Leaning Plants

Plant Adaptations, Growth, and Tropisms

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Grade Level	4th Grade	**Time Frame**	3-5 class period(s)
Subject	Science	**Duration**	Additional time needed to complete plant gr

Essential Question

How do the structure and behavior patterns of organisms enable them to survive?

Summary

In this lesson, students will explore and explain why plants lean toward a window and discuss other adaptations of plants. This lesson can take up to six weeks if you choose to study the full plant growth cycle with students.

Snapshot

Engage

Students participate in an I Notice, I Wonder activity as they observe pictures of plants.

Explore

Students explore plant reactions on the Missouri Botanical Gardens website and engage in a Collective Brain Dump of new information.

Explain

Students complete a Claim, Evidence, Reasoning (CER) activity to explain why plants lean.

Extend

Over the course of six weeks, students investigate their own claims by planting and observing growing plant seeds.

Evaluate

Students form new claims, evidence, and reasoning based on the detailed evidence collected throughout their investigation.

Standards

Oklahoma Academic Standards (4th Grade)

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

Attachments

- CER-Template-Leaning-Plants.docx
- CER-Template-Leaning-Plants.pdf
- I-Notice-I-Wonder-Guide-Leaning-Plants.docx
- I-Notice-I-Wonder-Guide-Leaning-Plants.pdf
- Lesson-Slides-Leaning-Plants.pptx
- Plant-Journal-Slides-Leaning-Plants.pdf
- Plant-Journal-Slides-Leaning-Plants.pptx
- Plant-Journal-Two-Column-Leaning-Plants.docx
- Plant-Journal-Two-Column-Leaning-Plants.pdf
- Time-Lapse-Slides-Leaning-Plants.pptx

Materials

- CER Template (attached; one per student)
- I Notice, I Wonder Guide (attached; one per student)
- Lesson Slides (attached)
- Time Lapse Slides (attached)
- Plant Journal (Slides) or Plant Journal (Two Column) (attached, optional; one per student)
- Sticky Notes (one stack per table or group)
- Chart paper (optional; two pieces)
- Soil
- Paper cups (one per student)
- Seeds (one seed per student; consider bean seeds, which grow quickly, or wildflower, lima bean, bush bean, or pepper seeds)

Engage

Teacher's Note: Activity Preparation

Throughout this lesson, students will record thoughts and data in their science notebooks. The format of the notebook will depend on existing class notebook procedures. The attached **Plant Journal (Two-Column)** and **Plant Journal (Slides)** are designated for students to use as they record the progress their seedlings. This functions as the lesson's capstone experience.

Before beginning the lesson, choose which version of the Plant Journal you would like students to use, and prepare a copy of the selected journal to distribute to each student. Additionally, note the two slide decks attached to this lesson: the Lesson Slides and the Time Lapse Slides. Be prepared to show both of these slide decks at different points in the Engage activity below.

Optional: Planting Seeds Later or Now

The following lesson invites students to explore plant reactions, construct their own claims about plant behavior, and then plant their own seeds to test their claim. However, you may instead choose to have students plant their own seeds at the beginning of the lesson so that seeds germinate as students progress. Consider which activity order would work better for your classroom.

To use the default activity order, begin the lesson with the Engage activity below and proceed as written.

To have students plant their seeds first, begin with the Extend phase of the lesson (starting with "Teacher's Note: Before Planting Seeds"). Students should plant their seeds and begin their journals with an entry that describes the first step in the planting process. Display **slide 13** during this activity. Then, after seeds have been planted and journals started, return to the Engage activity below.

Use the attached **Lesson Slides** to follow along with the lesson. Begin with **slide 3,** and introduce the lesson's essential question: *How do the structure and behavior patterns of organisms enable them to survive?* Move to **slide 4,** and briefly introduce the lesson objectives.

Pass out a copy of the attached **I Notice, I Wonder Guide** to each student, and display the attached **Time Lapse Slides** starting with slide 3. Introduce students to the I Notice, I Wonder learning strategy. Invite students to use this strategy along with the I Notice, I Wonder Guide to organize their thoughts about the plants in the photographs.

Display slides 4-10 of the Time Lapse Slides, one at a time. As you begin, ask students, "What do you notice about how the plant is growing?" The photographs illustrate changes in an indoor potted plant over a six-week period. Allow students time to write down their initial responses to the photos. Once they have jotted down their initial reactions, have them examine the photographs more closely and explore other observations. Note that slide 10 contains a before-and-after comparison of the first photo (week 1) and the last (week 7).

Give students time to write down anything they notice in the photographs. After a reasonable amount of time has passed, ask students to share out what they have noticed. Once each student has shared an observation, assign Elbow Partners. Have Elbow Partners work collaboratively to generate any questions they may have about the photographs.

Teacher's Note: Sharing Plant Photos

Keep the photographs of plants displayed at the front of the room where students can see them, or photocopy several packets of the photographs so that they can be shared among students in small groups.

Ask students to share what they noticed with their Elbow Partners. Set a timer for this discussion, or adjust as needed, to give each student an opportunity to speak.

Ask students to give a thumbs up if they hear some of the same things they have noticed from their classmates. After all students have shared their observations, have them share something a classmate noticed or wondered that was not on their own paper. As students share, record their responses and questions on chart paper, a whiteboard space, or similar.

Teacher's Note: Student Questions

The questions generated by the students and recorded on the class chart are very important to the lesson. These should function as guiding questions for the students to explore throughout the lesson.

If no student brought up that the plant in the photographs is leaning toward the window, introduce the question, "*Why does the plant lean?*" and add it to the bottom of the chart.

Explore

Return to the Lesson Slides, and show **slide 5.**

Review the student questions on the chart the class has generated before introducing them to the Missouri Botanical Garden website. There are several tabs explaining different plants, their parts, pollination, and other aspects of plants. The tab to focus on for this lesson is the Plant Adaptations tab.

Teacher's Note: Missouri Botanical Garden Website

The Missouri Botanical Garden website's Plant Adaptation tab offers additional resources that may be helpful for students to explore. They can learn about additional places beyond the eight most common habitats.

Distribute the appropriate link to students, and give students time to explore this tab. Ask them to examine all eight of the habitats and the types of plants native to each area. Ask them to scroll down each tab until they see examples of plants that live in each habitat. The website offers useful additional resources.

After students have examined the website, have them write down three or four facts in their Plant Journals that are particularly interesting to them. Invite each student to share out one interesting fact. If there are gaps in their collective information, ask questions pertinent to plant adaptation.

Show **slide 6**. Before introducing the concept of plant tropism, use the following questions to reinforce students' understanding of plant adaptation.

1. What information did you find on the Botanical Garden website that answered one of the questions you wrote on your I Notice, I Wonder handout?
2. Did you find any information that sparked a new question?
3. Did you find any information that explained how plants survive or adapt to their surroundings?

Show **slide 7,** which includes a link to the following video: Plant Tropism. Watch the video as a class. This video explains how plants respond to a variety of stimuli.

Show **slide 8**. After students have watched the video, engage the class in a Collective Brain Dump. To start this activity, give each table or group of students a stack of sticky notes. Ask the questions below aloud and have students write their responses on sticky notes.

1. What new information did you discover about plants from the video?
2. Does any of this information help you understand the "leaning" plants in the time lapse photos?
3. Does the video help you understand any of our I Notice, I Wonder questions?
4. Do you have any new questions to add to the I Notice, I Wonder chart?

Allow students to popcorn answers as they write and discuss. As the class finishes the Collective Brain Dump, direct students to add their sticky notes to a large piece of chart paper or whiteboard space in the classroom.

Before class ends, read aloud a selection of sticky notes so that the students can hear each others' ideas.

Teacher's Note: Stopping Point

If teaching the lesson over multiple class periods, consider pausing the lesson here for the day.

If you decide to do so, considering showing **slide 9** and inviting students to use the Point of Most Significance strategy as an Exit Ticket. Ask the class, "What point made so far has helped you understand why the plants in the time-lapse photographs gradually lean toward the window?"

Determine whether more exploration of plant adaptation or reteaching is needed. If student discussion confirms mastery of the concept, use their responses as the formative assessment for this point in the lesson.

Explain

Since this portion of the lesson is likely to start on a new class period, spend time going through the answers from the Collective Brain Dump and the responses to the Point of Most Significance Exit Ticket (if applicable). Use these as conversation starters to re-engage students in the lesson.

Show **slide 10.** Re-engage students in a discussion of the Plant Tropism video. Ask students if they have ever seen a Venus Flycatcher plant or sunflower plants leaning toward the sun. What happens when something like a fly or a finger lands on a Venus Flycatcher? The plant responds to touch.

Tell students that there are different ways that plants react to stimuli, such as **phototropism,** where they react to light like the sun, and **gravitropism,** where they respond to gravity. A response to touch is called **thigmotropism**.

After reviewing this content, ask students to turn to their Elbow Partners and discuss an answer to the following question: "*Based on what we have learned, why do you think the plants in the photographs we looked at in the beginning were leaning?"* Simultaneously display **slide 11,** which shows the essential question: *"How do the structure and behavior patterns of organisms enable them to survive?"* Displaying the essential question helps students to make connections.

Show **slide 12**. To structure this conversation, hand a copy of the attached **CER Template** to each group. Introduce students to the Claim, Evidence, Reasoning (CER) learning strategy. Ask students to use this strategy to complete the template with their tablemates. Students should first make a claim in response to the question ("*Based on what we have learned, why do you think the plants in the photographs we looked at in the beginning were leaning?")*.

Sample Student Response

Sample CER: My CLAIM is that plants lean toward the light because they need light to grow. My EVIDENCE so far is from the website and pictures. My REASONING is that if plants need the light and aren't leaning toward it, they could die.

After claims have been made, ask the class, "How can we prove these claims?" Ask guiding questions that move the discussion toward the idea that planting seeds and conducting an experiment with light can prove their claims.

After students have composed their individual CERs, group students by similar responses.

Extend

Ask students to come up with ideas to test their CER statements. Ask, "What could we do?" and "How should we design our investigation?"

Teacher's Note: Before Planting Seeds

Before you begin the next portion of the lesson, have all materials needed for planting prepared and set aside, including:

- Soil
- paper cups (one per student)
- Seeds (one seed per student; consider bean seeds, which grow quickly, or wildflower, lima bean, bush bean, or pepper seeds)
- Plant Journals (attached, optional; one per student)

The plant growth cycle is approximately 6 weeks. Plan to reserve a space that can be dedicated to the project for this length of time.

Inform students that, in order to prove their claims about why plants lean, they need to plant their own seeds and make observations about plant growth and reactions.

Distribute the prepared potting soil, paper cups, and seeds to students. Display **slide 13.** Have each student write their name on their cup, fill the cup with soil, and plant their seed inside the soil.

Have students place their cups in your prepared space. Leave the cups as they are until some seeds have started to sprout. This will take several days.

Once some seeds have sprouted, divide the class into two equal groups. Have one half of the class place their cups in the window where their seeds can receive direct sunlight. Have the other half of the class leave their plants on a table away from any windows.

Follow the procedure below over the course of the next several weeks:

1. Have students check their plants for changes every so often.
2. Have them water their plants as needed, reminding them to touch the soil to determine whether water is needed. They should make the decision to water or not to water based on their own observations.
3. Throughout this process, students should record their observations with notes and illustrations throughout the process (if you chose to prepare either version of the attached **Plant Journal,** supply each student with a copy to do so). Recording their daily observations provides structure for students in recording their plant data.
4. Continue to ask students how their data is helping them answer the questions on the I Notice, I Wonder chart. Remind students to record any new questions that arise.

Inquiring Questions

While students are observing their plants, make sure they are not simply measuring growth. Consider questions like these:

- "If the plant was leaning toward the light, what would happen if we turned it around?"
- "What is happening to the plants that are not leaning toward the light?"
- "Are the colors staying the same on the plants?"
- "Are some plants growing more leaves than others?"
- "How do the roots appear?"

Evaluate

Ask each student to return to their CER and write about whether their investigation proved or disproved their original claim. Ask students to compose another CER to show evidence and explain their reasoning.

Advise students that their new claim should include detailed evidence and reasoning based on the data collected from their own investigations. Have them write the reasoning section as a short narrative that explains what they observed and learned through the process.

Additional Projects to Demonstrate Understanding and Mastery of Concept

Consider any of the activities below to help your students demonstrate understanding of the concepts learned in this lesson:

- Write a skit or short play demonstrating plants and sunlight.
- Create a commercial for a product to help plants receive more sunlight.
- Create a vlog or Flipgrid explaining tropisms from a botanist's point of view. Upload the video to Seesaw or Google Classroom.
- Write and illustrate a short story about a day in the life of a plant.
- Create a diorama to illustrate the concept.
- Use Play-doh or Legos to build a set for a stop motion picture illustrating the concept.
- Use scraps of paper from magazines or drawings to create a collage depicting the concept.

Resources

- Jangsawant, P. (February 2020). Agriculture, flower. Pxhere. https://pxhere.com/en/photo/1603656
- K20 Center. (n.d.) Claim, Evidence, Reasoning (CER). Strategies. https://learn.k20center.ou.edu/strategy/156
- K20 Center. (n.d.) Collective Brain Dump. Strategies. https://learn.k20center.ou.edu/strategy/111
- K20 Center. (n.d.) Elbow Partners. Strategies. https://learn.k20center.ou.edu/strategy/116
- K20 Center. (n.d.) I Notice/I Wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.) POMS: Point of Most Significance. Strategies. https://learn.k20center.ou.edu/strategy/101
- Krause, J. (n.d.). Biology of Plants: Introduction. Missouri Botanical Garden. https://www.mbgnet.net/bioplants/main.html
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- Thurman, D. (2020). Plant Tropism. [Video]. SafeShare. https://safeshare.tv/x/ss5e569baeddf08