

Seeds

Key Topics: Seed Coat, Germination, Cotyledon, Endosperm, Roots, New Leaves, Photosynthesis, Embryo

Grade Levels: K, 2, 4

Inside or Outside

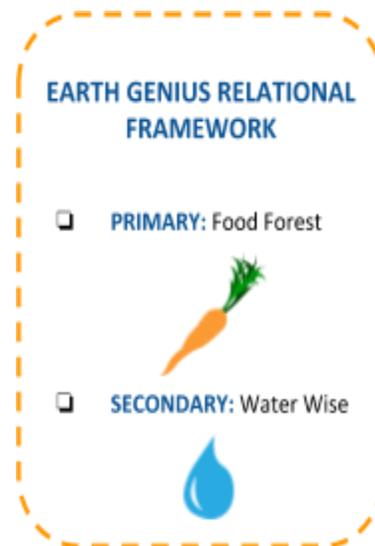
Lesson Overview:

Seeds are small but mighty! In this lesson students will explore seeds and learn that each one contains all the information necessary to grow into healthy, thriving vegetables for our garden. Learning will happen through a skit that relates common items such as a coat, a snack, and a hat to the structure and function of different seed components. Students will then dissect a variety of soaked seeds to understand that all seeds have these parts and therefore all seeds have the possibility to become a plant.

Activities:

Option 1 - Seed Skit: 20 minutes

Option 2 - Seed Dissection and Discussion: 40 minutes



Suggested Activities and Learning Objectives by

Grade Level:

- K:
 - K-LS1-1 What do plants need to survive?
- 2:
 - 2-PS1-1 How do plants disperse their seeds?
- 4:
 - 4-LS1-1 How does each part of the plant support survival, growth and reproduction?

Essential Question(s) that Connect CCCs and SEPs:

- Why are the cotyledons a necessary structure for a germinated seed to have before the true leaves emerge? Can the cotyledons photosynthesize?([Structure and Function](#); [Construct Explanations and Design Solutions](#))
- What is already known about the relationship between seed structure and function in growing into a plant? How can I best communicate about this relationship between structure and function? ([Structure and Function](#); [Obtaining, Evaluating, and Communicating Information](#))
- Do you notice any patterns between different seeds? Are there any similar structures? Why might different seeds have the same internal structures? What questions ([Patterns](#); [Asking Questions and Defining Problems](#))
- What is the cause of germination? ([Cause and Effect](#); [Asking Questions and Defining Problems](#))

Materials:

Part 1 - Seed Skit

- Seed Riddle, written or printed
- Backpack, full of crumbled paper so it looks full but is light enough for a student to wear
- Snack placed inside of backpack (use seeds like sunflower or pumpkin to keep it themed)
- Water bottle with straw inside of backpack
- Coat / rain jacket
- Hat (best if green)
- Tape and labels for seed parts

Part 2 - Seed Dissection

- Magnifying glasses - 1 per partner pair
- Paper towels / napkins
- Soaked lima beans - at least 2 per student
- Soaked variety of seeds - at least 2 per student
- Clipboards, paper, and pens if doing dissection outside

EG Team Support Needed:

- None

Prep:

This lesson can easily take place inside or outside without altering activities. Having a whiteboard and ample sitting space for the dissection activity is needed.

- Soak large lima beans, plus a bowl of a variety of other seeds, in water about 12 hours prior to activity. Bring to class. If conducting the optional adaptation for 3rd-5th graders, soak one type of bean for a variety of different time periods ie. one batch for 5 days, one batch for 3 days, one batch wrapped in damp paper towels for one day.
- Gather costume materials.
- Familiarize yourself with basic seed anatomy and drawing the structures (refer to diagram example below).

Activity Procedure:

Engage:

Greet your class with a riddle to get them thinking about what the day's lesson will be.

Read: *Seed Riddle* by Laurel Anderson

I appear dead before I am alive

Although often quite small, inside my skin a tree can live

I can survive hundreds of years without food or water

I can be as small as dust or as large as a football

Humans and animals eat me

I can fly, swim and hitch a ride

I can survive freezing, fires and intense droughts

What am I?

(Answer: a seed!)

Some seeds are very nutritious. They are rich in protein, minerals, fats, and vitamins. Why are they so nutritious? Life comes from seeds. The seed provides food for the embryonic plant. What are some examples of seeds we eat? What types of seeds did you eat for breakfast or lunch today? (Remember, grains, beans, and nuts are seeds!) Is there anything we eat that doesn't come from a seed? What about animals? (*All animals, whether omnivores or herbivores, rely on plants that come from seed somewhere along the food chain*). Could we survive without seeds? Today we are going to learn about how such a small thing has the potential to grow into large healthy, thriving vegetables for our garden.

Explore:

Action:

- 1) As you proceed with this skit, write vocabulary words as they come up in a word bank on the board to help students remember and apply them later in the lesson. Vocabulary words: seed coat, germination, cotyledon, endosperm, roots, new leaves, photosynthesis, embryo
- 2) Dress up one student as a hiker, with a coat and backpack. Ask the student how you protect yourself from the wind, rain and cold. (*A coat.*) Explain that a seed also has a coat and when conditions are right for growth, the seed will germinate. What **causes** a seed to germinate? (**Cause and Effect**; **Asking Questions and Defining Problems**) (*Water!*) The seed will absorb water and split the seed coat. Put the label "Seed Coat" on the coat and have the student remove the coat and hang it up with the label showing.
- 3) Ask the student what a hiker would need on a long hike. (*Lunch.*) Have the student open the backpack and find the snack. Explain that seeds also store food and they store it in a cotyledon. The cotyledons are inside of the seed and are the first leaves to appear when the seeds sprout. It is also known as an endosperm. These provides the initial energy for the plant to germinate and grow. The word cotyledon is from the Greek *kotyle*, meaning "hollow object," alluding to the spoon or bowl shape of the leaves. Attach the "Cotyledon" label to the backpack.
- 4) What else does a hiker need? (*Water.*) Have the student remove the water bottle from the backpack. How do plants get water? (*Roots.*) Attach "Roots" to the straw of the water bottle.
- 5) What else might the hiker need on a hot day? (*A hat.*) Attach the "New Leaves" label to the hat. Have the student remove the hat from the backpack and compare the hat to the first green leaves a seedling puts out to absorb sunlight. Plants can make food from sunlight, which humans cannot do. This process is called photosynthesis. When the true leaves emerge, the cotyledons fall off. Why are the cotyledons a necessary **structure** for a germinated seed to have before the true leaves emerge? Can the cotyledons photosynthesize? (*The plant cannot photosynthesize to provide food for itself until the true leaves emerge, so the cotyledons feed the plant in the meantime!*) (**Structure and Function**; **Construct Explanations and Design Solutions**) Have the student remove the backpack.

- 6) Explain that the leaves and roots grew from the embryo inside the seed. Put the sign “Embryo” on the student.

Explain:

Review the various parts of the seeds using the props and vocabulary on the board.



Ask students to raise their hands to share:

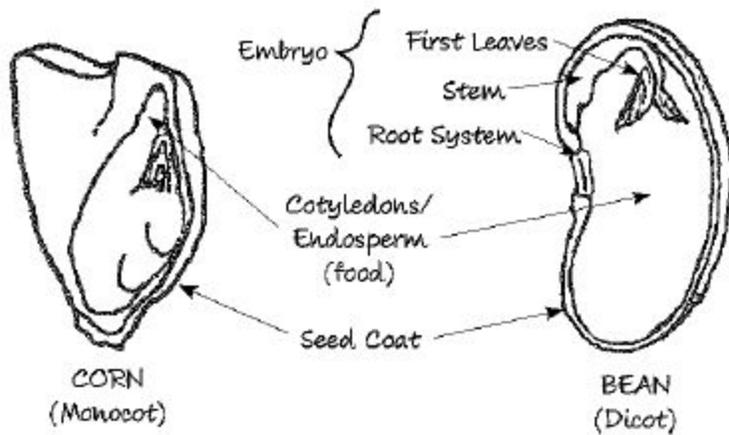
What did we learn about the **relationship between seed structure and function** for growing into a plant? How does the seed coat function? The cotyledons? The true leaves? etc. (The seed coat keeps the seed insulated, the cotyledons provide the initial energy for germination, etc.) (**Structure and Function; Obtaining, Evaluating, and Communicating Information**)

Elaborate:

Action:

- 1) Have the students break into pairs. Partnering with the person next to them at their workstations (whether inside or outside) works well here. Remind students what the callback will be for this project (give me 5, silent coyote, chime, etc). Explain that together they will dissect seeds. Invite students to take four lima beans from the bowl and two hand lenses and place them on paper towels in their work space. Be sure to allow students to explore other seeds (in addition to lima beans) that have less obvious structures, such as peas and sunflowers, after their initial dissection of the lima bean. It will take more time to find the **structures** in smaller seeds, but it is worth the effort for students to understand that all seeds have these parts and therefore all seeds have the possibility to become a plant.
- 2) Instruct students to investigate one of the beans they have placed on the paper towel with step-by-step directions. They may use their hands or other simple instruments you may provide such as toothpicks. Encourage the use of process skills by asking students to observe size, shape, number of parts, textures, etc.
- 3) Challenge them to identify the following parts (circle the vocabulary words on the board): seed coat (outer protection of seed - wrinkly and paper thin), embryo (part that will grow into the plant), and the cotyledons or endosperm (surrounds the embryo and is food for the baby plant until it is big enough to produce its own food).
- 4) Gently rub the seed between your fingers to remove the outer skin or seed coat. What is this and what is its function? (*Seed coat and it protects the seed within it.*)
- 5) Demonstrate how to split it in half by following the outer curve (looks like a rainbow!) with your fingernail or toothpick. Have students open and look inside their seeds using magnifying glasses.
- 6) Ask them to describe what they see in their seeds. Do you notice any **patterns** between different seeds? Are there any similar structures? Why might different seeds have the same internal structures? (**Patterns; Asking Questions and Defining Problems**)
- 7) Turn so that you're facing away from the students and explain that you'll be drawing a seed based on their descriptions, without looking at the seeds yourself. As they describe the seeds, draw one somewhere so that everyone can see it. For example, you might ask: *Who could describe the shape of the seed?* As one student describes it, draw whatever they describe. They

can modify their descriptions based on how accurate your representation is. Then you might ask, *Who can describe something they see on the inside of the seed?* Continue until you have a full picture of a dissected seed. Ask students to draw a similar diagram of the parts of a seed and label it with you. Refer to the bean below for a simple and accurate representation:



Every seed has a seed coat, and an embryo made up of leaves, stem, and root system. Seeds have either one or two rudimentary leaves called cotyledons. Seeds with one cotyledon are monocots. Seeds with two cotyledons are dicots.

Evaluation:



Ask students to raise their hands to share:

We have already identified the seed coat. (Label the seed coat on your drawing.) Inside the seed coat are large fleshy structures. **What are these and their function?** Cotyledons, or endosperm, store food to help the plant grow until it produces true leaves. It feeds that baby plant while it's underground. Sometimes we think of this as the seed's "lunchbox." Once the plant breaks through the soil and the true leaves emerge, it can start to gather sunlight and make its own food. What is this process called? (*photosynthesis*). Cotyledons die back as the true leaves emerge to carry out photosynthesis. What happens if you plant a seed too deep?

What do they see in the inner curve of the cotyledons? It looks a bit like a tail. **What is its function?** (Baby plant or embryo, made up of the first true leaves and the roots. It is food for the baby plant until the first true leaves emerge to photosynthesize). (**Structure and Function; Obtaining, Evaluating, and Communicating Information**)

Review: So seeds have a coat and a lunch box to stay warm, protected, and well fed while they grow underground!

Also, refer back to the Learning Objectives for your grade level and ensure that they have been met by asking the given learning objective question.

Extension Activities:

- How do seeds travel? Students learn by experiment with a variety of seeds. Why is it advantageous for coconuts to float, or for dandelion seeds to fly? This lesson is an intersection of adaptations and structure and function. Follow this lesson plan: [Seed Ya Later](#)
- Students engineer their own “seed” by mimicking structures of real seeds that allow for traveling. Follow this lesson plan: [Adapt-a-Seed](#)
- Have students go into the garden and collect seeds from different plants. The seeds are ready when seed pods are brown and dry. Describe and categorize these seeds. Use this [Seed Saving Packet Template](#).
- Instruct students to hypothesize as to the needs of the seed in order to germinate/sprout (water, soil or other medium to hold moisture, warm temperature). Ask students how they might test their hypotheses. Would the same be true for all seeds? Allow students to set up and conduct experiments to test hypotheses formed. Have them gather needed resources (books to verify guesses, materials to test needs of seeds) and follow through with experimental activities. Require students to journal findings of all experiments stating whether hypotheses were proven or disproved.

Tips and Caveats:**Adaptations for 3-5**

After students dissect seeds to identify components, have students dissect and observe seed germination in action! Soak one type of bean (lima, pinto, etc.) for a variety of different days ie. one batch for 5 days, one batch for 3 days, ~~one batch wrapped in damp paper towels for 1 day.~~ You can even make it a blind experiment by not labeling the length of time each seed was exposed to water and leaving that for students to determine.

Cited Curriculum:

LifeLab - The Growing Classroom: [Seedy Character](#)

FoodCorps and LifeLab - Sprout Scouts: [Seed Soiree](#)

Occidental Arts and Ecology - A Handful of Seeds: [A Seed is a Plant in a Box with its Lunch](#)

Ag in the Classroom - Oh Say Can You Seed: [Bean Dissection](#)