ALL for Science™
Authentic Literacy and Language for Science

Baylor College of Medicine
CENTER FOR EDUCATIONAL OUTREACH

DAY 5: ARE ALL PLANT LEAVES THE SAME?

MINI-LESSON

Teacher introduces the "Making Connections across Informational Texts" anchor chart and models the strategy for the class.

SCIENCE INQUIRY CIRCLES

Teams use a different resource to answer another inquiry question or add information to a question already answered.

GUIDED SCIENCE INVESTIGATIONS

Teams use the "Leaf Structures" diagram and "Leaf Morphology" chart to make observations about leaf samples.

ABBREVIATED STANDARDS

- Reading TEKS: 4.6.E
- CCSS: RI.4.9, W.4.7
- NGSS: 4-LS1-1
- Science TEKS: 2018–19: 4.10A; 2024–25: 4.13A

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Day 5: Are All Plant Leaves the Same?

Literacy Strategy: Making connections across informational texts.

Science Concept: The shape of the leaf is one adaptation that plants have made over time to survive in their environment.

Science and Literacy Connection: Scientists make connections between what is already known and new information that is collected through observations and investigations.

Mini-Lesson (15 minutes)

OVERVIEW

Scientists are responsible for reading a lot of texts as they explore what other scientists have said about their topic. As they read, they can end up with a lot of unconnected or random information, some of it repetitive. Therefore, scientists have to be able to pull information together in concise, brief ways. To do this, they use a strategy called "making connections across informational texts."

This strategy is similar to one you may have used before—making self-to-text, self-to-self, and self-to-world connections—but this strategy (sometimes called "making connections") is usually only used when reading fictional texts. The strategy we'll use today—"making connections across informational texts"—is used with nonfiction texts, such as scientific articles.

NOTE: You are encouraged to create the "Making Connections across Informational Texts" anchor chart with your learners as you move through the lesson, using the provided anchor chart as a model. Post it for easy reference when completed and remind learners to refer to the anchor charts during inquiry circles.

MATERIALS

Teacher needs:

- chart paper
- marker(s)
- "Making Connections across Informational Texts" anchor chart as a model
- any two informational texts about cacti to model the strategy (see examples below)

Model Books	Model eBooks (on EPIC)
From Seed to Cactus by Lisa Owings	*From Seed to Cactus* by Lisa Owings

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What Do You Find on a Saguaro Cactus? by Megan Kopp *Cactuses (Rookie Read about Science)* by Allan Fowler *Saguaro Cactus (Habitats)* by Paul Berquist	*What Do You Find on a Saguaro Cactus?* by Megan Kopp *Prickly Plants: Stuck!* by Ellen Lawrence *Cactus (See it Grow)* by Anastasiya Vasilyeva

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Tell what the strategy is (declarative knowledge)

1. *The strategy we are using today is called "making connections across informational texts." This strategy is important for a few reasons:*
    - *It helps me determine if the author's claims and statements are reliable;*
    - *It helps me sort through the repetitive information I find when I read a lot of informational texts about a topic; and*
    - *It helps me pull all the information together into concise, or brief, statements.*

Tell when and why to use the strategy (conditional knowledge)

1. *I know to use the strategy when I'm reading more than one informational text about a topic, or when I find multiple claims being made about a specific question I'm asking. Sometimes I make connections within a single text, and other times I make connections across several informational texts.*
2. *I don't make connections the entire time I'm reading. I do it strategically when I come across information I've been looking for, such as the information I'm going to enter on my Inquiry Chart.*

Tell how to use the strategy (procedural knowledge)

1. *As I start to read, I first think about what I already know about a topic because accessing my prior knowledge is an important part of making connections within and across informational texts.*
2. *As I read, I realize that I'm reading something that is similar to (or different from) what I've read before. This is a connection.*
3. *If the connection is similar, I often don't need to do anything. However, if the connection is different, I need to stop and try to evaluate the claim or statement the author is making.*
4. *Something that helps me make connections while reading scientific texts is the way the ideas are sequenced, such as the way the author presents and justifies causes and effects, or the way the author compares (for similarities) and contrasts (for differences) facts and claims.*

Model the Strategy

Use any two informational texts about cacti to model the strategy. Below is one example of how you might model making connections across two informational texts.

1. *Let's practice our new strategy.*
2. *Lisa Owings, the author of* From Seed to Cactus*, writes, "The roots spread widely and keep close to the surface. After a rain, the roots bring water and nutrients to a growing cactus" (p. 8).*

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3. *That reminded me of something similar I read in another text. Megan Kopp, the author of* What Do You Find on a Saguaro Cactus? *writes, "A saguaro cactus can survive up to two years without rain. Its roots spread out far across the ground. This helps the cactus take up water from the ground quickly"* (p. 13).
4. *I think both authors are telling me the same thing. The statement that cactus roots "spread widely and keep close to the ground" (Owings) is similar in meaning to the statement that cactus roots "spread out far across the ground" (Kopp). Also, both authors tell me that spread-out roots "bring water and nutrients to a growing cactus" (Owings) and "help the cactus take up water" (Kopp).*
5. *Although I haven't seen any cactus roots, the author's claims make sense when I compare them to what I already know. I know that cacti need water to survive in a hot, dry place. Having spread-out roots that help take up water would be helpful for living in a hot, dry place where it doesn't rain very often.*
6. *Since what I'm reading across both texts is consistent (the same) and makes sense with what I know, I think the authors claims are reliable and I can trust them. These claims help me answer one of my inquiry questions: What features of a cactus allow it to survive and thrive in its ecosystem?*

Science Inquiry Circles (30 minutes)

OVERVIEW

Scientists often work in teams when conducting text inquiry and science investigations. Today, learners will work in inquiry circles to investigate different questions about representative plants. Prior to starting the inquiry circle work, be sure to have texts and technology available for your learners. You may have some teams working online while other teams work with traditional texts. This will depend on your access to technology and texts.

MATERIALS

Each team needs:

- team Inquiry Chart
- pencils
- access to informational texts/media

Teacher needs:

- "Plant Resources" spreadsheet for ideas

PROCEDURE

Each *italicized statement* below contains suggested wording the teacher may choose to use for the lesson; additional teacher actions and considerations are in parentheses.

Before Inquiry Circles

1. *It is time to get into our inquiry circles. You will be with the same team as yesterday, but you will rotate the science roles.* (Assign roles at your discretion and have the Equipment Directors gather the Inquiry Chart for their team).
2. *You are already familiar with the Inquiry Chart and the inquiry questions. Today you will answer more questions or add additional information to a question you've already answered.*

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3. *As you look for answers to your questions, you will practice your roles as scientists. As scientists, you will make sure to carefully record your findings and your sources on your Inquiry Chart.*
4. *As you read, remember that you can make connections across all types of text, including books, eBooks, and websites.*

During Inquiry Circles (20 minutes)

1. *Today you will use a different book, website, or eBook to find answers to the question you're investigating about your plant group or add information to a question you've already answered.* (You might choose to show or project the sample Inquiry Chart as a guide. Also, you may choose to be more explicit for your class and only allow them to answer one question at a time daily. Use your judgement on the level of guidance, especially in the first few days.)
2. *We have anchor charts to help guide your thinking. Do not forget to use them while working.* (Refer to the "Making Connections across Informational Texts" anchor chart and the other anchor charts already introduced. Remind learners that they can use any of the reading strategies taught so far.)
3. *The Lead Scientist will guide all inquiries for the day by picking which question(s) will be answered. The Data Scientist will record all source information and the answers to your inquiry questions on the Inquiry Chart.*
4. *Remember, it is important to record where you found the information (source) on the Inquiry Chart so that you do not plagiarize.* (Remind your learners to record the title and author for texts and the title and URL for websites or videos.)
5. *Everyone should help find the answers to the questions online and in texts.* (Remind learners how the Inquiry Chart will organize their progress.)
6. *My role is to help guide the inquiry circles, but I expect you to work as a science team to solve your problems together.* (While teams are working, walk around the room to facilitate as needed.)

After Inquiry Circles (10 minutes)

1. *As we conclude our inquiry circles for today, each team will have a chance to share the information they found related to their questions, what they accomplished, and what literacy strategies they used. The Lab Director will lead the discussion about today's results. What has the team learned about its plant group? What problems did the team encounter? How did the team resolve those problems? Did the team use a reading strategy? Which one and how did it help? What new questions does the team have?* (After you have allowed the teams to gather their thoughts, have the Data Scientist share with the class. Try to encourage teams to share a variety of things—you do not want just facts about plants, just reading strategies, or just cooperative learning strategies.)
2. (After all teams have shared, thank them for their hard work, and point out any excellent behaviors that you observed. If you saw an outstanding example of using a reading strategy or collaborative work, explicitly point it out. If you notice any problems in the teams during the lessons, take a moment to point them out, and explain your expectations for all future inquiry circles. Collect all Inquiry Charts or have learners put them in their normal classroom place for ongoing work so they can easily access them.)

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Guided Science Investigation (30–45 minutes)

OVERVIEW
Today learners will examine the morphology (the size, shape, and structure) of real leaves; then formulate a question to investigate about plant structures.

GUIDING QUESTIONS
Are all plant leaves the same? What role do they have in providing what a plant needs to survive? What is leaf morphology?

BACKGROUND INFORMATION FOR THE TEACHER
Plant leaves have many different shapes that are linked to the type of environment (past and present) they live in. Fossil evidence provides important clues about past environments and gives us a look at the adaptations that plants made in response to changes in their environments. It is important for children to understand that the changes we refer to occurred over long periods of geologic time.

By examining the morphology (the size, shape, and structure) of a leaf, we gain a better understanding of the diversity of plant leaves and how these structures function to meet the needs of particular plants.

MATERIALS
Each team member needs:
- science notebook
- pencil
- goggles
- gloves

Each team needs:
- a bag of 8 leaves (for a team of 4)
- hand lenses
- "Leaf Morphology" chart (paper copy or electronic access)
- "Leaf Structure" diagram (paper copy or electronic access)

Teacher needs:
- a sample leaf
- "Leaf Morphology" chart (paper copy or electronic access)
- "Leaf Structure" diagram (paper copy or electronic access)
- trays or gallon ziplock bags
- a collection of assorted leaves

SETUP
- **Before the class**, the teacher will need to collect a variety of leaf samples for learners to examine. A mixture of both fresh and dried leaves is preferred, with some samples attached to a stem (if possible, give similar sets of leaves to each team).
- Make 1 paper copy of the "Leaf Morphology" chart and 1 copy of the "Leaf Structure" diagram **for each team** or provide access to electronic versions.

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- Prepare to project or share the “Leaf Morphology” chart and the “Leaf Structure” diagram.
- Organize a bag or tray for each team that contains the following:
    - leaf samples (6 to 8 different samples for each team to allow each team member to work with 2 leaf samples)
    - 1 “Leaf Morphology” chart
    - 1 “Leaf Structure” diagram
    - hand lenses
    - goggles
- Place all the materials in a central location for distribution.

SAFETY

Children should wear safety goggles and gloves as they examine leaf samples. Children should also avoid touching their faces while handling the plants and should wash their hands after their work.

DAILY OBSERVATIONS

Learners will examine leaf samples.

PROCEDURE

Engage

1. Hold up a sample leaf so everyone can see it and ask, *Do you think all plant leaves look exactly like this one?* Accept responses (children will likely answer “no”).
2. Confirm their ideas that there are indeed many different types of plant leaves.
3. Tell the class that today they will take a closer look at the structure and variety of leaves to prepare them for developing a question to investigate about the structures of plants.
4. Have the Equipment Directors collect a bag or tray of materials for their team.

Explore

1. Share that leaves have some common features, even though they may look different. Ask the teams to find the “Leaf Structure” diagram in their bags or tray. As you point to the different parts on the projected leaf image, have them follow along and find it on their diagram.
2. Begin by pointing out the large, broad surface of the leaf called the **leaf blade, or lamina**. *Why do you think plants have leaves?* Accept responses. Explain that the function of the blade is to absorb sunlight, water, and air to produce food for the plant through a special process called photosynthesis. The surface of the blade may have different textures and colors, depending on the plant.
3. Next, point out the system of **veins.** *What do these remind you of?* Accept responses. (Veins in our bodies?) Describe how veins transport water and nutrients throughout the plant, much like veins in our bodies transport blood. Add that veins also provide structural support for the leaf.
4. The **tip**, **or apex**, of the leaf improves water drainage from the leaf. *Why do you think that might be important?* Accept responses. Explain that it acts like a pour spout, preventing a leaf from damage due to high water retention. The leaf tip can have different shapes.
5. The **base** is the bottom part of the leaf that connects to the stem or petiole.
6. The **petiole** is the long, thin stalk that connects the base of the leaf to the stem of the plant. However, not all plants have a petiole. The petiole holds the leaf toward the light and helps with the transport of water and nutrients to the plant.
7. Next, explain that the **margin** is the edge of the leaf and can have different shapes. The margin helps to identify different plants.

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8. Point out that there is a brief description of each structure and its function below the image for reference.
9. Project or share the “Leaf Morphology “chart. Point out how this chart identifies many different blade shapes, margins (the edge of the leaves), and venation (the pattern of veins) of leaves.
10. Add that the “arrangement “of leaves refers to how leaves are positioned or arranged on a stem; learners will not record that today, but it may be important to think about during the plant observations.
11. Instruct them to use the “Leaf Morphology” chart in their materials to make observations on the leaf samples you have provided. **Each team member should make two different observations.** They can decide which leaves they will observe.
12. Draw the chart below on the whiteboard and ask learners to copy it into their science notebooks, along with today’s date. This is the information they need to make note of during their observations.

Leaf sketch	Shape of the leaf	Margin	Venation

13. Let the class know they have 15 minutes to complete their observations. Move between teams as they work, offering guidance or clarification as needed and posing open-ended questions for their consideration as they make their observations. (*Are you finding the information you need? What are you noticing about the leaves?)*

Explain

1. When time is up, give each team 1 minute to describe (in two-word responses) what stood out in their observations on the leaves. Write responses on the whiteboard and invite learners to make notes of what others share in their science notebooks. Review responses. If not mentioned, ask if they noticed any patterns.
2. Share that the place on Earth where plants live, rainfall amounts, and nutrients in the soil can all affect the shape of a leaf. The shape of a leaf made some species of plants better suited to living in a particular habitat or environment.
3. Explain how studying information about modern-day plants helps scientists identify fossil plants. Leaves, stems, seeds, and other plant parts that have been fossilized give scientists clues about the environments the plants grew in.
4. Plants found in animal waste (coprolites) and even in fossilized stomachs also give evidence of the animals that ate them. Unfortunately, some kinds of plants decompose faster than other organisms, making plant fossils rare compared to fossilized bones, teeth, and shells.
5. End the discussion by asking them to turn and share an answer to this question with a partner: *Do you think the leaves are the most important structure in a plant? Why or why not?* Listen to responses.

Elaborate

1. Tell the class they will be examining live plants from different groups in the coming days. They will also look at fossil evidence that gives proof of plant existence long ago, and they will learn a bit about what Earth’s environment was like in the time period when these plants appeared.

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2. **Today, teams should develop a question they want to investigate about plant structures**. What do they want to know about them? Have they always looked the same? What adaptations allowed plants to survive in changing environments?
3. Remind learners again how important it is for all team members to contribute ideas about what to investigate.
4. Allow 10 minutes for discussion among team members, then ask them to write their question in their science notebooks. In the next class they will have an opportunity to review it.

Evaluate

1. Are learners making careful observations and describing details or patterns in the leaves?
2. Are learners using new science language in their responses, either verbal or written?

Science Language

- **Observation** is carefully looking at something or someone to gather information.
- **Data** are facts and information (such as images, words, and measurements) collected during an investigation.
- **Plant adaptations** made some species of plants better suited to living in a particular habitat or environment.
- **Leaf morphology** refers to the size, shape, and structure of a leaf.
- A **leaf** is the part of a plant that absorbs sunlight, exchanges gases, and makes food for the plant.

Expanded Standards

Reading TEKS

4.6E: Make connections to personal experiences, ideas in other texts, and society.

CCSS

RI.4.9: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. **W.4.7:** Conduct short research projects that build knowledge through investigation of different aspects of a topic.

NGSS

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Science TEKS

2018–19: 4.10A: Explore how structures and functions enable organisms to survive in their environment.

2024–25: 4.13A: Explore how structures and functions enable organisms to survive in their environment.

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