Plant Structure & Function: Stations

4th Grade

NGSS: 4-LS1-1

Background

Read Pre-Lesson Preparation Before Class

Lesson Description

Plants are the most successful living things on Earth. They have survived hundreds of millions of years despite five mass extinctions and continue to thrive. In this lesson students will learn about the structures plants need to survive through station investigation. Once they have completed their stations, students will apply what they've learned by modeling how a fern is able to survive without seeds.

Driving Phenomenon

Millions of years before flowering plants evolved on Earth, ferns and other plants covered the landscape. Not all plants grow from seeds and seeds didn't evolve until millions of years after ferns and similar plants. Ferns grow from spores instead of seeds but are still one of the most, if not the most, successful plants on the planet.

Driving Questions

- What parts does a plant need to survive?
- How do plants adapt to live in different places?

Learning Objectives

- Students use models to gain an understanding of basic plant anatomy.
- Students will apply knowledge of seed plants to learn about how spore plants survive.

Time Requirements

- 2 hours 20 minutes

Prerequisite Knowledge

- Introduction to structure and function.
- Not all parts of the Earth's crust formed at the same time.

Teacher Resources

1. Fern Image
2. Station Rotation Cards
3. Seeds Video
4. Article: Florida fern fans fight to save plants that are in danger of disappearing

Student Resources

1. Station Rotation GraphicOrganizer
2. Seed Plant and Fern Models
3. Fern Research handout
4. Claim- Evidence-Reasoning

Acknowledgements

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How can we know about Earth's past before humans existed?

Full lesson procedures begin on the next page

Engage | 20 minutes	
Students will make observations of an image of plant spores and make predictions of what this plant needs to survive.	Notes
Teacher Resources: 1.0	
Explore | 30 minutes	
Once students have predicted what the fern needs to survive, they will learn about seed plants through a stations rotation. Students will create a model of a seed plant while completing their stations.	Notes
Teacher Resources: 2.0 Student Resources: 1.0	
Explain | 20 minutes	
After students have completed their model of a seed plant, they will complete a prediction model of the fern with labels and explanations.	Notes
Student Resources: 2.0, 2.1	
Elaborate | 25 minutes	
Students research how fern plants reproduce without seeds.	Notes
Teacher Resources: 2.0, 3.0, 4.0 Student Resources: 3.0	
Evaluate | 40 minutes	
Students evaluate their research by creating a claim-evidence-reasoning argument for how ferns reproduce without seeds.	Notes
Student Resources: 4.0	

How do ferns survive without seeds?

Materials

NOTES

Prepare stations for the Explore phase in advance. It is recommended that station materials and Station Information Sheets are placed together in bins so the teacher can easily distribute them when needed. Depending on the number of students, if could be beneficial to have two sets of each station for
a total of eight stations to limit crowding and expand workspace.

- Projector or Smartboard for showing students images
- Computers, Chromebooks, or tablets for student research and investigation
- White board or chart paper for recording student responses
- String/yarn in a light color (white, cream, yellow)
- Small disposable cups
- Blue food coloring
- Red food coloring
- Green construction paper
- One inch paper squares- different colors, including the same green construction paper
- Two trays or bins (optional)
- Flashlights (one per station set)
- Leaves (have students bring them from home or collect at recess)- 2-3 per station set
- Information cards (Teacher Resource 2.0)
- Examples of live plants, if possible: real leaves and pine sprigs from neighboring trees, air plants, moss, or ferns. Otherwise, provide images of these plants.

Lesson Enrichment Ideas

READ

The Magic School Bus Plants Seeds
by John Speirs and Joanna Cole
A book about how living things grow. http://www.worldcat.org/oclc/933301673

I Wonder Why Trees have Leaves
by Andy Charman
Colorful illustrations help the reader learn many facts about plants, such as why fruits are sweet, which plant has a private pool, and how certain plants attract insects.
http://www.worldcat.org/oclc/52738417

WATCH

Seeds
This video provides a background of how seed plants evolved.
https://vimeo.com/203210139

How do ferns survive without seeds?

Engage

1. Project the image of the fern (Teacher Resource 1.0) to the class.

2. Gather observations from students. What do they notice? What does the plant need to survive? How do the parts of the plant help it survive?

3. Ask students to share their observations and record them on chart paper or the board.

Explore

1. Distribute Student Resource 1.0, the stations and modeling packet to students. Review how students will collect data and observations for each station.

2. Divide the class into groups of three or four. Have students rotate through stations in their small groups using their packets to collect observations and make inferences about each plant part as they rotate through the stations.

3. Distribute stations/bins prepared ahead of time (root, stem, leaves, flower). Each group of three or four should begin with one bin.

4. Before students begin, instruct them to read the entire information card before beginning the station. As students complete the stations, they should record their observations in the table of their packet. When they are finished, they can move on to the next station. You may also wish to time the stations to help groups circulate evenly.

5. If students finish early, they can make sure each plant part is labeled and sketched, they have written what each part does, their writing is legible, and their stations are clean.

Explain

1. Once students have completed the stations have them complete two full models (Student Resource 2.0 and 2.1). For the first model, they should draw and label each portion of a standard flowering plant, show how water moves through the plant, and how sunlight moves through the plant. Students may use words, arrows, drawings, or other symbols to show their knowledge.

How do ferns survive without seeds?

Explain

2 For their second model, project Teacher Resource 1.0 again. Explain to students that the plant they have been observing is called a fern. Ferns survive without seeds.

3 Next direct students to create their second model. In the second model, students should draw a fern, and label each of the same components. Students will need to make an educated guess on how ferns reproduce since they don't have flowers or seeds.

Elaborate

1 Have students share out their prediction models in small groups. Ask for students to volunteer their educated guesses on how ferns survive without seeds.

2 Once students have shared their thoughts, let them know they will be researching how ferns reproduce without seeds. Direct students to the information gathering handout in the students resources (Student Resource 3.0). Review your protocol for using technology to research answers if appropriate. Suggested resources for research can be found in the Suggested Resources section (see right).

Evaluate

1 Allow students to revise their model based on what they've learned in their research. Students should focus on spores and where spores exist on the plant.
2 Have students use Claim-Evidence-Reasoning to explain their model (Student Resources 4.0).
3 After students have completed their CER, share information about ferns and details about their life cycle and how they reproduce at Unfolding of Microplant Mysteries (scroll down to the ferns section for this information).

SUGGESTED RESOURCES

Seeds
This video provides a background of how seed plants evolved.
https://vimeo.com/203210139

Florida fern fans fight to save plants that are in danger of disappearing
Newsela article about ferns and spores.
https://newsela.com/read/fern-crisis/id/10754/Plant

Teacher Resource 1.0

Fern Close Up

kaibara87 [CC BY 2.0 (https://creativecommons.org/licenses/by/2.0)]

Full Fern Plant

Lotus Johnson [CC BY 2.0 (https://creativecommons.org/licenses/by/2.0)]

Teacher Resource 2.0

Leaf Station Information Sheet

Materials:

- Leaves
- Flashlight

1. Look at the materials in this station. Examine the shapes of the leaves and discuss with your group what you see on the leaves. Pick up a leaf. Take a flashlight and shine as much light on the surface of a leaf. **Did the light touch both sides of the leaf or only one side?**

2. Try shining the flashlight from different distances. **Did the light touch the entire surface of the leaf? What does the flashlight represent?**

3. Plants use sunlight to make their food through a process called photosynthesis. Photo means "light" and synthesis means "the process of", therefore **photosynthesis is the process of using sunlight to make food!**

Discussion

- What is the function of the leaf? Why is the leaf important for the plant?

Root Station Information Sheet

Materials:

- Bin or tray
- Pitcher with water
- Blue food coloring
- light colored yarn or string

1. Put one or two drops of blue food coloring in a small cup of water.

2. Take a piece of string or yarn and place it in a cup of blue water.

Discussion

- How does the string or yarn absorb (take in) water?
- How is the string like a plant root?
- Why do you think you added food coloring to the water?
- What did the food coloring represent?

Teacher Resource 2.0

Stem Station Information Sheet

Materials:

- Celery stalks with leaves
- 2 cups
- Sugar water dyed red
- Water dyed blue

1. Examine the celery stalk. **What do you notice? Where is the blue? Where is the red?**

Discussion

- Which color do you think matches the phloem (FLOH-em), an internal structure that carries food from the leaves to the rest of the plant?
- Which color do you think matches the xylem (ZAHY-luhm), an internal structure that carries water from the roots to the rest of the plant?

Flower Station Information Sheet

Materials:

- One full sheet of green construction paper set in a tray.
- One inch squares of construction paper (green, red, white, blue, yellow) set on top of the green sheet

1. Look at the materials in this station. **Which squares of paper appear brighter on the green paper?**
2. Flower petals are bright colors to attract insects. These insects stop to eat on the flower and then pick up polled on their feet and spread it to other flowers.

Discussion

- If you were an insect, how would you know where to go for food?
- How might flowers help plants and trees grow and survive?
- Why are flowers typically bright colors? Why don't we see green flowers very often?

Plant Structure Stations

Student Resource 1.0

Plant Structure Name	Structure What does the plant part look like?	Function What does the plant part do?
Leaf		
Stem		
Flower		

Name:

Date:

Student Resource 2.0: Plant Models

Flowering Plant Model

Model Checklist

Labels	Arrows
☐ Flower	☐ Sunlight moves
☐ Stem	☐ Water moves
☐ Xylem	
☐ Phloem	
☐ Roots	
☐ Leaves	

Student Resource 2.1: Plant Models

Fern Model

Model Checklist

Labels	Arrows
☐ Stem	☐ Sunlight moves
☐ Xylem	☐ Water moves
☐ Phloem	
☐ Roots	
☐ Leaves	
☐ Part for reproduction	

Fern Research

Name:

Date:

Student Resource 3.0

Research Prompt: How do ferns survive without seeds?		
Source 1: **Site**_____ **Author**_____ **Date Published** _____	**Fact(s)**	**How does this fact help answer the prompt?:**
Source 2: **Site**_____ **Author**_____ **Date Published** _____	**Fact(s)**	**How does this fact help answer the prompt?:**
Source 3: **Site**_____ **Author**_____ **Date Published** _____	**Fact(s)**	**How does this fact help answer the prompt?:**

Claim-Evidence-Reasoning

Name:

Date:

Student Resource 4.0

CLAIM - EVIDENCE- REASONING
TOPIC: **What question are your trying to answer?**
CLAIM: **What is your answer to the question?**
EVIDENCE: **What facts have you learned that support your CLAIM?**
REASONING: **How does your EVIDENCE support your CLAIM?**

Fact 1	Fact 2