

INSIDE OUT

Students observe a mushroom and draw internal and external views to describe its shape. Then they learn how these views correspond to engineering and architectural plans, and think about how to apply these strategies to future journal entries.

Time

Introduction: 10 minutes
Activity: 30–50 minutes
Discussion: 10–15 minutes



Materials

- Journals and pencils
- One button mushroom per student
- Cutting board or paper towel and a knife (for cutting the apple)
- Plastic serrated knives (one per student)



For Extension

- One apple
- Engineering or architectural blueprints showing plan, elevation, and section of the same object (download from the internet)

Teaching Notes

Being able to use images to clearly display data and ideas is an important part of visual and scientific literacy. The discussion questions at the end of the activity are key to students' process of making sense of the experience and identifying ways to incorporate these strategies into their future journal entries.



Architects and engineers have developed a clear and adaptable system for describing objects with pictures. Instead of drawing a single portrait, they make measured drawings of the top or bottom view (plan) and the side view (elevation). Section views show internal structures by slicing the object from different angles and drawing the view perpendicular to the cut. Architects and engineers can also construct a 3-D drawing of the object as seen from another angle. This powerful approach is easily adapted to nature journaling. This strategy for diagramming can become a part of students' nature journal tool kit, offering a simple way to capture visual information.

Definitions

Plan view: the view from directly overhead, or the traditional map view. The plan view may show the outside of the object (top or bottom) or the internal structure.

Elevation view: the side view, at 90° to the plan view, as seen from the outside. The elevation may show the long axis (side) or short axis (end).

Section view: the cut view, showing the internal structure. A longitudinal section cuts through the long axis of the object. A transverse, or cross section, cuts through the short axis of the object. Reference lines drawn on the plan view show how sections correspond to the other drawings.

NATURAL PHENOMENA

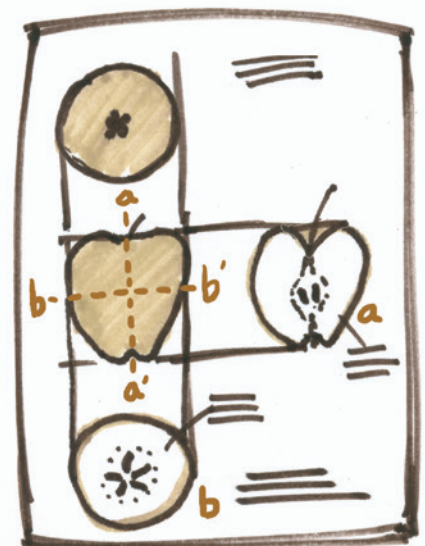
We use apples and mushrooms for this activity because they have a distinct top and bottom and show different patterns in longitudinal and transverse sections. They are also relatively easy to cut with a serrated plastic butter knife. You can also lead this activity in the field with wild mushrooms. Remind students not to taste or eat unknown wild mushrooms.

PROCEDURE SUMMARY

1. Use the smallest possible number of drawings to fully describe the shape and structure of a mushroom.
2. You will need to show different views, and you may cut your mushroom to see what these different views look like.

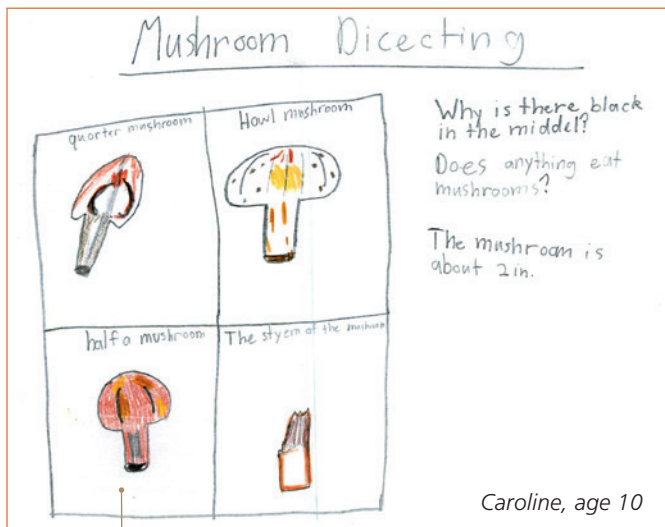
DEMONSTRATION

When the whiteboard icon appears in the procedure description: Draw a side view of an apple or mushroom, then add other views, including cross and longitudinal sections. *Note:* Unlike in other activities, this demonstration is done during the extension, not the introduction.



PROCEDURE STEP BY STEP

1. **Pass out one mushroom to each student, then challenge them to figure out the minimum number of diagrams they need to fully describe it, asking them to briefly discuss their ideas with a partner.**
 - a. "In a moment, it will be your challenge (should you choose to accept it) to use diagrams to describe the shape and structure of the mushroom."
 - b. "What is the minimum number of drawings you would need to fully describe a mushroom's shape and structure? What angles or views would you show? Discuss this with the people next to you."
 - c. "You will have fifteen minutes to develop this set of drawings, and after that we will discuss everyone's ideas and approaches."
2. **Pass out plastic knives and tell students that they may use the knives to cut the mushrooms to reveal the inside, but that, before they cut, they should think carefully about which angles would be the most useful.**
3. **As students work, take time to circulate, troubleshoot, and engage students in dialogue about how they are choosing to make their diagrams.**
 - a. As you circulate, ask students questions such as "How does the angle of the cut change the view that you see?" or "Why did you choose to show the mushroom from that angle?"



This page includes writing, drawing, measurement, and questions. These were introduced in a previous exercise. Students build skills with each new journal project.

Words help reinforce and explain the drawing. On its own, the meaning of the gray mark is not clear. With the written note, it is clear that it represents a hollow space.

This pale smudge is from a mushroom stain!

DISCUSSION

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

General Discussion

Call the group back together and ask students to discuss their approaches using the questions here, first in small groups, then with the whole group.

- a. "Please gather with a small group, then each present your drawings and explain why you chose the views you did, then notice differences and similarities in your diagrams."
- b. (With the whole class) "Let's look at how all of us as a group chose to draw our mushrooms. Discuss with a partner: Are there any views that most or all of the groups chose? Why might those views have been so useful? Can you think of any descriptive group names that we could use to categorize these views?"

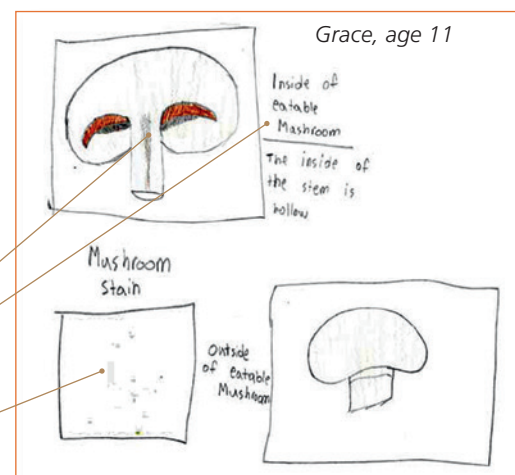


Patterns

- a. "Were there any patterns in the individual repeating parts of the mushroom?"
- b. "Were there any exceptions to these patterns? Where were they? Why do think these exceptions may have occurred?"
- c. "What are some possible explanations for the patterns of growth we saw?"
- d. "Was there a pattern to the way the individual parts fit into the larger structure?"

Structure and Function

- a. "Look at one of the structures you drew in your diagram, such as a seed or a stem. How do you think this structure works? Why might it be shaped the way it is? How might its form, texture, or color affect how it functions?"



EXTENSION: PLAN, ELEVATIONS, AND SECTIONS

1. Describe how architects and engineers use plan (top view), elevations (side views), and sections (cut views) to show objects. Cut an apple to demonstrate and label different views, and then pass out examples of architectural or engineering plans for students to observe.
 - a. "If we draw this apple from the side and the top, we see different shapes and structure. If we cut the apple in half from top to bottom (so that you get two similar pieces), we see a view of the inside and core that looks like this. This is called a longitudinal section."
 - b. "If we cut the apple across the middle (so that the stem and the circle of the sepals are on separate pieces), we get a view that looks like this. This is called a cross section. All of these views and sections show you different aspects of the shape and structure. You can use these views and sections to describe any object."
 - c. "Here is an example of [architectural or engineering] plans. Architects and engineers use plan (top view), elevations (side views), and sections (cut views) to describe objects and organize data efficiently on paper."
 - d. "Some of these views are similar to those you all used to describe your mushroom."
 - e. "With your group, observe the plans in front of you and discuss what you notice. What different kinds of features are revealed in each view?"
2. Point out how students can now use this approach to diagramming as a way to sketch objects in future journal



Tracing is a great way to draw something at its actual size (or slightly larger). Indicate scale by writing "life size" or 1/1 next to the drawing.

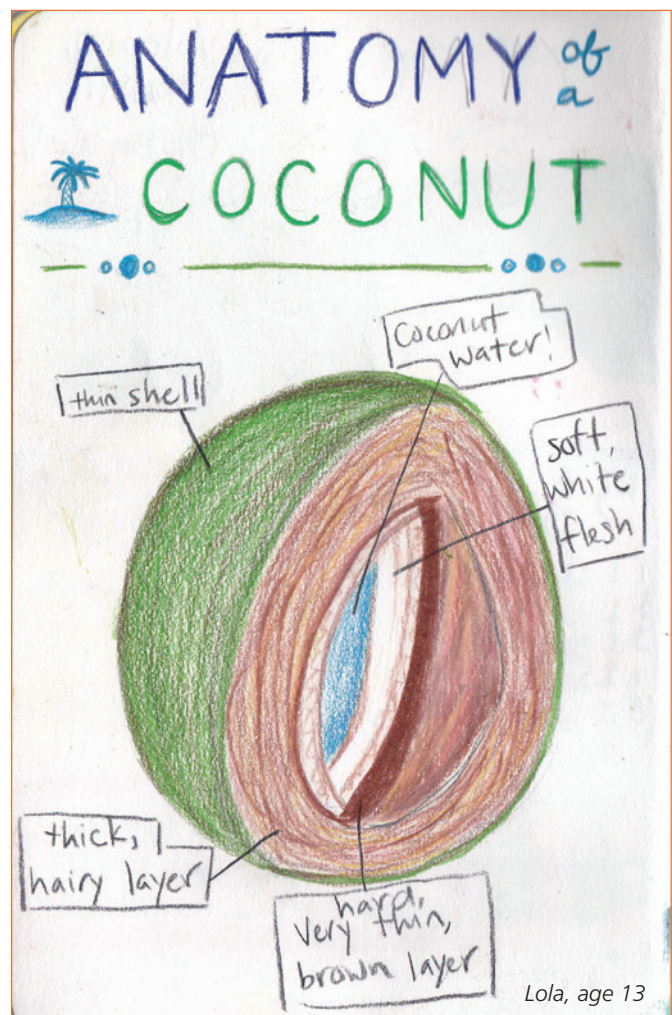
entries, and ask them to discuss how they might use drawings to describe a nearby object.

- a. "When we study other natural objects, such as shells or flowers, or any human-made objects around us, such as tea cups or pencils, we can use some of these views to show our observations. Sometimes you might choose to use all these different views; sometimes you might just use one or two views."
- b. "With a partner, look at an object nearby and discuss what views would be the most helpful in describing the object, and how you could show and organize that on your paper."

FOLLOW-UP ACTIVITY

Bite by Bite

A fun way to extend this activity and practice drawing is to give each student a whole apple, let them draw it, then tell them to make successive drawings as they eat the apple down to the core.



A cutaway three-quarter view is challenging to construct, but shows structure and texture of the inside and outside more than any other view. The ability to visualize and draw such views is evidence of increasing visual literacy, and develops with practice.