STRING SAFARI

Students discover a world of wonders within the boundaries of a loop of string. Using maps, drawings, and diagrams, they describe their discoveries in the pages of their journals.

Time

Introduction: 5 minutes
Activity: 20–45 minutes
Discussion: 10–15 minutes
Extension: 20–30 minutes

Materials

- ☐ Journals and pencils
- ☐ Pieces of string, 1.5–3 m (5–10 ft.), or hula hoops, one per student

optional

- ☐ Printout of Dürer's "The Great Piece of Turf"
- ☐ Hand lenses

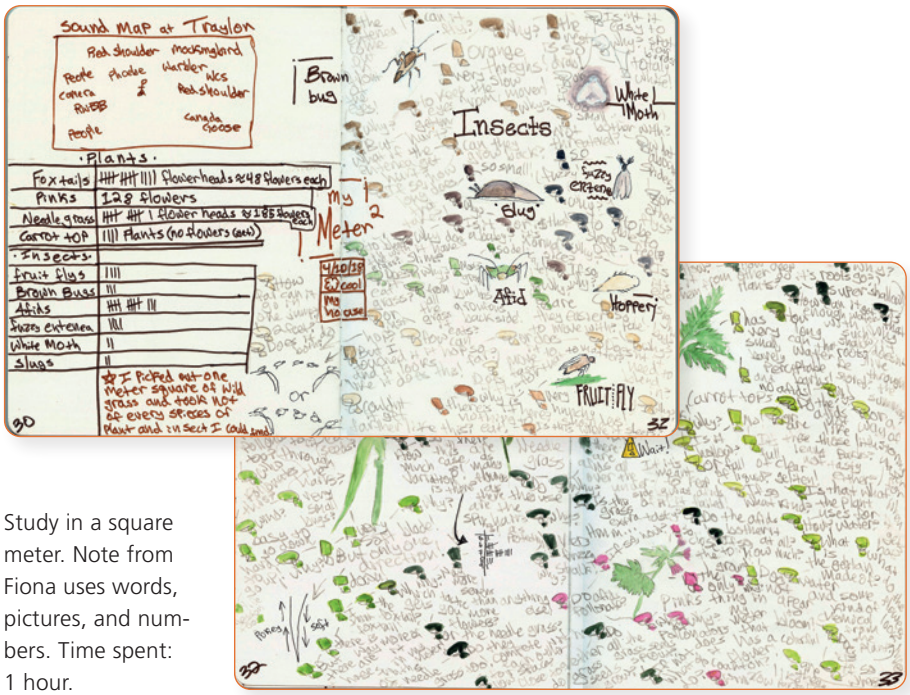
Teaching Notes

To give students a sustained experience of connection with a patch of land, integrate this activity with *Sit Spot* and offer repeated opportunities for students to return to their "string world." They will notice small shifts over time and engage in an authentic study of phenology (seasonal changes). This deepens students' connection with nature and offers a set of observations and data that can be used to better understand the place as a whole.

In 1503, the artist Albrecht Dürer painted "The Great Piece of Turf," a portrayal of a section of weeds and grasses from a German meadow. Each blade is rendered in crisp detail. The painting reveals the complexity and beauty of roadside weeds that are easily overlooked and shows how a small patch of ground can be a rich area for study. In this activity, the string loop focuses students on a particular area and creates a special world in which they find surprising wonders and treasures. Just as field scientists' focused study is a foundation for their thinking, these discoveries can become the driving force of students' learning about life science concepts.

NATURAL PHENOMENA

This activity can be conducted in any outdoor area with varied ground cover. This could be the unmanaged border of a sports field, a vacant lot, or other natural area. Look for spots with different species of weeds and other small plants, and unusual objects such as pinecones, lichens, mushrooms, or rocks. The loop of string does not to be large. In fact, giving students a very large area to observe might be overwhelming. We suggest cutting the string into 1.5–3 m (5–10 ft.) sections.



Study in a square meter. Note from Fiona uses words, pictures, and numbers. Time spent: 1 hour.

PROCEDURE SUMMARY

1. Put your loop of string on the ground.
2. Use writing and drawing to record observations about as many subjects as you can within the loop.
3. Use numbers to record amounts of interesting subjects.

DEMONSTRATION

When the whiteboard icon appears in the procedure description: Make quick sketches of plants and animals found within a demonstration loop of string as you describe the activity to students. Simulate adding written notes with sets of horizontal lines. If you plan to do the *Making a System Model* extension activity, leave blocks of white paper on the right and left sides of the paper for the input and output arrows, and instruct students to do the same. You may want to have the students draw light circles in these areas to remind them to leave these sections blank.

PROCEDURE STEP-BY-STEP

1. **(Optional) Show students Dürer's "The Great Piece of Turf," asking them to share observations about it out loud with a partner.**
2. **Explain that students will get to explore their own "tiny world" by using a loop of string to mark off an area to study.**
   a. "You are about to discover a world hidden in plain sight. When you train yourself to look closely, you can find amazing things anywhere."
   b. "In a moment you will each get a piece of string. We will then spread out and each find a patch of ground that contains interesting things."
   c. "You will use your piece of string to make a circle on the ground, and that will be your 'tiny world' to explore and study."
3. **Explain that students will observe objects within the string circle, then use words, pictures, and numbers to record each subject they find.**
   a. "Look for plants, animals, natural objects, evidence of animals, or any other interesting treasures you can discover in your loop of string. You will need to observe closely to find as much as you can within the boundary."
   b. "Use words, pictures, and numbers to describe what you find."
   c. "What are some things you expect to find that you could include in your journal entry?" (Students might say: soil, dead leaves, insects, etc.)
4. **Explain that students don't need to make detailed drawings of every subject, and can use words or a small map to show where the subjects appear in the circle.**
   a. "Trying to make a detailed drawing of everything in the loop of string exactly where it appears could take a long time, especially if there are leaves or plants on top of each other."
   b. "You could draw a small circle in the center of your page, make individual drawings of each thing you find in the loop of string around the circle, and then use writing and arrows to describe where they are found."
   c. "You could even make a small overhead map to show where each object you draw is found within the loop of string."
   d. "Does anyone else have any ideas about creative or interesting ways to record what we find?"
5. **Suggest counting and observing differences and similarities among objects students find a lot of, such as pinecones or leaves.**
   a. "If you find a lot of some kind of object, like a lot of pinecones or rocks, you could count them or observe similarities and differences."
6. **Tell students that it's OK if they get engrossed for a little while in observing a certain object or organism within their loop of string.**
   a. "You might find one object or organism that is very intriguing to you, and if you get lost in observing it and recording observations about it, that's OK."
7. **If you will be doing the *Making a System Model* extension activity, instruct students to leave a blank spot to the right and left of the page.**
8. **Tell students to keep looking for things even if they feel "done," and to see what interesting things they can notice after they feel as though they are done.**

a. "At some point before the time is up, you will probably get the sense that you are done. Remember, this is just a feeling, and has nothing to do with how much or how deeply you can observe."

b. "If you feel done, notice the feeling and then see how much more you can discover after that."

9. Set boundaries, give a time limit, ask if there are any questions, then send students out to journal. Be a role model by working in your own journal.

10. When half the allotted journaling time has elapsed, circulate, troubleshoot, refocus, encourage, and talk to students about their observations, using questions like these:

a. "What else do you notice?" (Student makes observations.) "Good—put that down in your journal."

b. "What are other ways you could describe what you find in this space or add more details to your notes?" Possibilities include maps, cross sections, close-ups, alternate drawing angles, more written notes (paragraphs, bullet points, or labels).

DISCUSSION

Lead a discussion using the general discussion questions and questions from one of the Crosscutting Concept categories. Intersperse pair talk with group discussion.

General Discussion

a. "In groups of four, share your notes and observations, and discuss: How did limiting your observations to the area inside the string affect the way you observed? What was it like studying a 'tiny world'?"

b. "What was the most interesting observation you made? What questions do you have about what you found in your loop of string?"

c. "During your study, did you come up with any new ways of taking notes or recording information you could use again in the future?"

d. "If you could do this same activity again in any location on earth, where would it be, and why?"

Stability and Change

a. "Did you see any evidence of things that are changing in your observation area? How can you tell?"

b. "If you came back in one week, do you think you would notice any changes in the area you studied? What might those be?"

c. "If you set up a camera to record your area over one year, what changes would you expect to see?"

d. "What thing in the area you observed would change the most? What would change the least?"

Patterns

a. "Take a look at the notes or observation areas of a couple of people nearby. What are similarities and differences that you notice in the types of things that are in your circles?"

b. "What about the location of things in the circle? For example, are there leaves all over in every person's circle, or are there other patterns of things that were found?"

Cause and Effect

a. "Take a look at your observation area and journal page. Did you notice any mysteries to unravel? A mystery might be a hole in a leaf, the location of a pinecone, or a piece of grass that has been bent."

b. "When scientists notice something, they often think about how it came to be, or what caused it. See if you can come up with some possible explanations for the mysteries in your circle."

Energy and Matter

a. "Did you see any evidence of decomposition [or, if students don't know that term, "things breaking down"] in the area you studied? What did it look like? Say as much as you can about what this process looks like."

b. "Did you see any evidence of last year's plants? What do they look like now? Where are the plants from two years ago?"

STRING SAFARI EXTENSION: MAKING A SYSTEM MODEL

The area within the string can be a jumping-off point for beginning to think about ecosystem modeling. Systems thinking can help students explain their observations or make nuanced predictions about what might happen in a given area if conditions change. All system models have boundaries that define what is inside and outside the system. Even in a seemingly clear system such as a pond, exactly where do you draw the boundary? Do you draw the line at the water's edge, the zone of wet soil, the extent of pond-related vegetation, or the watershed boundary? These boundaries must be decided, but they are somewhat arbitrary. Practicing making a system with the string as a boundary will prepare students to apply systems thinking in other contexts.

After defining the boundary, students think about interactions between plants, animals, and microbes within the system; consider outside forces entering the system (inputs); then discuss things leaving the system (outputs).

PROCEDURE SUMMARY

1. Convert the objects in the diagram to a system model: use words, pictures, and arrows to identify boundaries, system components, and the inputs and outputs of the system.
2. Use words, pictures, and numbers to identify and show interactions between system components, inputs, and outputs.

DEMONSTRATION

When the whiteboard icon appears in the procedure description: Draw arrows between system elements that may interact. Add labels to the arrows, briefly describing the interaction.

Add an input arrow and list things that enter or influence the system. Add an output arrow and list things that leave or are produced by the system.

Time

30–40 minutes

PROCEDURE STEP BY STEP

1. **Briefly define what a system is, offering some examples that students will be familiar with (e.g., the respiratory system, a bicycle).**
   - a. "A system is a group of related parts that work together. For example, your body is a system of organs that function together to keep you alive. The parts of a bicycle are a system."
   - b. "The parts of a system interact and affect each other. For example, a bicycle pedal is connected to the gears with a chain, which turns the wheels when you push on the pedal."
   - c. "A system can be any size, from the digestive system contained in one small organism, to a small pond, to entire forests, to climate systems that encompass the entire earth."
   - d. "You can think of parts of nature, such as a tree, as systems too; parts of a tree interact with and impact each other."
2. **Tell students that they will practice using the idea of systems by looking at their loop of string as a boundary.**
   - a. "To practice thinking about things as a system, we are making these loops of string the boundaries of our system."
   - b. "Draw a dotted line around the things on your page to represent the boundary of this system."
3. **Guide students through the process of identifying parts of their system, thinking about how the parts interact with each other, and using arrows to represent these interactions.**
   - a. "Discuss with a partner: What are the parts of the system in your loop of string?"
   - b. "Can you think of any ways that the parts within the system might interact with each other?"
   - c. "Take a moment to draw arrows between elements in the system that you think interact with each other. Label the arrows with a brief description of the interaction it represents."

4. **Guide students through the process of thinking about the inputs to the system by asking them about forces outside the loop of string that interact with the system, and how those forces affect the system.**

   a. "What are some forces that may affect this system, but are not inside this loop of string? Consider things you cannot see, and things that may have happened in the past but that you do not see going on right now."

   b. "These are called inputs. Draw a big arrow pointing into the system and label it with the inputs you named."

   c. "How do these inputs affect the parts of the system—the things you found, labeled, and described there?"

5. **Guide students through the process of thinking about outputs of the system by asking them what leaves the loop of string, and how that affects nearby areas.**

   a. "What are some of the things that leave the loop of string? Does the system create or produce anything? Again, think about things you both can and can't see."

   b. "These are called outputs. Write down some of the outputs you named, then draw an arrow around them, pointing out of the system."

   c. "How do these outputs interact with or affect nearby areas?"

6. **Ask students to make some predictions about what might happen if the quantity of an input, such as water, were to change.**

   a. "Now that we've labeled some interactions among members of the system, and inputs and outputs in it, we can use our model to think about what could happen to the parts of the system if the conditions of this area were to change in the future."

   b. "Look at the set of inputs you listed. What might happen if one of these inputs, such as water, increased or decreased in quantity?"

   c. "Use the interactions you labeled to trace how that would impact the things inside the system."

   d. "How would those changes, in turn, affect the outputs of the system?"

7. **Explain that any part of the system with lots of arrows pointing to it interacts with many other parts of the system, and that changes in that one part of the system can greatly affect everything else.**

   a. "Was there any part of your system that had a lot of arrows pointing to it? This means that a lot of things within the system interact with it."

   b. "If it were to disappear or decrease in quantity, that could significantly affect the other parts of the system."

8. **Point out that the thinking students are doing is similar to the thinking that scientists do when they study ecosystems and how they might be affected by changes in the environment.**

   a. "Scientists often use systems thinking and have these kinds of conversations when they are looking at ecosystems and trying to make predictions about what might happen in the future."

9. **Explain that the boundaries of a system affect what we learn from it, then ask students to think about what might be different if the boundary were much smaller or much larger.**

   a. "For this system model, our boundaries were a loop of string."

   b. "When you're making a system, you can choose to put the boundary in many different places. In the case of a pond, you could draw a boundary where the water ends, or around the plants next to the pond, or where you stop seeing the influence of water."

   c. "Where you draw the boundaries of the system affects the kind of explanations you make about what is happening within the system."

   d. "If you were instead to define the boundary of the system as one plant, how would the inputs and outputs change? What about if you defined the system as this whole [forest, meadow, schoolyard] instead of the loop of string?"

FOLLOW-UP ACTIVITIES

Repeating the Activity in a Different Environment

Students could repeat this activity in a different ecosystem or biome, then think about the differences between the two areas.

"The Magic Circle": Team Observation

A desert ecologist once drew a 100-foot circle around a Joshua tree, then directed his whole group of students to observe, categorize, and draw everything they saw within it. This larger riff on the circle of string can build a group's understanding of a specific area and environment, and could be a fun way to frame the activity *Team Observation*.