Observing Life in a Square

Students experience fieldwork in their own backyards.

By Meredith Park Rogers and Melonie Steele

Study nature, love nature, stay close to nature. It will never fail you.
–Frank Lloyd Wright

This quote embodies the kind of connection to our outside world we wish for all children. Surveying 150 pieces of research on outdoor learning, Dillon et al. (2006) found "substantial evidence to indicate that fieldwork properly conceived, adequately planned, well taught and effectively followed up offers learners opportunities to develop their knowledge and skills in ways that add value to their everyday experiences in the classroom" (p. 107). The study described in this article has elementary students exploring their own backyards to experience the kind of fieldwork scientists might do in order to add value to their learning about the living world around them.

The Role of Fieldwork in Elementary Science Learning

Much has been written about developing outdoor classrooms or how to generate effective and integrated learning using the outdoors (e.g., *Science and Children* vol. 37, issues 5 and 7). However, with the release of the *Next Generation Science Standards* teachers need to consider how they are going to design their science curriculum to include opportunities for students to learn about core disciplinary concepts, science and engineering practices, and the big ideas of science referred to as crosscutting concepts (NGSS Lead States 2013). For a seamless integration of all three dimensions, teachers will need to reimagine their approach to teaching science.

The "life in a square" unit is designed to address this integration of science and engineering practices, core disciplinary ideas, and crosscutting concepts outlined in the new Standards. Bridging these areas of knowledge helps students to see how core ideas extend beyond the boundaries of a single science discipline. Life in a square provides students with opportunities to first learn necessary skills for effective fieldwork, such as making direct observations and the use of science tools to enhance those observations, and then how to explain evidence to make sense of what might be going on within the system being studied (Park Rogers 2009). At the same time, teachers can go into depth about the needs and development of living things (plant and animal) according to their grade level expectations (LS4 Biological Evolution: Unity and Diversity; NGSS Lead States 2013). Thus students learn to blur the boundaries of various forms of science knowledge.

Setting Up

This eight-week study took place at the beginning of the school year in 45-minute blocks that were set aside each Monday, Tuesday, and Thursday afternoon. The first two weeks focused on making scientific observations and how to use scientific tools to assist with observing (Scientific knowledge is based on empirical evidence; NGSS Lead States 2013, Appendixes, p. 98). Since this was the first science unit of the school year, we (the teachers) selected the locations for the plots (or squares). This helped to reduce safety concerns because only plots with plants that were familiar or native to the area but not poisonous (e.g., poison ivy) were selected. Each plot was marked off as 30 cm × 30 cm square using four white flags. The plots varied in their contents, some being a combination of grass and rocks and others having planted flowers within them. Classes held during the first two weeks served as a type of formative assessment to sort the 28 students into teams of 3–4 to balance students' strengths and weaknesses. Each student was required to complete his or her own science notebook entries, but group members were encouraged to talk and share what they were recording to demonstrate the idea that scientists do not always observe and interpret information in the same way (Science is a human endeavor; NGSS Lead States 2013, Appendixes, p. 100).

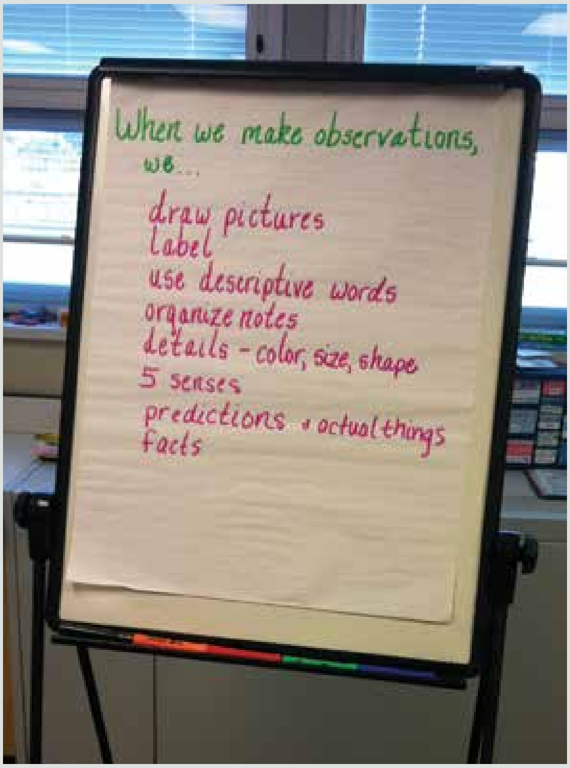
CAUTION

PHOTOGRAPHS COURTESY OF THE AUTHORS

A student gets a close-up look with a hand lens.

FIGURE 1.

Making observations chart.



Learning to Work Like Scientists

For the first Monday, students examined nature pictures using an interactive whiteboard. The goal of this lesson

FIGURE 2.

Safety poster reviewed for making observations outside.

CAUTION! Before heading to your Life Square remember…

We will be safe scientists when observing by:

- Not tasting anything in our square – we will look, smell, hear and touch only.
- Not touching any plants that are not in our square or we do not know.
- Not touching any insects that we are not sure about – we will just watch them.
- Letting our teacher know if we have allergies to any plants or insects.

As scientists, we will observe carefully and will use our science tools properly!

FIGURE 3.

Sample journal prompt developed to guide students' data collection using tools.

A magnifying lens helps a scientist ________________________.

In our Life Square, we found a ________________ needed a closer look.

Without a magnifying lens	**With** a magnifying lens

was to learn what it means to make a good (or useful) observation in science. Each picture required students to "take a closer look" (observe) and from this infer what happened. In their science notebooks, students wrote down what they saw using words or pictures. After a few minutes, students were asked to share what they recorded. Although they were able to verbalize what they saw, several were unsure of how to infer.

As the week progressed, the class practiced with more pictures, and we modeled various ways for the students to record their descriptions and make inferences from them until eventually students were able to it on their own. They noticed the more detailed their notes were the easier it was to infer. The week's activity concluded with developing a class anchor chart, "When we make observations, we …" (Figure 1, p. 27). Together, the class also developed a definition for the words *observation* and *inference*, adding them to the terminology section of their science notebook. The working definition the class developed for the term *observation* was *using your senses to notice things in the natural world*, and the working definition for the term *inference* was *using our observations to make a claim explaining what is happening or name what something is*.

From reading their first-week notebook entries, we noticed most students focused only on their sense of sight when making observations and we wanted them to have a full sensory experience (excluding taste) when observing life in their squares. It was important at this point in the unit to also explain the need to be safe when using senses to observe in science. Considering

Using the Strategy at Other Grade Levels

Although the Life in a Square unit targets second grade, the premise of the activity offers endless ways to connect science to students' interests at various grade levels. For example:

Kindergarten

The class could explore one larger plot together with students working in pairs to study a section of the larger plot. A single question could guide students' explorations and a class notebook (e.g., BIG book journal) could be kept where all pairs of students' weekly observations are recorded for collective interpretation toward answering the question. We also suggest the use of the trade books From *Seed to Plant* (Gibbons 1993) and *Growing Patterns* (Campbell 2010) to support students with thinking about patterns they might observe in the natural world and structures of plants to record in their observations.

Grade 3

Students could work individually rather than in groups to collect the data. Prompts would still be helpful to incorporate, but over time these prompts could lessen and the students could be expected to generate their own charts, conclusion statements, and so on. We also suggest the use of the trade book *Life in a Bucket of Soil* (Silverstein 2000) as a way of suggesting to students at this grade level that observing the life in a square sometimes requires going below the surface.

Grade 5

Depending on the students' previous experiences with this type of inquiry learning, students could spend less time with Monday modeling activities and move into the experimental design aspect of the unit sooner. Students could work individually, in pairs, or small groups to design their own experiment. They would formulate their own questions and develop their own procedures for carrying out the investigation. They should also be expected to refer to additional resources to justify their interpretations based on known scientific reasoning. Presentations of their results to the class could be in the form of a poster board or some other electronic format (e.g., Prezi or Voice Thread) (see Internet Resource).

Recording observations.

this need, we reviewed with students the safety precautions outlined in Figure 2 (see NSTA Connection).

Students were also having some difficulty with organizing their data. Therefore, we decided for week two to focus instruction on how to make and record *quality* observations. We emphasized that multiple observations are important for making credible predictions and conclusions. We introduced the use of T-charts to organize data, modeled recording details using multiple senses, and asked students to complete predictive statements using the phrase, "I predict ____ is a _____ because ______." At the conclusion of this activity, the word *prediction* was also added to the terminology list in the students' notebooks. The working definition developed for the term *prediction* was *to take what we know from our prior observations to consider what might happen next and why* (science practices: Analyzing and Interpreting Data; NGSS Lead States 2013, Appendixes, pp. 71–73).

The use of such predictive prompts was carried throughout the other weeks of the unit, especially when the students started going outside to observe their own plots. Different prompts were provided each week (see Figure 3), but students were also encouraged to write and draw other things they felt were pertinent to their square and note changes. While the prompts initially provided a focus for class discussion, over time the students' individual notes about changes in their squares resulted in them


The interactive whiteboard served as a tool for teaching observations.

raising questions and drawing connections to disciplinary content they were interested in studying (i.e., the effect of precipitation and temperature on plant growth) (performance expectation: 2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats; NGSS Lead States 2013, p. 19).

Acting as Scientists

During week 3 we were ready to go outside to observe the designated squares. Monday's class focused on observing and recording for comparisons to be made. This modeling session was followed by an opportunity to apply these skills Tuesday and Thursday. This pattern of modeling a skill used in science, followed by two days of application, occurred for three weeks. The skills for conducting scientific inquiry emphasized in weeks four and five were:

- The use of tools (e.g., a magnifying lens) to support observations (see Figure 3, p. 28, for one week's journal prompt).
- Thinking of various ways scientists include measurement in their field work. For example, the use of thermometers for temperature, rulers for measuring the length or height, and the use of proper units for each were discussed Monday. On Tuesday and Thursday, students were required to incorporate measurement in their data collection and note changes between the two days.

By week 6 students were ready to design a simple investigation of their square. Since this was the beginning of the school year, we provided guidance with formulating the question they would investigate (Science Practice 2-LS4-1: Planning and Carrying Out Investigations, NGSS Lead States 2013, p. 19). We looked back through each group's weekly field notes to find something interesting in their observations or something repeatedly noted so perhaps they would want to explore it further (Crosscutting Concept: Patterns, NGSS Lead States 2013, Appendixes, p. 82). We then conferenced with each group about the idea, helping them to frame a question and brainstorm the kind of data they would need to collect to answer their question. Some of the groups' questions related to topics such as leaves changing on a tree within their square, plants beginning to die, differences in the plants that were in the shade versus sunny regions, evidence of particular animals encroaching on their square, and so on. These independent group investigations occurred in stages, with one week dedicated to observing and recording and another week focused on interpreting the data to develop a conclusion to answer their question. How to develop an evidence-based conclusion was a science practice modeled for them in a Monday class (science practice: Constructing Explanations and Designing Solutions, NGSS Lead States 2013, Appendixes, pp. 74–75).

FIGURE 4.

Flap-book sample assessment.

Assessing Scientific Thinking

Both formative and summative assessment was critical to the success of this unit. Providing the students with their own science notebook gave us access to the students' thinking as scientists. We reviewed the notebooks at the end of each week to decide what topic to focus on for the following Monday.

In terms of summative assessment, for the final week of the unit (week eight) students were asked to use their notebooks to find an aspect of their plot they would like to explore deeper. They were given a "flap-book" (see Figure 4) with each flap representing a different science skill they learned about over the course of the unit. The first page of their book provided space to write the question they wanted to explore more deeply. The second page focused on observations, and students were encouraged to use all of their senses as well as scientific tools to record multiple observations from different perspectives. They were also encouraged to draw and label pictures as part of their data recording. The third page was where the students were to document a conclusion or claim in response to their question. Page 4 required that they list the specific evidence from their observations (page 2) that they used to formulate their conclusion statement. Using what they learned from their investigation about how things were changing in their square, on the final page the students made a prediction about what they thought their square would look like in a couple of months (crosscutting concept: Patterns; NGSS Lead States 2013, Appendixes, p. 82). The book served as a culmination of each student's learning over the course of the unit and was graded.

The "Life in a Square" study offers elementary students the opportunity to integrate core disciplinary ideas in science with scientific practices and crosscutting concepts (e.g., patterns). By studying the science that is occurring in their own backyard, this unit introduces students to the notion of how to conduct fieldwork in science, while encouraging them to explore their personal interests. ■

Meredith Park Rogers **(mparkrog@indiana.edu)** ***is an associate professor at Indiana University in Bloomington, Indiana. Melonie Steele*** **(melonie.steele@comalisd.org)** ***is a second-grade teacher of science, social studies, and writing at Mountain Valley Elementary School in Canyon Lake, Texas.***

References

Campbell, S.C. 2010. *Growing patterns.* Honesdale, PA: Boyds Mills Press.

Dillon, J., Rickinson, M., Teamey, K., Morris, M., Choi, M. Y., Sanders, D., and P. Benefield. 2006. The value of outdoor learning: Evidence from research in the UK and elsewhere. *School Science Review* 87 (320): 107–111.

Gibbons, G. 1993. *From seed to plant.* New York: Holiday House Publishers.

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

Park Rogers, M.A. 2009. Elementary Preservice teachers' experience with inquiry: Connecting evidence to explanation. *Journal of Elementary Science Education* 21 (3): 47–61.

Silverstein, A. 2000. *Life in a bucket of soil.* Mineola, NY: Dover Publications.

Internet Resource

Cool Tools for Schools
http://cooltoolsforschools.wikispaces.com/Presentation+Tools

Connecting to the Standards

Standard: 2-LS4 Biological Evolution: Unity and Diversity

Performance Expectation:
2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.

Disciplinary Core Idea:
LS4.D Biodiversity and Humans

Science and Engineering Practice:
Planning and Carrying Out Investigations

Crosscutting Concept:
Patterns

NGSS Table 2-LS4 Biological Evolution: Unity and Diversity
www.nextgenscience.org/2ls4-biological-evolution-unity-diversity

NSTA Connection

For more outdoor safety tips, visit *www.nsta.org/SC1412*.