

Photographing Shapes and Patterns in Nature

Overview: Like real scientists, your students must learn keen observation to take in information and record details of what they see. After all, it's only after someone has really seen something that he or she can make sense of it. Photography, especially photographing shapes and patterns, can be a great learning and assessment tool for capturing observations, documenting experiments, and revealing student understanding.

Grade Level/Range: 3rd -8th Grade

Objective:

Students will:

- Photograph different types of leaves found on plants in a school garden or from a schoolyard or natural space
- Compare their leaf photos to look for patterns and common characteristics
- Practice using online or hard copy resource materials to identify their plants

Time: 1 to 2 hours

Materials:

- Access to plants with leaves
- Digital cameras
- Plant field guides
- Common Leaf Characteristics handout
- Pencils and paper

Background Information

When you have students train their eyes on the shapes and patterns in the natural world, you enrich science knowledge while also inspiring both artistic and mathematical thinking. Plant leaves make interesting subjects to study when teaching them to observe both shapes and patterns. Leaves come in a wide variety of shapes, sizes, arrangement patterns and textures. Learning how to observe leaf characteristic similarities and differences helps us identify plants and also understand how they are grouped into families.

These following are common characteristics of plant leaves (download the Common Leaf Characteristics handout for line drawings of each):

Leaf Category:

- Needle-like leaves
- Scaly leaves



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- Broadleaf or flat leaves

Leaf Structure:

- Simple: Each leaf is made up of one blade attached to a stem
- Compound: Each leaf is made up of several smaller leaflets. The leaflets can be joined at one based and called palmately compound or spread out along a stem and called pinnately compound

Leaf Arrangement on the Stem:

- Opposite: Leaves are positioned on the stems opposite of each other
- Alternate: Leaves are staggered on the stem (not opposite of each other)
- Whorled: Three or more leaves are attached to the stem at about the same place

Common Leaf Shapes:

- Elliptical
- Oval
- Oblong
- Ovate
- Linear
- Lanceolate
- Deltoid
- Cordate

Leaf Margins

- Entire
- Toothed
- Lobed

Leaf Venation

- Palmate: Veins appear to originate from a common spot at the base of the leaf
- Pinnate: Leaf has one central vein down the middle with more spreading out along the sides of the central vein
- Parallel: Veins run parallel to each other

Laying the Groundwork

Show students two different types of plants (container grown or in ground). Ask, How can you tell these two plants apart? Encourage them to identify several differences, such as leaf shape, stem texture, height, and structure. Explain to students that experts—called taxonomists—classify and name plants according to the physical characteristics of leaves, flowers, fruits, seeds, and plant growth.

To enable others to identify unknown plants, taxonomists write field guides that lead readers through a series of questions about the observable characteristics to help them determine the plant in question. Leaves are the most common characteristic used for tree identification. Introduce students to the

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Arbor Day Foundation's What Tree is That?™ online guide (<https://www.arborday.org/trees/whattree/>) or a printed field guide to demonstrate this process.

Exploration

1. Introduce students to some of the different leaf characteristics that can be used to distinguish one plant from another. Download the Common Leaf Characteristic handout to help you explain each characteristic and/or bring in live samples for students to explore.
2. Take students out into the school garden, schoolyard or a local natural area and ask them to take photos of different types of leaves they find using digital cameras. For each sample, ask them to first take a close up shot of an individual leaf, then take a second shot that shows how the leaves are grouped together or arranged on the stem. This is an activity that works well for small groups of students. If you do not have access to digital cameras, an alternative is to allow them to take carefully collect leaf samples the plants. Make sure to demonstrate how to gently remove a few leaves in a way that will minimally impact the plant's health.
3. Once you are back in the classroom, print out the photos or alternatively save them to one computer and project them to a screen. Ask students to look for similarities among the leaves and group them together based on their physical characteristics. For each leaf sample have students use the Common Leaf Characteristic handout to describe: leaf category, leaf shape, leaf structure, leaf margins, leaf venation and leaf arrangement. This can be done as one large group or in small groups.
4. Next use the field guide you demonstrated in the Laying the Groundwork to identify the plants your leaves came from. Depending on how the quality of the photos, you may need to take another trip outside for more photos or to get a second look at the plant as a whole.
5. After students have a chance to identify their plants, bring the groups together to discuss their results. Ask students, was identifying your plant easier or harder than you thought it would be? What characteristics did you find most useful in helping you to identify your plants? How could we improve our photos to make this a more effective tool for identification?

Making Connections

As a class, discuss the pros and cons of using plant leaves to identify and classify plants. What happens in the winter? Do leaf characteristics always mean plants are related? What are some other qualities we can observe and/or measure that help us identify a plant?

End by looking at the bigger picture, why is it important for us to be able to identify and group similar plants? Share with students that plant classification can help botanist and gardeners better understand the life cycle, habitat and needs of plants.

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Branching Out

Garden Changes and Cycles

The concept of change over time is a foundation of curriculum frameworks and standards, even for the youngest students. By capturing a plant or location at various points during a life cycle, season, or year, students have a chronological record they can draw on to practice sequencing, predict changes, grasp concepts (like how a flower becomes a bean), and so on. They might train their lenses on the garden cycle, the life cycle of a particular plant, the process of decomposition (e.g., by taking shots every few days of a squash left outdoors in the heat), stages of a Monarch butterfly, or seasonal changes in a tree or meadow.

Create a Photo Field Guide

After learning how to use a field guides have your students make their own specific to your school garden or schoolyard. Bring in many different types of field guides for students to peruse and/or check out online examples. As you look at them, ask them to pick out elements that make them useful. When you get done share your guide with the other students and your community.

Writing About Images

Schoolyard images that grab students' attention can be excellent springboards for practicing writing and vocabulary. Lay the groundwork by having students select schoolyard photos they've taken. These might be intriguing images snapped for fun or those taken to illustrate a particular concept or theme. Next, ask individuals or small groups to examine a photo and brainstorm descriptive words, phrases, and analogies. These lists should inspire write creative captions or short stories that say something about the importance of what students captured.

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