Common Core State Standards	Connections to Classroom Activity *Students:*
Preschool Literacy, Language and Communication	**ELA-LITERACY Kindergarten**	
Literacy Goal P-LIT 4. Child demonstrates an understanding of narrative structure through storytelling/re-telling. Goal P-LIT 5. Child asks and answers questions about a book that was read aloud. Goal P-LIT 6. Child writes for a variety of purposes using increasingly sophisticated marks. **Language and Communication** Goal P-LC 2. Child understands and responds to increasingly complex communication and language from others. Goal P-LC 3. Child understands, follows, and uses appropriate social and conversational rules. Goal P-LC 5. Child expresses self in increasingly long, detailed, and sophisticated ways. Goal P-LC 6. Child understands and uses a wide variety of words for a variety of purposes. Goal P-LC 7. Child shows understanding of word categories and relationships among words.	**Language** CCSS.ELA-LITERACY.L.K.1.D Understand and use question words (interrogatives) (e.g., who, what, where, when, why, how). CCSS.ELA-LITERACY.L.K.5.A Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent. CCSS.ELA-LITERACY.L.K.5.C Identify real-life connections between words and their use (e.g., note places at school that are colorful). **Speaking and Listening** CCSS.ELA-LITERACY.SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups CCSS.ELA-LITERACY.SL.K.2 Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood. **Writing** CCSS.ELA-LITERACY.W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). CCSS.ELA-LITERACY.W.K.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question. **Reading** CCSS.ELA-LITERACY.RI.K.1 With prompting and support, ask and answer questions about key details in a text CCSS.ELA-LITERACY.RI.K.4 With prompting and support, ask and answer questions about unknown words in a text. CCSS.ELA-LITERACY.RI.K.5 Identify the front cover, back cover, and title page of a book. CCSS.ELA-LITERACY.RI.K.6 Name the author and illustrator of a text and define the role of each in presenting the ideas or information in a text.	• Use question words when talking about the story • Ask and answer questions about rain in the story and water outside • Provide details and evidence from the story • Use words for a variety of purposes (predict what will happen in the story and predict what will happen in outdoor investigation) • Sort objects into categories (soak or roll) • Identify examples from their own lives for words in the lesson (model, magnify, predict, etc.) • Recall information from outdoor investigation to answer questions in whole-class discussion • Record results from rain investigation in writing with support from adults • Communicate results with peers

Using targeted vocabulary to extend children's conceptual knowledge. "Today, as scientists, we are going to go outside and *model* rain. We want to *observe* rain on many different surfaces. What are some surfaces we could explore outside? Because we are scientists, before we *test* (try), we *predict*. What is *predict*?" Throughout the conversation and to reinforce student responses, we referred back to the story and the use of prediction and observation of pictures.

Using a visual to depict a vocabulary concept. Students were given a data collection sheet (Figure 1, p. 32) that depicted visuals for *soak* and *roll*. We modeled how to successfully use the sheet for *prediction*. "Before testing, predict. Will the water soak in or roll off? Circle the image that matches your prediction." We then modeled the use of the eye dropper to *model* rain, and then the use of the hand lens to *magnify* and *observe* the drops, and finally record the *results*. "*Results* are what happened. Record your results by circling the image that matches what happened, *soak* or *roll*."

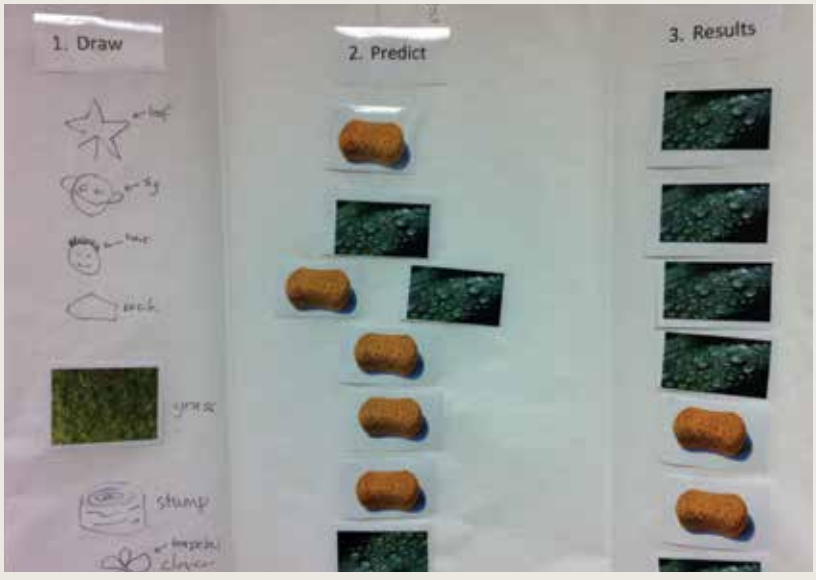
Scaffolding with adult support. We had students divided into four groups of four to five students, with four adults and two middle school students as group leaders to assist with the procedures and labeling of drawings on the student sheet. Students were a mixed group of three- to five-year-olds. The student data collection sheet was used as both a formative assessment during the lesson and as a final summative assessment. Recording data on the student sheet proved to be the biggest challenge for the three- to four-year-olds. Most four- to five-year-old students remembered our modeling of how to record data on the student sheet. Group leaders provided one-on-one modeling of the student sheet with the younger students. Some students chose natural surfaces and others chose artificial surfaces like playground equipment, which is what we expected.

Explain

When we returned from outdoors, we used a large piece of butcher paper to record the class results (Figure 2) from individual student sheets. After recording results, we examined the data for patterns and asked questions like, *were your predictions and results the same? What results surprised you? Did water look the same on all surfaces?* The students noted that many of their results were different than their predictions. We discussed and emphasized how this was okay, *this is what scientists do, they test their predictions*. We began the discussion by having a few students share their results but then realized that it would take far too long for each student to share the results of three surfaces so we changed to a "how many of you tested…" approach with students raising their hands in response. Last, we referred back to the book and read some of the "A Splash of Science" section and asked, *how many of you tested something with a waxy or a plastic surface?* Many raised their hands and noted that the water rolled up in a ball or rolled off of surfaces with a coating (waxy leaves, painted bench, and so on). We discussed that water likes to roll up into a sphere shape but some of the surfaces might break the sphere shape.

FIGURE 2.

Class results.



Elaborate

In retrospect, one of the challenges we faced is that we were classroom guests and we weren't able to take advantage of the classroom routines and schedules in order to expand the lesson to a whole unit of study. Although we feel the lesson was successful as a stand-alone, it might be better expanded to a multi-day unit where we could elaborate and embed the unit across an entire day through various routines. We would likely begin the same way, by reading the book and introducing the activity during circle time, then in small groups carry out the activity outdoors and complete the charts individually (as described here), but then during playground time, we would have the materials

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available again for open exploration before coming back to the whole-class discussion and chart. This could lead to further project-based learning focused on engineering design through prompts such as:

Let's imagine that you wanted to build a fort outside and you wanted to build it with materials from nature like we found today. Imagine that you wanted to stay dry in your fort. What type of materials found today would be best?

or

Imagine that you are a _____ (bird, type of insect) How do you use water (drink, wash)? How do you use surfaces outside? Do you want to hide under leaves? Or do you want to be rained on?

We would then provide more time for students to build structures and models to solve problems or answer questions. We would also intentionally embed materials related to the day throughout different play areas such as the library, dramatic play area, playground, and sensory table.

Evaluate

We used questioning as a preassessment and as a formative assessment. For example, we asked, "What is rain made of?" To which the students shouted, "water!" Knowing the students already knew that rain was made of water, we could focus on water observations. We used the student sheet to check for student understanding on concepts and tasks and as a summative assessment. We also used the whole-class discussion at the end to make sure that students could explain vocabulary and science content.

Conclusion

Preschool is the perfect time to use the shared book strategy to engage students in scientific talk and scientific inquiry. This strategy allowed students to build both science and literacy skills to support future science learning. The hands-on, outdoor activity allowed students to connect talk with their everyday lives and to bridge expectations of Head Start and those of the *NGSS* and *CCSS*. ■

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Resource

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