Using Inquiry to Learn about Soil: A Fourth Grade Experience

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ABSTRACT In this article, we describe a fourth-grade inquiry unit on soil. The unit was designed and taught by preservice elementary teachers as part of a university science methods course. Using a student-driven inquiry approach to designing curriculum, the unit engaged fourth graders in learning about the physical properties soil, erosion, worms, and plants. Hands-on activities, literacy strategies, and informational texts and websites were used to build student learning.

KEYWORDS Earth science, elementary, inquiry

BACKGROUND

As part of a field experience for an elementary science methods course, university students (preservice teachers) worked in groups of four to develop and teach science lessons to fourth graders. The topic of the field experience was soil and had been selected by the cooperating fourth-grade teachers at the elementary school where our field experience was held. We were able to teach an eight-session inquiry unit on soil, and each lesson was 1 hr long. Our university requirements included incorporating literacy as well as science into the lessons so we will highlight where integration occurred. Our article has four main sections: the rationale for teaching and designing the lessons the way that we did; the day-by-day plans with activities highlighted and described, a discussion of the work that the fourth graders produced and what we were able to assess about their learning from the products that we collected; and last, connections to the fourth- and fifth-grade Next Generations Science Standards (NGSS) (2014) and the Common Core Standards for English/Language Arts (CC/ELA) (Common Core Standards 2010). In addition to scientific writing, reading of nonfiction, and informational texts and the process skills associated with science learning (observations, recording, sense-making, etc.), we focused on the following conceptual ideas (both for the preservice teacher learning and for the fourth-grade learning): soil is an important and changing material for many living things; soil is affected by wind, water, and other elements; and soils look and
feel differently depending on where they are located and how they function in the environment and the physical properties of soils. See Table 1 for a complete list of activities and corresponding days in the unit.

### THINGS TO CONSIDER WHEN TEACHING SCIENCE

For 6 weeks before the start of the field experience, we participated in an inquiry unit around soil with our science methods professor. This long-term investigation afforded us the opportunity to engage with inquiry ourselves and also to increase our content knowledge of soil. Both of these were very important since, for many of us, the opportunities to engage with inquiry had been limited, and many of us did not recognize the complexity of learning about soil. For example, during our first day of investigating with our professor, many of us were thinking things such as “What is there to know about soil?” and “How can we spend several weeks investigating dirt?” At the same time, we were reading and learning about inquiry-based science teaching in our science methods class. These readings, coupled with the hands-on investigations, allowed us to experience inquiry firsthand before we tried to teach that way. We quickly realized that engaging in inquiry could be exciting and frustrating at the same time. While we appreciated the attention that our professor paid to our questions, it was challenging to be so responsible for decision-making when we were used to being told what to do or what steps to follow. Ultimately, as a group we were able to be successful with inquiry and feel better prepared to teach that way. Several instructional strategies that our professor used helped us plan when it came to designing our own lessons for the fourth graders. Grounded in the readings for our courses and the experiences that we had ourselves, there were three main ideas that we looked to when it came to making our own instructional decisions. We will describe these below.

### Student Voice Is Critical

For us, student voice means that students are encouraged and expected to participate in instructional decisions (Koch 2009). Sometimes these can be “big”

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**TABLE 1 Activities and Engagements for Fourth-Grade Soil Unit**
decisions, such as what topic to study, but more often they are “small” decisions—for example, choosing a station, participating in making a KWL (Know, Want to know, Learned), or helping to develop a “next-step” activity—that help to empower students to see themselves as capable of doing science and able to make decisions about their learning. During the development of the inquiry unit, we paid careful attention to when and where we could add opportunities for student voice and choice. We knew from our own experience with the soil inquiry that making decisions and being involved with the curriculum development was key to keeping us engaged and involved with the learning. For example, when we were instructed to choose a station that was most appealing to us, we were more likely to be engaged. In the role of the teacher, this approach allowed us to stay connected to the ideas that the students had. When students were able to share their ideas, they were able to see how what they already knew and experienced was an important part of the learning process.

Literary and Visual Activities Strengthen the Science Learning

Almost from the beginning of our own inquiry experience, we were connecting to visual literacy and language activities. One of the activity stations that we explored ourselves was an “invitation” station that encouraged us to read about how soil was used around the world. The short articles (National Aeronautics and Space Administration n.d.) were printed out and attached to construction paper. We were invited to read about the ways that international cultures use and value soil. These multicultural and literary connections allowed us to see (and then help the fourth graders see) how science is not only traditional experiments but also a way to think about how the natural world connects to us in many ways. Using visual and literacy resources and activities taps into additional ways to engage students with science. As teachers we used text sets when possible to offer students an informal way to find information. While some scientific ideas are best learned through hands-on activities, many other ideas require connecting to text sources for further elaboration. Students were also encouraged to draw as a way to not only represent their thinking but as a way to push their thinking even farther.

Getting to Know Students and Their Ideas Helps to Plan Instruction

Since inquiry is student-driven, it is imperative that we as teachers understand what our students are thinking. Making sense of the student thinking is not always easy (Hammer and van Zee 2006), but it can always be useful in helping us plan instruction. We also found that getting to know students on a personal level helped us to learn conceptually what students knew and wondered about the topic, understand modes and ways of knowing that worked for individual students, and honor and value ideas that students would bring from their home and life outside of school (Moll et al. 1992).

Additionally as part of the inquiry planning, we needed to figure out for each session what students were thinking and wondering about so that we could plan effectively for the next lesson. It was important for us to use different strategies (e.g., hands-on activities, KWL chart, science talks, writing in journals) to get students to share and record their ideas and questions (e.g., Why is soil different colors?, What lives in the soil?).

In the following sections, we describe the unit of study and include the purpose for the lesson, materials used, procedures and activities, and observations and discussion for each of the 8 days. We include connections to the NGSS and the CC/ELA standards after each lesson description as a way to make the connections between science and literacy more tangible. To make the connections most relevant, we have included whichever NGSS and CC/ELA standard, practice, core idea, essential concept, and so forth we felt was most appropriate for the activities and learning goals. We ask the reader to refer to the websites for fuller descriptions of these.

SOIL—THE UNIT OF STUDY

Day 1—Doing Science

Purpose

The main goals for day 1 were to get to know our students and their ideas about being a scientist, doing science, and soil. We used several different strategies and activities to gather this information (see below procedures and activities). These activities helped us to get to know our students (their interests, likes/dislikes, etc.)
and to offer them a way to talk about science experiences that they wanted to share. Having materials to visually represent concepts encouraged the students to not only write but to draw their ideas.

**Materials**

- Journals/Documenting system for each student (anything will do, such as stapled-together paper or inexpensive notebooks or folders)
- Colored pencils
- Chart paper

**Procedures and Activities**

To understand our students' current knowledge about science, we conducted a Science Interest Inventory. Questions included

What is a scientist?
What does science mean to you?
Can you do science every day?
What do you like about science?
What don’t you like about science?
If you could investigate anything as a scientist, what would you do?

We had students respond to the prompts and then had a group discussion. This helped us learn about the students and also encouraged them to learn more about one another. As teachers we also shared our thoughts on science and learning and doing science. We conducted a modified KWL (Carr and Ogle 1987) discussion with our students to record what they already knew about soil and what they would like to learn about soil (what questions they had). We did this same activity in our own class, and we were all amazed at the number of things that we both knew and wondered about with regard to soil. To develop ownership of the unit, we had students decorate and use a science journal (see Figure 1). The journal was helpful as both a recording tool and as an assessment piece at the end of the unit.

**Connections to NGSS and CC/ELA**

- NGGS: Connects to Practice 1—Asking questions (for science).
- CC/ELA: Literacy.W.5.8—Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

**Observations and Discussion**

From the Interest Inventory, we learned that our students had some positive experiences and perceptions of science. No students in our group made negative comments about science or said that they did not like science. All the members of our small group stated they liked science or were “OK” with science. All of the students were excited to be able to do science “experiments,” and we realized that students used the words “experiment” and “activity” interchangeably. Students were encouraged to draw, write, and then discuss their perceptions of science. Using multiple modes of expression (Girod, Rau, and Schepige 2003) allowed us to see the different perceptions about doing science, and being a scientist, that students had. As we expected, some students had traditional ideas about being a scientist, similar to Barman (1997) (e.g., scientists are white men working in a lab), while others had more nontraditional ones (e.g., scientists can be women of color and/or working in non-lab settings). From the KWL, we learned that our students were interested in different types of soil as well as extensions of soil such as erosion, volcanoes, plant life, and animal life. This was critical information for us as curriculum planners.

**FIGURE 1** Science journal.
Day 2—Investigating Local Soil

**Purpose**

In our first session, we used detailed questioning to begin to understand our students’ ideas about soil and dirt. We also asked what they wanted to learn about soil and dirt. For this second session, we wanted the students to investigate the different properties of soil, but in a way that would physically engage them and promote questions and curiosity about the topic. In our college class, we used the terms “physical messing around” and “mental messing around” (modified from “messing about” in Hawkins 1962) to describe the processes of wondering, thinking, and physically manipulating materials at the beginning of the inquiry experience. With messing around, the specific goals are student engagement, wonder, and generation of questions. We found that this messing around helped (for us and for the fourth graders) to build confidence in the ability to do science. As the students were messing around, we wanted to study their strategies of observing and investigating. How comfortable were they making decisions about what to do next? How easy was it for them to use equipment and develop investigative processes? This lesson engaged the students mentally and physically and helped us determine what supports the students would need to move forward in their investigations.

**Materials**

- Journals/Documenting system for each student
- Colored pencils
- Chart paper
- Local soil samples (collected by the preservice teachers and professor)
- Microscopes
- Paper plates and spoons to “mess around” with the dirt
- Magnifying glasses
- Books about soil—our read-aloud book SOIL! Get the Inside Scoop (Lindbo 2008)

**Procedures and Activities**

To understand our students’ current knowledge about soil and to get students to generate questions about soil, we asked students questions such as: What does the soil look like? In plain sight? Under a microscope? Under a magnifying glass? How do the colors differ from one another? How are the textures different? Are there similarities in the different soils? What do you wonder about? Students were supplied with a science journal and writing tools to record their ideas, observations, and questions. Students were supplied with various observing tools (hand lenses, magnifiers, rulers, and microscopes) and were encouraged to make observations about the local soil samples that we provided. Students were encouraged to write down their questions as well as their observations.

**Connections to NGSS and CC/ELA**

- NGSS: Connects to Core Idea ESS2—Earth’s Systems—how and why is Earth constantly changing?
- NGSS: Connects to ESS3:C—Human impact on Earth’s systems.
- CC/ELA: W.4.2D—Use precise language and domain specific vocabulary to inform about or explain the topic.

**Observations and Discussion**

When we started our lesson, we told the students to be ready to discuss, in our group, some things they had learned about soil from using their senses. This included looking through the microscopes, feeling the soil with their hands, and smelling the soil samples. The students observed and documented the colors of soil (brown, red, beige, and black) as well as the texture of the soil (lumpy, wet, dry, and crumbly). The students became excited when we discovered items in the soil, such as twigs, roots, bugs, and the occasional pebble. It was very engaging for the students to use different tools to get a closer look at the soil. Students’ questions included: Why is the soil not one color? Why is the soil wet? Why is the soil so lumpy? Do, and how can, things live in soil?

Day 3—Investigating Soil Near and Far

**Purpose**

Based on the standards and what the class was interested in (see questions above), we wanted the students to continue to make connections between the
composition of soil and its function. As a way to do this, and to build on the students’ interests, we asked them what they thought soil in other places/states might look like and why. The students stated that they did not know what soil would look like from other places because they had never been there. They also said that they were interested in what other types of soil would look like.

**Materials**
- Journals/Documenting system for each student
- Colored pencils
- Chart paper
- Soil samples
- Microscopes
- Paper plates and spoons to “mess around” with the dirt
- Spade (to collect the dirt from outside)
- Magnifying glasses

**Procedures and Activities**
We organized a collection of soils for the students to investigate. In our own college course, we had access to soil from Arizona (from our professor), and we collected samples ourselves from Georgia as well as Florida. We also collected soil from the schools grounds and added these to the original collection. We started a discussion with the students about what soils in other places might look like. Continuing with the KWL allowed us to give our students voice and showed us what they knew and what they still wanted to know about soil. We took our students outside and had them collect soil samples with us. The students took some time to investigate the soil using their senses, magnifying glasses, and microscopes. Students were asked to record (i.e., write and/or draw) what they observed and what they wondered about in their journals. When they finished with their journal entries, we conducted a group conversation about what everyone found and described in their journals. We also added information and questions to our KWL poster. During the discussion, we were careful to let the students share their observations and questions, and we tried to encourage them to ask each other about what they had done. We were intentional about this as a way to help build confidence in the scientific process.

An activity that grew unexpectedly out of the investigating was one centered on the solubility of soil. Students were interested in how the different soils would interact with water, and we encouraged them to develop a way to investigate this. The students decided to mix water with the different soil samples to see what would happen. This activity supported the student-driven nature of the inquiry and helped the students develop an understanding of how different soils mix with water. It also helped students think about why soils might seem wet and how that connects to the function of soils in different places.

**Connections to NGSS and CC/ELA**
- NGSS: 5-PS1-3—Make observations and measurements to identify materials based on their properties.
- CC/ELA: W.5.7—Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**Observations and Discussion**
We revisited the KWL chart to find out what the students wanted to explore next and to record ideas and understandings from the soil/water activity. We discussed in detail the solubility of soil. We introduced the word solubility as a “science word” after the students realized that certain samples dissolved more in the water. The students liked seeing and feeling how the soil changed in texture when we added water. The students were quick to observe and notice that sand did not interact with water the same way as more “dirt-like” soil did. We talked about why this could be, and several students gave explanations and reasoned why they thought sand and soil mixed differently. Students were making sense of how the materials’ ability to stick together was connected to the location and function of the soil. For example, a grainy sand material vs. a smoother local soil might offer insights into how plants in the local environments used the soil for support and water supply. It was also becoming clear that the students liked the KWL chart because the “what we learned” section of the KWL chart grew with each session that we met. We found the KWL to be a very productive tool to use during this inquiry investigation and an excellent way to document students’ learning.
Day 4—Erosion

Purpose

After four sessions observing, classifying, and analyzing different types of soil, we looked to the KWL, and the students, to help decide which direction to take the inquiry. We saw that during our first session, students expressed an interest in erosion, and this also connected to the NGSS and the pacing guide framework for the school district. From our discussions with the students we knew erosion had been briefly discussed in their class. We saw this as an opportunity to extend that learning. Our main goals for this day were to get the students thinking about two main types of erosion—wind erosion and water erosion. Since students had already been thinking about how water interacts with soils, this seemed to be a reasonable next step.

Materials

- Journals/Documenting system for each student
- Colored pencils
- Chart paper
- Graphics and books about erosion
- Hair dryer
- Tablet/iPad/Computer (to show pictures of the different kinds of erosion)
- Box
- Sand
- Wet and dry soil
- Gravel
- Dirt
- Cup
- Water

Procedures and Activities

We started the lesson by asking the students what they knew/remembered/thought about erosion. We showed the students pictures and books that illustrated erosion as a way to extend the discussion and generate more questions. We then offered two activities for the students to engage with. The first one was a wind erosion activity. Both wet and dry sand were subjected to the “wind” from a hair dryer. Before blowing any materials, we asked the students to predict which type of soil they thought would erode the quickest and why. The next activity we did involved water erosion. We took sand, dirt, and gravel (intentionally choosing differing particle sizes and solubilities) and put them in three separate containers. We used the same amount of water each time and poured a light stream of water onto the three samples. Together, we observed what the water did to each sample. During and after these activities, we had the students write or draw pictures in their science journals about what they noticed and why they thought it happened. We also had a group discussion about what each student wrote down.

Connection to NGSS and CC/ELA

- NGSS: 4-ESS2-1—Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- CC/LA: W4.8—Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information and provide a list of sources.

Observations and Discussion

The students were engaged with the activities with wind and water. With the wind and dry sand activity, the students noticed that when the blow dryer was turned on, the sand flew around very easily. Some students suggested this could have been because of the sand’s “lightness” and that the sand would naturally be blown away because it does not seem to weigh as much as the wet sand. Students recognized that the effects of wind erosion would be experienced sooner with the dry sand. The students compared the dry sand to the wet sand with the wind activity, noting again how the two differed in a comparable way to when the water was added to the samples during the previous session. Students developed a sense that soil materials with and without water experienced effects differently and therefore were a part of erosion at different rates. With the water activities, the students noticed that some sand absorbed a bit of the water and some sand did not because the water pooled in areas of the container. Students were able to discuss how a material’s ability to absorb water might have an impact the effects of erosion.
Days 5 and 6—Soil as a Habitat

Purpose

The students had been fascinated with finding worms and other living things in our dirt samples, so we felt it was important to attend to their curiosity and explore soil as an animal habitat. Since we also wanted to extend our students’ experience with soil beyond the physical properties of soil to how soil supports life and is important in the environment, this was a nice way to meet both goals. What we realized was that we essentially began this extension on day 3 with the water activities and continued through day 4 with erosion. Further extending the inquiry into “what lives in soil” seemed a logical next step.

Materials

- Journals/Documenting system for each student
- Colored pencils
- Chart paper
- Materials for worm habitat (SPELL Outloud)
- Books and Internet resources that included information about soils ecosystem, what lives in soil, worms, and how worms affect soil

Procedures and Activities

Our lesson plan consisted of four stations that we spread out over 2 days. We did the first two stations on day 5, and the last two stations on day 6. We had the students split into two groups. Each group started at one station and moved to the next when they were ready. Two preservice teachers were at each station asking questions, probing thinking, and guiding the students in their tasks. At the first station, the students began to read about the types of animals that live in the soil and how soil is used for a “home.” Using questions that they had generated and that we had recorded on our KWL, students used Internet and print resources (a variety of books easily obtained from a local library) to find answers to their own questions. The students documented their findings under the “L” on the KWL as well as in their journals. In the second station, the students went outside to collect a soil sample that “housed” some sort of living thing, whether it was an animal or a plant. The sample was brought back to the classroom and explored with their senses, magnifiers, microscopes, and measuring tools. In the third station, the students collected and observed earthworms from around the school. We put the worms first on a tray so that we could observe them. At the end of the session, we placed the worms in the worm house that was built as part of station 4. The worms were measured and observed, and students predicted what they would do and why. In the fourth station, the students created a simple earthworm house. Together we constructed the worm house and recorded how we saw the worms adapting and moving. There are many online resources for building a worm habitat—see SPELL Outloud as an example. Before actually constructing the house, the students generated predictions on what the worms would do in the house and what a worm house might need. These predictions were then used as launches for discussions once the worm house was built.

Connections to NGSS and CC/ELA

- CC/ELA: Literacy.RI.5.7—Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
- CCSS.ELA: Literacy.RI.5.8—Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).
- CCSS.ELA: Literacy.RI.5.9—Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- CCSS.ELA: Literacy.RI.5.1—Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- CCSS.ELA: Literacy.RI.5.2—Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- CCSS.ELA: Literacy.RI.5.3—Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

Observations and Discussion

All the stations supported the students in understanding that animals need things such as food, water,
and sunlight (indirectly). Students were able to conjecture what the animals needed by observing them and the worm house and by examining the informational resources. Because they really had a purpose for reading (Romance and Vitale 1992), the students connected to the books that were brought for them to explore. Several times students at different stations would arrive at the same conclusions and could confirm for one another that indeed the information was correct. For example, one student read that worms and other underground animals that live in the soil “like” the coolness of the soil and are protected from the harsher elements by being below the ground’s surface. This idea was confirmed by another student, who was busy observing the living worms in the worm house! It was powerful to have the students engaged in multiple stations simultaneously.

**Day 7 — Soil and Plants**

**Purpose**

The soil explorations on days 5 and 6 generated many questions about the plants that grow in soil. While we didn’t have much time remaining, we felt it was appropriate to start exploring plants within our soil. The students were very engaged when they were digging and finding samples, so we extended the investigation of soil by encouraging them to physically engage in finding plant samples.

**Materials**

- Journals/Documenting system for each student
- Colored pencils
- Chart paper
- Variety of books
- Plant samples from gardens
- Articles and pictures devoted to plants (for the students to access in their research)
- Materials necessary for collecting and storing plant samples

**Procedures and Activities**

We opened the lesson by making predictions about our earthworm habitat. Then we made observations about the habitat and recorded them in our journals. We then moved on to discussing our knowledge about plants and used the books and resources provided to answer questions and discover more about plants (see Figure 2 for a chart students made that includes questions and knowledge about plants). We then took the students outside to collect their own plant samples. We also brought plant samples for students to look at. We passed around the samples to let all the students feel and see all the samples. The students made observations and recorded what we as a group learned in our journals (see Figure 1). We also released our worms from the habitat/ecosystem.

**Connections to NGSS and CC/ELA**

- CC/ELA: W.5.7 — Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

**Observations and Discussion**

We started our discussion with the earthworm habitat. The students made several noticings about the tunnels the earthworms had created. The students also observed that one of the worms died but that other worms were still alive. We discussed why the earthworm might have died and what we could have done to prevent that. Several students went back to the books on earthworms and searched for information about keeping worms alive in constructed habitats. The students then passed around samples of plants from flowerbeds and gardens. They commented on the texture of some of the plants and the variations from other plants. We looked at the roots of the plants, if possible. The students made comments about the thickness or thinness of roots. There were many questions and ideas about how the roots in plants can hold onto soil and minimize erosion.

**Day 8 — Documenting Our Learning**

**Purpose**

We intentionally chose activities to close our unit that would showcase how much the students had learned over the 8 days. We created a graffiti board puzzle (Short, Harste, and Burke 1996) (described
below), discussed our KWL charts, and completed a read-aloud book selected by our students.

**Materials**

- Journals/Documenting system for each student
- Colored pencils
- Books, articles, pictures, and their journals to help the students review the information they learned
- Puzzle pieces for graffiti board (to connect their learnings together)
- *How Groundhog’s Garden Grew* by Lynne Cherry

**Procedures and Activities**

The graffiti board is a literacy strategy often used after a group of students have read a book or had a similar instructional experience. Typically, a large piece of poster board or butcher paper is used as the “board,” and students, supplied with markers, crayons, and pencils, are encouraged to record/write/draw their thoughts and ideas in random places on the poster. After the poster is created, it can be used as a touch point for discussing ideas generated by the students, to make connections between different ideas and to encourage even more questions. We modified the strategy a bit by using large puzzle-shaped pieces as the graffiti boards (see Figure 3). The puzzle pieces were then assembled together to create a large class puzzle. As a way to tie together many of the ideas we anticipated that the students would share, we brought several read-aloud books and asked the students to choose one for us to read together as a closing activity. Anticipating the need for closure, we discussed with the students that this would be our last day. We thanked the students for working with us and for participating with writing in journals and discussing as a group/small groups.

**FIGURE 2** Student generated chart about plants.
Connections to NGSS and CC/ELA

- NGSS: 4-EES2-1—Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- NGSS: 5-PS1-3—Matter and Its Interactions: Make observations and measurements to identify materials based on their properties.
- CC/ELA: W.4.2D—Use precise language and domain-specific vocabulary to inform about or explain the topic.
- CC/ELA: W4.8—Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information and provide a list of sources.

Observations and Discussion

Using the puzzle pieces, the students documented many ideas, such as properties of soil, color of soil, solubilities of soil, and the connection between soil and erosion. Students connected to the activities that we did with the wind and water as well as the solubility experiment that they designed themselves. Several students drew pictures of worms and worm habitats, and several drew different root systems with notes about how the thickness of the roots could protect soil from erosion. Assembling the puzzle by connecting all the pieces allowed us as a class to celebrate everyone’s contributions. The students were excited to share what they had recorded on their puzzle piece, and the completed puzzle was a nice, large class representation of the unit.

CONCLUSIONS AND/OR IMPLICATIONS FOR TEACHING

Through this soil study, we were able to experience the importance of inquiry learning and teaching. While we were facilitators, and definitely made instructional decisions, the idea that the students’ questions and interests played a strong role in the direction of the inquiry was a critical component to the success of the unit. The students were highly engaged in the activities, and we expect that this had much to do with the fact that the topics were ones that they previously expressed interest in. Through the use of the journals and graffiti board, we were able to include many opportunities for students to represent their understanding with drawings, and this also helped to engage the students. Drawings and informal written work (e.g., KWL charts) gave us several access points into the students’ understanding about soil, erosion, science, and worms. These and science talks allowed us to tailor the lessons to the interests of the students while staying on track with our standards. While it was not always easy to incorporate the things that we felt were important in teaching science (student voice, literacy connections, and student-driven curriculum), these tenets were overwhelmingly successful in engaging students and in helping us understand students’ thinking.

REFERENCES


FIGURE 3  Puzzle piece.


