Journey to the Center of a Seed

The following activity is from the curriculum guide GrowLab: Classroom Activities for Indoor Gardens and Grow Lights. This curriculum brings plant-based explorations to life through 46 lesson plans and hundreds of extension activity ideas that spark students' curiosity about plants and invite them to think and act like scientists. Click here for more information or to order this guide.

Overview: Students observe, sort, and classify a variety of seeds according to different properties, and then take a journey inside a bean seed to predict and observe changes that occur during seed germination.

Grade Level/Range: Grades K-4

Objective:
Student will:

- Learn how to sort and classify seeds by external characteristics.
- discover what's inside a seed, to predict how seeds will change after sprouting, and to observe the sprouting (germination) process.
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Time: 30 to 45 minutes for initial discussion and investigation, 7 days to observe seed growth

Materials:

- assorted seeds
- dried lima beans (at least two per student)
- cup of water
- hand lens
- glue
- toothpicks
- plastic bag
- paper towel

Background Information:

Seeds grow into new plants. Each seed has a seed coat and an embryo containing tiny leaves, a stem, and roots. The seed coat protects the embryo while a temporary food supply nourishes it, either as an endosperm packed around the young plant or stored in special leaves called cotyledons. Most seeds are either moncots, having one cotyledon, or dicots, with two. Seeds remain inactive until conditions are right for them to begin to grow, or germinate.

All seeds require oxygen, water, and the proper temperature range in order to germinate. Oxygen and moisture, initially taken in through the seed coat and later by the root, help the seed get energy from its food supply. Different types of seeds have specific temperature requirements and preferences for germination. Many seeds also require proper light conditions to germinate: some require light, while others are inhibited from germinating by light.

Seeds have their own source of nutrients (in the cotyledons or endosperm) to sustain them through early life, so they do not require additional nutrients. The proteins, fats, and carbohydrates stored for the benefit of the young plant are what make seed such a rich and vital food source for humans and other animals.

When a seed is exposed to proper conditions for germination, water is taken in through the seed coat. The embryo's cells begin to enlarge and the seed coat breaks open. The root emerges first, followed by the shoot, which contains the stem and leaves.

Advanced Preparation:

Prior to the activity, obtain a mixture of seeds of different colors, textures, and sizes. Large seeds like beans, corn, peas and squash are easiest for young students to handle. Try to locate some fuzzy or fluffy seeds (tomato, dandelion, milkweed). Old seeds from outdated seed packets are ideal for Groundwork activities. Small envelopes can be used to store seed mixtures for individual groups.

Laying the Groundwork:

1. Give each pair or small group of students ten to fifteen assorted seeds. Ask each group to discuss how their seeds are alike and how they're different, and then sort seeds into groups according to the way they look. Give some examples for grouping such as: rough and smooth, dark colored and light colored; large and small.

As a class, discuss the different properties that the students used to sort the seeds. Put up a class chart with the headings: size, shape, color and texture (and any other properties such as smell, that might have been suggested). Ask the class under which category each of their descriptive words belong. For example:

Size	Shape	Color	Texture
huge	oval	brownish	rough
tiny	round	tan	fuzzy
big	bumpy	spotted	smooth
long		red	bumpy

2. Continue focusing on seed observations by conducting one or all of the following activities:

- Invite small groups to play "I'm thinking of?" with their pile of seeds. One student thinks of and describes a particular seed to the other students, who must carefully observe and guess which seed is being described. Or, have the audience ask "yes" or "no" questions about the description of each seed.

- Play a seed Memory game. Have pairs of students carefully observe a mixture of seeds. Then have one student remove and hide just one of the seeds from the group. The other must describe the missing seed.

3. When the above activities are complete ask: How do you think these seeds with different outsides look inside? What do you think you might find inside a seed? What have you ever observed to make you say that? Give students each a lima bean seed. Ask them to draw a picture of what they predict it looks like inside.

Exploration:

1. Give each pair of students two lima bean seeds (from step 3 above), ½ cup of water, and a hand lens. Have them place their seeds in water for twenty-four hours and examine them regularly. Be sure to start some extra seeds, in case some don't germinate. Ask: What do you predict will happen to the seeds while they are soaking?
2. After twenty-four hours, ask: How did your seeds change while they soaked in water? Did this match your prediction? What do you think was happening inside the seed? Have students in each pair help one another carefully peel the outer coat from one of the seeds. Then guide them or help them to pull the coatless seed in half with a fingernail.
3. On the same drawing students made in step 3 above, ask students to draw a picture of the inside of one of the split seeds. Ask: How does what you see inside the seed compare to your original prediction? Does any part of the inside of the seed look like a familiar plant part? Which? Do you think the seed is alive? Why or why not?
4. Have students place their seeds (both the whole bean seed and the seed that was split in half) in a plastic bag with a moist paper towel for a week. Ask: What do you predict will happen to the seeds during the week?
5. Continue observing the seeds daily for a week. Students should record changes by making new drawings next to their originals. Consider having students make a growth chart to record changes during germination, by folding a long strip of paper like an accordion and clipping it with a paper clip. Draw on one section at a time as the seed grows. When complete, unfold to view the sequence.
6. At the end of the week, discuss findings. Ask: How did different parts of the seeds change during the week? What happened first? Next? Did everyone's seeds change at the same speed? In the same order?

Growing Idea: If you germinate one bean seed every day for seven day, you'll end up with all the stages of germination at one glance!

Making Connections:

Ask students the following questions:

- Which different parts of the seed turned into what you predicted? Did any surprise you? Which?
- Do you think seeds are living or non-living? What did you observe to make you believe that?
- After exploring seeds inside and out, why do you think seed coats are so hard?
- What new questions do you have about your seeds?

Branching Out:

Science:

- Plant your seeds and continue to observe and measure growth using a variety of measurement methods.
- Investigate the power of growing seed. Fill a plastic container (e.g. yogurt container) with pea or bean seeds and add water. Seal the container and watch what happens once the seeds have expanded overnight.
- Explore monocots (e.g., corn and other grasses) and dicots (e.g., bean, pea, tomato). Compare the insides of these seeds and observe differences in early growth.

Math: Have students secretly line up assorted seeds in certain sequences (smallest to largest) or patterns (rough-smooth-rough). Challenge other students to guess the sequence or pattern.

Nutrition: Generate a list of seeds eaten by humans. Consider those that are eaten whole (rice, peanuts) and those that are processed so they don't resemble seeds (wheat flour).

Arts: Act out the process of seeds growing.

