Lesson Outcomes
In this lesson, students will identify that seeds germinate and grow into plants.
- A seed is made up of different parts (cotyledon, seed coat, embryo).
- Seeds sprout into baby plants.

Standard Alignment
Common Core - English Language Arts
- SL.K.1. Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- SL.K.3. Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- SL.K.4. Describe familiar people, places, things and events and, with prompting and support, provide additional detail.
- SL.K.5. Add drawings or other visual displays to descriptions as desired to provide additional detail.
- SL.1.1. Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
- SL.1.3. Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- SL.1.4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.
- SL.1.5. Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- SL.1.6. Produce complete sentences when appropriate to task and situation.
- SL.2.1. Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
- SL.2.3. Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
- SL.2.4. Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.
- SL.2.6. Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Next Generation Science Standards
- K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
• 1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.
• 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Materials & Preparation

• **One day before the Garden Activity:** soak seeds (preferably lima beans) for seed dissection
• The Bean Seed worksheet (front and back) - 1 per student
• The Bean Seed Pictures - 1 per student
• The Bean Seed Descriptions - 1 per student
• Familiarize yourself with your Learning Garden
  Reminder: Big Green's Garden Educators are always available for additional support via email or by phone call

Seed Dissection Work Station:

• Soaked seed - at least 1 per student (preferably lima beans from the grocery store)
• Magnifying glasses - enough for easy sharing at work station
• Paper towels - at least 1 per student
• Seed Dissection Work Station worksheet - 1 per group or work station

Teacher Background

Germination is defined as the beginning of growth. The term is most commonly associated with plants, describing the process of a seed sprouting into a seedling. The term germination can also be applied to spores or buds.

When seeds are dry and hard, they are dormant. For a seed to germinate, the dormancy period will need to be broken with water and warmth. When a seed is moistened, it will absorb water, breaking the seed coat and initiating the use of the food supply in the cotyledon through the activation of enzymes that produce energy for the seed to sprout.

Temperatures must fall between a specific range for seeds to germinate. Most seeds grown in the Learning Garden germinate between 60° and 90° Fahrenheit (15° and 32° Celsius), but each seed has a unique temperature range for germination. Sunlight supports the germination process as it provides warmth to the soil. Although uncommon, some seeds do even need direct contact with sunlight to germinate. Sunlight warms the soil to help initiate germination. Once leaves have sprouted, and it is also the primary energy source for plant growth through the process of photosynthesis.

All flowering plants are classified as either a monocot (one cotyledon) or a dicot (two cotyledons). In a monocot, one cotyledon, or one seed leaf, will emerge from the
germinating seed. In a dicot, two cotyledons, or two seed leaves, will emerge from the germinating seed. There are other differences between a monocot and a dicot, most notably the leaf structure. In a monocot, the leaf veins are paralleled, like a blade of grass. In a dicot, the leaf veins are netted, or spread, like an oak leaf.

Use the chart below to help familiarize yourself with monocot and dicot examples.

<table>
<thead>
<tr>
<th>Monocot Examples</th>
<th>Dicot Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garlic</td>
<td>Onion</td>
</tr>
<tr>
<td>Corn</td>
<td>Wheat</td>
</tr>
<tr>
<td>Rice</td>
<td>Grasses</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Beans</td>
</tr>
<tr>
<td>Peppers</td>
<td>Peas</td>
</tr>
<tr>
<td>Rice</td>
<td>Carrots</td>
</tr>
<tr>
<td>Grasses</td>
<td>Cauliflower</td>
</tr>
</tbody>
</table>

When seeds sprout in the soil, the radicle, or embryonic root, will be the first to emerge from the seed coat. The developing stem, described as the epicotyl, will emerge next and will grow towards the surface of the soil, eventually pushing its way through. The developing stem will bring the cotyledon along, which appears as the first two sprouting leaves, which looks different than the true leaves of the plant that grow once the stem and roots are established.

Introduction
Spend time discussing the following introductory questions:
- What does a seed need to sprout?
- What is a hypothesis?

Make a list of student responses on the board and group or categorize responses together. Discuss and strike any responses that are not needed to germinate a seed.

Introduce and define the word germination and review the two things seeds need to germinate – warmth and water. Let students know that today they will be exploring the inside of the seed, so they understand how a seed germinates – from the inside out!
CLASSROOM ACTIVITY
During the classroom portion of today’s lesson, students will be learning about the different parts of a dicot seed – it is easiest to use a lima bean seed for this activity.

1. Pass out The Bean Seed Pictures and The Bean Seed Descriptions.
2. Have students cut out each picture and description.
3. Read each description aloud or ask a student to read aloud.
4. Help students match each picture to the correct description.
5. Once all the students have paired up the photos and the descriptions, pass out The Bean Seed worksheet and instruct students to glue each pair to the worksheet.
6. As a classroom, in small groups, or individually have students complete the question at the end of the worksheet. Discuss as a group.

Break here if this lesson will be taught in two sections.

GARDEN ACTIVITY
Welcome your students to the Learning Garden and line students up along one side. Stand on the opposite side of the Learning Garden so you can address the entire group.

Ask students if they know what they will be doing in the Learning Garden for the day’s lesson. Let them know they will be dissecting a seed and learning about the parts of a seed.

1. Let your students know that today they will be working in workstation groups to dissect and explore the inside of a seed. Ask for a student volunteer to review the definition of germination.
2. Introduce the supplies at seed dissection workstations.
3. Assign students to workstation groups. Be sure to bring enough supplies for each workstation.
5. Walk the groups through the seed dissection activity step by step.
6. Complete the following steps to successfully dissect your seed:
   • Select a soaked seed and run your fingernail along the rounded edge.
   • Carefully split open your seed into two separate sections.
   • Remove the skin surrounding your seed.
   • Place the three different seed parts on a paper towel.
7. Instruct the students to label the parts of the seed with your workstation group.
8. Gather your students back together and review the parts of a seed and the function of each plant part.

NOTE: As the teacher, be aware of poisonous plants and other hazards in and around your Learning Garden and review those concerns with your students.
Review any additional rules of the Learning Garden. Ask students about known bee/wasp sting allergies before going into the Learning Garden.

**Conclusion**
Have students share out key parts of the day’s activities and review the Key Understandings for this lesson.
- Ask students why seeds are so important. What part do they play in plant survival?
- Ask students to think about the location of seeds for different plants in the Learning Garden.

Students should clean-up the Learning Garden as needed.
The Bean Seed

1. Cut out the pictures and descriptions.
2. Match the pictures to the correct description.
3. Glue the photos next to the correct description.
All plants make seeds, which means that the plant that grows from a seed will look like the plant it came from. Is this true or false? Circle one.

TRUE    FALSE
THE BEAN SEED PICTURES
This is the **seed coat** and it protects the baby plant from insects, disease, and damage.

This is a **bean seed** and it is a dicot. This means it has two cotyledons, which appear first when the seed sprouts.

This is the **embryo** and it will sprout into a baby plant with warmth and water.

This is one of the two **cotyledons** and it gives the baby plant food to grow.
Seed Dissection Work Station

Word Bank:
Cotyledon  Seed Coat  Embryo

ALL PLANTS MAKE SEEDS!

I think my seed will turn into a plant that looks like this: