2018 Investigation Teacher Instruction Sheet

INVESTIGATION TITLE: Woody Plant Structure: Who, What, Where, When and Why?

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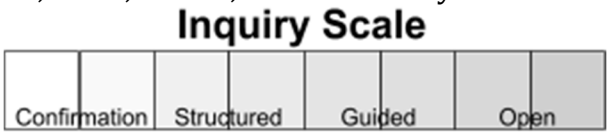

Grade level: 4

Time Required: three, 45-minute class periods plus one post-assessment day at the end of the unit.

- Day 1: engagement activities (pre-assessment, *Are Trees Alive* reading and class discussion, watch three short YouTube videos).
- Day 2: begin investigation (review protocol, collect data, analyze and interpret data).
- Day 3: finish investigation (construct explanations, draw conclusions, present findings).
- Day 4: Post-assessment (draw a model of two woody plants).

Unit Context: This investigation is part of a larger unit called Plant and Animal Structures at Center School, an effort to understand the various structures of woody and herbaceous plants at Center School and how diversifying the plant structures in our butterfly garden will attract a variety of other pollinators such as bees, wasps, flies and ants.

Sequence and Lesson Title	Investigation or Activity Description
1. Woody Plant Structure: The Same or Not the Same… You Decide	**Students will learn about woody plant structure and identify some of the woody plants that are growing in the woods behind The Center School.**
2. Herbaceous Plant Structure: The Same or Not the Same… You Decide	Students will learn about herbaceous plant structure, identify some of the herbaceous plants that are growing in the woods behind The Center School and note any pollinators present on their plants.
3. Pollinators and Plants, Perfect Partners	Students will increase their knowledge of herbaceous and woody plant structure, identify some of the plants growing in The Center School pollinator garden, understand that different types of plant structures attract different pollinators and that insects and plants have coevolved over time to attract one another. Students will complete a design challenge: can you draw a plant that will attract a new pollinator to our butterfly garden?
4. Pollinator Paradise	Students will use data from the other three lessons to help them choose a variety of plants to put in our existing butterfly gardens as well as in other areas of the school to attract a variety of other pollinators such as bees, wasps, flies and ants.

Investigation Focus: Students will learn about various woody plant structures, understand how they relate to the human body's structures and identify some of the herbaceous plants that are growing in the woods behind Center School.

State Learning Standards:

- **MA Science and Technology/Engineering Standards: 4-LS1-1.** Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior and reproduction. Clarification statements: Animal structures can include legs, wings, fins, feathers, trunks, claws, horns, antennae, eyes, ears, nose, heart, stomach, lungs, brain and skin. Plant structures can include leaves, roots, stems, branches, flowers, fruits and seeds. State assessment will be limited to macroscopic structures.
- **MA Digital Literacy and Computer Science Standards: 3-5.CT.c.2** Collect and manipulate data to answer a question using a variety of computing methods (e.g., sorting, totaling, averaging) and tools (such as a spreadsheet) to collect, organize, graph, and analyze data

Learning Outcomes:

- Students will use observation to collect and record qualitative and quantitative data.
- Students will compare and contrast various woody plant structures to each other and to the structure of the human body.
- Students will compare and contrast two woody plant structures and observe how different plant structures such as leaf shape and type along with various means of seed dispersal help them survive.
- Students will identify two woody plants growing in the woods behind The Center School
- Students will draw and label a woody plant

Materials List:

- Science notebooks
- Writing implements
- Clipboards
- Colored pencils
- Magnifying glasses
- Document camera
- Chromebooks with Plantnet and inaturalist apps
- Measuring tapes
- Craft gloves
- Attached student instruction sheets
- Timer for teacher
    - Structured-level Instruction Sheet
    - Guided-level Instruction Sheet

Advanced Preparation:

- Submit permission slip to nurse and administration in August before school starts. Send home permission slip on the first day of school.
- Explore woods behind school ahead of time to get a sense of woody plants growing in the wooded area.
- Ask for parent volunteers to accompany us in the woods.
- Teacher will take photos of woody plant specimens from home as well.

Introduction/Background Information

Plants differ in various ways. One way in which plants differ is that they are either woody or herbaceous. Woody plants have a stem made out of lignin a "solid, rigid structure that prevents damage" all year-round no matter the temperature. Herbaceous plants have a stem made out of cellulose which is strong, but not nearly as rigid as lignin, and crushes easily.

But not all woody plants are the same. There are two types of woody plants deciduous and coniferous. Deciduous trees often have broad leaves "unlike the thin needles of the conifers." In autumn, these leaves change color and the tree sheds them. Oaks, beeches, maples, elms, and birches are deciduous. "Coniferous trees have narrow hard leaves called scales or needles. Most of them are evergreen, meaning that they stay green during the winter and don't have leaves that change colors and drop during autumn season. Conifers get their name from having cones that house their seeds. Some examples of coniferous trees include cypresses, pines, cedars, firs, and redwoods (Biology for Kids: Trees)."

Although woody plants' structures vary, their purpose is to help the plant survive just like our body structures help us survive. For example, a tree's bark is like our skin because it protects a tree's inside parts just like our skin protects the inside of our bodies, and a trees leaves are like our nose and lungs because a tree breathes through its leaves (Stewart, Chesley 295).

Engaging Experience: Teacher will read *Are Trees Alive?* by Debbie Miller and write the following human body structures on chart paper: feet, legs, arms, skin, nose/lungs, veins and smiling face. Then, students will each receive a copy of the tree structure cards found on page 296 of *Perfect Pairs*. Next, students will write the appropriate corresponding human body part underneath the corresponding tree structure. Please note that corresponding body structures of fruits and seeds will not be discussed. Although, seeds can be compared to babies because they will grow into adult trees.

Guiding Question(s): How does a woody plant's structure help it survive? Do all woody plants have the same structure? Why or why not?

Investigation:

Day One: Pre-assessment and Engagement Activities

- Draw and label a model of a woody plant on a loose piece of paper. Have students write names on models and collect the models so that they can be photocopied.
- Teacher will read *Are Trees Alive*? by Debbie K. Miller. Teacher will give each student a set of tree structure cards. Underneath each tree structure, students will write the corresponding human body structure.
- Students will watch these three videos about the difference between coniferous and deciduous trees, identifying coniferous trees and identifying deciduous trees.

- https://www.youtube.com/watch?v=-lc3vLCKdmg Deciduous vs. Coniferous

- https://www.youtube.com/watch?v=qFVh2fTR2XA Different types of conifers

- https://www.youtube.com/watch?v=Yz7DZqSvh5c Different types of deciduous trees

- Whole group discussion about which woody plants we'll find in the woods behind Center School. Teacher will create a chart with the various categories: deciduous, coniferous and shrub.

Day Two: Begin Investigation

- Review behavioral expectations for being in the woods
- Complete the collect and analyze data sections in the structured or guided student forms.

Day Three: Finish Investigation

- Students will construct explanations and draw conclusions.
- Share explanations and conclusions with another set of partners.
- Partners will present findings to class.

Day Four: Assessment

- Students will draw and label models of two different types of woody plants.

Vocabulary: Definitions from various sources such as, https://web.wpi.edu/Images/CMS/PIEE/3d1.pdf and https://plants.usda.gov/growth_habits_def.html

- Cone- the dry fruit of a conifer, typically tapering to a rounded end and formed of a tight array of overlapping scales on a central axis that separate to release the seeds.
- Coniferous- Evergreen trees with narrow hard leaves called scales or needles that house their seeds in cones.
- Deciduous-Broad leaf trees that have leaves that change color and shed their leaves in the autumn.
- Evergreen-trees that stay green during the winter and don't have leaves that change color in autumn and fall to the ground.
- Bark-tough, exterior covering on a woody plant's roots or stem.
- Structure- the arrangement of various plant parts.
- Leaf- a usually flat, green, plant structure used in photosynthesis and transpiration (breathing).
- Root- a plant structure that provides stability to a plant, collects water and nutrients from the soil, and is usually found below the ground.
- Tree- a woody, perennial plant usually more than thirteen feet tall.
- Trunk- a long part, the stem, of a woody plant made out of lignin that connects various structures (leaves, flowers, roots) to each other and functions in the transport of water and nutrients
- Vascular-Has a system of tubes to move water and nutrients.
- Lignin-a chemical compound found in plant cells making them woody and rigid.

Assessment:

Pre-Assessment: Students will draw and label a model of a woody plant.

Embedded Activity Assessment: Student created data charts in notebooks observed while floating through the classroom and classroom chart and discussion about woody plants' similarities and differences.

Post-Assessment: Students' will draw and label a model of two different woody plants and answer the guiding questions in their notebooks.

Resources for Educators:

Stewart, Melissa and Chesley, Nancy. *Perfect Pairs: Using Fiction and Nonfiction Picture Books to Teach Life Science.* Grades 3-5. Stenhouse Publishers, Portland, ME. 2016.

Resources for Students:

Davies, Nicola. *The Promise*. Candlewick, Somerville. 2017.

French, S. Terrell. *Operation Redwood*. Amulet Paperbacks, New York. 2011.

Hopkins, H. Joseph. *The Tree Lady: The Story of How One Tree-Loving Woman Changed a City Forever.* Beach Lane Books, San Diego. 2013.

Miller, Debbie S. *Are Trees Alive?* Bloomsbury, New York. 2003.

Preus, Margi. *Celebritrees: Historic & Famous Trees of the World*. Henry Holt and Co, New York. 2010.

Sayre, April Pulley. *Full of Fall*. Beach Lane Books, San Diego. 2017.

Wrap Up:

Discuss as a class:

1. How does a woody plant's structure help it survive?
2. Do all woody plants have the same structure? Why or why not?
3. How does a woody plant's structure compare to the structure of the human body?
4. What do you know about the woody plants at Center School?

Following the discussion students will be asked to write the answers that the group creates in their notebook. This will help address any gaps that they may still have had when they answered the guiding questions with their partner.

Connection: This lesson connects to day two at Tower Hill because we talked about plant structure and identified woody plants on the grounds. We also talked about how seeds travel. During our exploration of the woods behind Center School, we will most likely find samaras and cones which will also connect to the Tuesday activity at Tower Hill where we discussed how seeds travel and then tried to engineer a seed that could travel fifteen feet from its host.