bright Girls

Broadening Research Interest in Geoscience, Habitat, and Technology (BRIGHT)

Investigation 8: OBSERVATIONAL DRAWING

Grades 9-12

Time requirement: 1 hour

Next Generation Science Standards (NGSS)

Science and Engineering Practices

Asking Questions and Defining Problems

- Ask questions
  - that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Disciplinary Core Ideas

Life Science [if drawing specimens that were once living, e.g., fish, leaves, shells]

- LS3: Heredity: Inheritance and Variation of Traits
  - LS3.B: Variation of Traits
    - Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors.

Earth and Space Science [if drawing rocks]

- ESS2: Earth's Systems
  - ESS2.C: The Roles of Water in Earth's Surface Processes
    - The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.

Crosscutting Concepts

Structure and Function

- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

OVERVIEW

In science, observation is an initial step in generating new ideas. This exercise helps refine observational skills through drawing, and demonstrates that close observation leads to new questions.

LEARNING OBJECTIVES

Students will be able to:

- create a scientific sketch that communicates information that can be used by other scientists.
- identify and describe specimen characteristics.
- discuss and give examples of how:
    - observation is a core practice for scientists.
    - close observation leads to new and more focused questions.
    - drawing from observation increases awareness of details.

INSTRUCTIONAL APPROACH

Close observation is a core practice of science. It allows us to break through our assumptions and preconceptions and notice new features and patterns in the world around us; ask new questions; discover new techniques; and generate new ideas. The instructor should guide the students through questions and prompts that encourage:

- attention to details of texture and form
- development of new questions based on observations
- discussion of how scientists approach their work

The instructor should accept all student answers as value-neutral, and refrain from offering corrections to drawings. Instead, the instructor can help students observe their subject more closely by calling students' attention to details with open-ended questions such as:

- *How many colors do you see?*
- *How does the texture change in different areas of the object you are drawing?*

SCIENCE BACKGROUND

When we draw from life, we must overcome our preconceived visual memory and train ourselves to draw what we actually see, rather than what we think we should see. Close observation is a skill that gets better with practice. Learning to draw from life also helps us see things we normally overlook in the world around us. Because drawing requires sustained and focused observation of form, proportion, texture, and light, we must overcome assumptions about what we think we are looking at, and instead begin to truly see what we are looking at. This close observation reveals new details and features, which in turn helps us generate new questions and ideas about the subject of our study. Such questions, in turn, can guide scientific investigations or aid in distinguishing different types of specimens.

MATERIALS

- Specimens, 1 per student
- Rite in the Rain 4x6" notebooks, 1 per student
- Masking tape, 1 roll
- Permanent markers, several
- Drawing pencils and erasers, 1 per student

ACTIVITY

Setup

Decide what students will draw. Scout field area if they will collect it themselves, or collect it ahead of time, e.g., rocks, leaves, fish, insects, flowers, minerals, shells, seedpods.

Investigation

1 hour

1. Introduce "drawing as thinking" as a practice to record our observations, inferences, and questions. It is also one way we will share our ideas to generate group discussion around what we are studying. Ask students:

    - *Does anyone use journals or sketchbooks outside of school? What kinds of things do you record?*
    - *What are the benefits of observation and drawing?*

Remind students that their field notebooks are their space to observe and wonder about the natural world (give ownership).

Ask students how scientific drawing might be different from drawing for art. How might they be similar? Students turn and talk then share out to the group. Address the challenge of dealing with an inner negative voice and the importance of value-free judgements of drawings and other ideas shared within the group.

Emphasize that the act of drawing can be as valuable as the drawing itself in coming to a deeper understanding of something, because drawing forces us to look carefully and to develop a familiarity with our study subject.

2. For students to get the maximum benefit out of this exercise, they should be able to choose from a range of specimens, rather than being assigned one. These can also be collected in advance during a quick trip outside, where students can select specimens that interest them.

   Distribute specimens to students, e.g., if using fish for subsequent dissection, or give them a few minutes to gather their own (e.g., rocks, leaves). The more similar in size and shape the specimens are to each other, the more difficult the challenge will be. Make a plan to put specimens back after the activity (e.g., rocks) or collect only what is needed (e.g., a few leaves from living plants, or fallen leaves).

3. Instruct students to write their names on pieces of masking tape and attach them to the underside of their specimens (or dissection trays, if applicable).

4. Give students half an hour to draw and describe their specimens in their field notebooks. Encourage students to measure their specimens and add descriptive labels to aid identification. Remind students that it is OK if their drawing does not look exactly like their object (representational accuracy can be developed through practice, but it is not the goal here) and that it is more important to record everything they see and notice about their object.

5. As the students draw, direct their attention to various features with prompts:

   - *What colors/textures do you see? Do they change in different areas?*
   - *Are there repeating shapes or other patterns?*

   Instructors' note: If a student finishes quickly, ask them to continue drawing until the time ends, adding more and more detail to their drawing. If there is not room on their drawing for more marks, they can start another "detail" drawing elsewhere on the page and focus on a small area of their object (for example, the wing of an insect, or the pistil of a flower).

Do not suggest corrections to drawings. Instead, ask questions that help students observe their object more closely. Asking about relationships (e.g., What is the difference in texture between the petal and the leaf?) can direct students' attention to the information they are missing and help them hone their own observations.

6. Have small groups (five to eight students) mix up their specimens and try to find them again based on their drawings. Have students reflect on what parts of the drawings helped them identify their specimen. Then, give them a chance to add a few more details to their drawings.

7. Have all students put their specimens on one surface, then mix them up. Students trade field notebooks with each other and try to find the sample depicted in each notebook based on its drawing and description. Can someone who did not observe the same specimen identify it based on the drawing and notes of the first student? This emphasizes the importance of acute observation and detailed documentation, especially when other scientists will be using one's work.

8. After a few minutes to study the specimens and drawings, students place each notebook next to the sample to which they think it corresponds. Ask:

    - *Who thinks they have the right sample?*
    - *Who drew this sample? Was it a match?*

    For mismatches, compare samples and drawings side by side. Have the group try to identify each specimen and ask them how they know.

9. Have students reflect on what they think a good scientific drawing includes. Ask questions such as:

    - *What observations were particularly useful in finding your specimen or your classmate's specimen?*
    - *What other details, words or measurements could have made it easier to find the correct specimen?*
    - *How does drawing (vs. taking a picture) help you notice the details of a specimen? What questions arose about your specimen as you drew it?*

    If students have trouble formulating questions based on their observations, prompt them by asking why they think their object has a specific feature. For example, a student might share that they noticed a texture of tiny craters all over the bird's egg they were drawing. Ask if they think the texture has a function, and what it might be? Does it remind them of anything they have seen before?

Drawing and dissecting salmon specimens. Photo by Suzanne Perin

Have students record the questions that arose about their object as they drew it on an adjacent page of their notebook.

Sources

http://www.colorsofnature.org/wp-content/uploads/2013/01/Kit1-ALL_3-2017.pdf

https://www.calacademy.org/educators/lesson-plans/observing-variation

Photo by Michelle Eakman

Extension

Now that students have generated questions about specimens that interest them, you may extend this activity be asking students to research their questions. Ask each student to choose one of the new questions that arose as they observed their specimen closely. Have the students investigate this question and compile their findings in a written report, a notebook entry, or an oral presentation to the class.

This investigation makes a great introduction to dissection, e.g., if using fish.

Other possible drawing exercises include drawing from memory (vs. observation) and blind contour drawing. See http://www.colorsofnature.org/wp-content/uploads/2013/01/Kit1-ALL_3-2017.pdf.

Field drawing with observations and interpretations

30 minutes

1. Give students ten minutes to work in silence in their science notebooks to record aspects of the habitat and explain that we will share these drawings with each other in order to generate a discussion about it. To encourage them to look more closely, consider prompting questions. Examples include:

    - *What parts of the habitat matter to the species of interest?*
    - *How do humans use this habitat?*

2. Ask students to stand in a circle and lay out their field notebooks in the middle for the group to see. Encourage them to compare and contrast the field drawings and written descriptions. Helpful questions to guide discussion:

    - *What kinds of details did people record?*
    - *How did different students use text or aspects of their drawings to record observations?*
    - *Any tricks you might steal for your next field drawings?*
    - *Did anyone generate new questions about this habitat after having a chance to sit and observe in silence?*
    - *While drawing, did anyone observe anything surprising or unexpected?*

3. Ask students to find something in the habitat they find interesting and bring it back to the group. Ask them what an inference is and how it differs from an observation. Have them work in pairs or small groups to describe the object they collected. During the first round of sharing within small groups or pairs, share only observations (two-three minutes). In the second round, share only inferences. In the third round, share personal connections and curiosities (questions). If students share connections with an object or the place, encourage them to cite their sources.

4. Solicit ideas from the students about ways that observations and inferences can be kept separate or clearly identified in a science notebook (e.g., dividing the page and listing out observations and inferences separately, using opposing pages for each, labeling with an "O" or "I").

Drawing with hand lenses

30 minutes

- Hand lenses (1 per student)

This extension allows students to explore a tool that changes the scale at which they observe their specimen, and consider the benefits and limitations of this approach.

1. Hold up a hand lens for the class to see and ask students if they have ever seen or used a hand lens? When? What do they do (function)? Hand out the hand lenses and allow students to spend a few minutes observing their objects through them.

2. Ask if anyone has discovered an optimal distance for using the hand lens and have them share with their peers.

Instructors' note: Bring the hand lens close to the eye and move the object towards the hand lens until it comes into focus. The focal length will depend on the magnification power of the hand lens. For a 10x magnification hand lens, the focal length will be an inch or less.

3. Confirm that everyone has been able to obtain a focused image with the hand lens.

4. Let students know that portable hand lenses, also known as loupes (pronounced "loops"), are scientific tools.

    - *Why might a scientist use this tool?*

5. Let students know they will be using this tool to observe their chosen object and will be drawing the magnified image they see. This can be just a small part of the object, such as the surface texture or a specific feature.

6. Ask students to begin a 10-minute drawing of their object as seen through the hand lens. They can draw in pen, pencil, colored pencil, or a combination, whatever they feel is most appropriate to record their observations.

Reflection

10 minutes

Ask students to share their discoveries.

- *What are the benefits of using the hand lens to observe your object?*
- *What are the drawbacks or limitations of using the hand lens to observe your object?*
- *What did you notice about your object when observed through the hand lens that you did not notice before?*
- *Is there anything you could do to make the hand lens more useful as an observation tool?*
- *What other tools might you use to examine your object?*

Have students make notes on the back or in the margins of the drawing, including their reflections on the benefits and drawbacks of using a hand lens.

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