



GROWTH AND CHANGES IN PLANTS: How Does A Plant Grow?



The Big Eco Idea: Plants grow and change and they have distinct characteristics.

Description Of the Task:

Students work in cooperative learning groups/pairs to understand how plants grow (seed and root processes). They observe and explore both growth processes through hands-on activities, by dissecting various seeds and analysing some root systems. All participants will experience and care for their own green garden.

Curriculum Expectations:

SCIENCE & TECHNOLOGY-*Understanding Life Systems: Interactions in the Environment*

- 1.2 assess the impact of different human activities on plants, and list personal actions they can engage in to minimize harmful effects and enhance good effects
- 2.1 observe and compare the parts of a variety of plants
- 2.3 germinate seeds and record similarities and differences as seedlings develop
- 2.6 use appropriate science and technology vocabulary, including stem, leaf, root, pistil, stamen, flower, adaptation, and germination, in oral and written communication
- 3.1 describe the basic needs of plants, including air, water, light, warmth, and space
- 3.2 identify the major parts of plants, including root, stem, flower, stamen, pistil, leaf, seed, and fruit, and describe how each contributes to the plant's survival within the plant's environment

Lesson Title: How Does A Plant Grow?

Unit: Science-Growth and Changes in Plants

Grade: 3

Time: 115 minutes (total)

- 40 minutes for the Introductory Activity (Schema Activation - Maple Seed Survival Game / Seed Role Play / Rooting)
- 55 minutes for the Enhancing Activity (Hook – What's Inside a Seed / Seed Labelling / What's all the Root About)
- 20 minutes for the Culminating Activity (Green Thumb Garden)

Groupings

- Students working in small cooperative learning groups
- Students working individually
- Students working as a whole class
- Students working in pairs

Teaching / Learning Strategies

- Inquiry
- Discussion
- Science learning log/journal
- Brainstorming

Assessment Strategies

- Science learning log/journal
- Observation
- Peer/self assessment

Assessment Recording Devices

- Rubrics
- Checklists
- Rating Scales

Resources Required:



Materials

Introductory Activity - Maple Seed Survival Game Activity / Seed Role Play Activity / Rooting

- Whiteboard/chalkboard
- Marker/chalk
- Plant (African Violet, Rex Begonia, Swedish Ivy, Coleus Geranium, Impatiens)
- Science learning log/journal
- **BLM 1.1.a** – Basic Plant Needs Cards – laminated (Soil, Water, Light, Air, Food, and Space)
- **BLM 1.1.b** – Maple Seed Cards – laminated (1/student)
- **BLM 1.1.c** – Food, Baby Plant, and Coat Cards – laminated (1/student)
- **BLM 1.4.f** – Pictures of Various Types of Vegetables
- **BLM 1.5.a** – Student Criteria for Science Learning Log/Journal
- **BLM 1.5.b** – Student Science Learning Log/Journal Page
- **BLM 1.5.c** – Student Rubric for Science Learning Log/Journal

Green Thumb Garden Activity –

- Plant pots (clay, plastic, or metal containers - 4/student)
- Hammer (to make a drainage hole)
- Nail (to make a drainage hole)
- Soil (enough to fill 4 pots/student)
- Potatoes (1 piece with an eye/student)
- Spider plant (optional)
- Green pepper, sesame, or other seeds (few seeds/student)
- Carrots or radishes (just the tops – 1/student)
- Water jug (1)
- Water
- Permanent markers

What's Inside a Seed Activity -

- Large bean seeds or can of beans
- Felt board
- Small plastic containers or Dixie cups – to put the beans in (1/student)
- Pencils
- Crayons or markers
- Toothpicks
- White labels
- Permanent marker
- Science learning log/journal
- **BLM 1.2.a** – My Seed Worksheet
- **BLM 1.2.b** – Seed Parts Cards
- **BLM 1.2.c** – Word Puzzle Worksheet
- **BLM 1.5.a** – Student Criteria for Science Learning Log/Journal
- **BLM 1.5.b** – Student Science Learning Log/Journal Page
- **BLM 1.5.c** – Rubric for Science Learning Log/Journal
- **BLM 1.5.d** – Peer/Self Assessment Form
- **BLM 1.5.f** – Anecdotal Record Sheet
- **BLM 1.5.g** – Rating Scale for Assessment of Seed Parts
- **BLM 1.5.k** – Rubric for Seed Germination

What's all the Root About Activity –

- Plant cuttings (African Violet, Rex Begonia, Swedish Ivy, Coleus Geranium, Impatiens)
- Knife
- Water
- Thin glass jar or large test tube (1/plant)
- Magnifying glass (1/student)
- Black construction paper (1/plant)
- Charcoal chips (available from a pet store)
- Pencils
- Markers/coloured pencils
- Science learning log/journal

- White labels
- Small trays or small box (1/student)
- Newspaper or butcher's paper
- Measuring spoons
- Science learning log/journal
- **BLM 1.4.a** – Plant Care Sheet
- **BLM 1.4.b** – Plant Labels (Carrot or Radish or Beet or Yam - 1 type /student)
- **BLM 1.4.c** – Plant Labels (Pepper or Sesame or Bean)
- **BLM 1.4.d** – Plant Labels (Spider Plant)
- **BLM 1.4.e** – Plant Labels (Potato)
- **BLM 1.4.f** – Pictures of Various Types of Vegetables
- **BLM 1.4.g** – Green Thumb Garden Task Card
- **BLM 1.5.a** – Student Criteria for Science Learning Log/Journal
- **BLM 1.5.b** – Student Science Learning Log/Journal Page
- **BLM 1.5.c** – Rubric for Science Learning Log/Journal
- **BLM 1.5.e** – Rating Scale for Green Thumb Garden Plant Log
- **BLM 1.5.h** – Student Reflection Notes
- **BLM 1.5.i** – Student Plant Log Book
- **BLM 1.5.j** – Rubric for Green Thumb Garden Activity
- **BLM 1.5.l** – Checklist for Green Thumb Garden Graphing Activity



Black Line Masters (BLM)

- **BLM 1.1.a** – Basic Plant Needs Cards – laminated (Soil, Water, Light, Air, Food, and Space)
- **BLM 1.1.b** – Maple Seed Cards– laminated (1/student)
- **BLM 1.1.c** – Food, Baby Plant, and Coat Cards– laminated (1/student)
- **BLM 1.2.a** – My Seed Worksheet
- **BLM 1.2.b** – Seed Parts Cards
- **BLM 1.2.c** – Word Puzzle Worksheet
- **BLM 1.3.a** – My Root Worksheet
- **BLM 1.4.a** – Plant Care Sheet
- **BLM 1.4.b** – Plant Labels (Carrot or Radish or Beet or Yam)
- **BLM 1.4.c** – Plant Labels (Pepper or Sesame or Bean)
- **BLM 1.4.d** – Plant Labels (Spider Plant)
- **BLM 1.4.e** – Plant Labels (Potato)
- **BLM 1.4.f** – Pictures of Various Types of Vegetables

- **BLM 1.3.a** – My Root Worksheet
- **BLM 1.5.a** – Student Criteria for Science Learning Log/Journal
- **BLM 1.5.b** – Student Science Learning Log/Journal Page
- **BLM 1.5.c** – Rubric for Science Learning Log/Journal
- **BLM 1.5.d** – Peer/Self Assessment Form
- **BLM 1.5.f** – Anecdotal Record Sheet



Print and Websites

Blevins, Wiley. (2003) *Parts of a Plant*. Mankato: Compass Point Books.

Bodach, Vijaya. (2007) *Plant Parts Series; Flowers, Leaves, Stems, Roots*. Mankato, MN.: Capstone Press.

Kalman, Bobbie. (1996) *How a Plant Grows*. New York: Crabtree Pub. Co.

Canadian Botanical Conservation Network for Kids. *Botanists in Training Program*.

http://www.rbg.ca/cbcn/en/cbcn4kids/kid_anatomy.htm

University of Illinois. *The Great Plant Escape*.

<http://www.urbanext.uiuc.edu/gpe/case1/c1facts2a.html>

- **BLM 1.4.g** – Green Thumb Garden Task Card
- **BLM 1.5.a** – Student Criteria for Science Learning Log/ Journal
- **BLM 1.5.b** – Student Science Learning Log/Journal Page
- **BLM 1.5.c** – Rubric for Science Learning Log/ Journal
- **BLM 1.5.d** – Peer/Self Assessment Form
- **BLM 1.5.e** – Rating Scale for Green Thumb Garden Plant Log
- **BLM 1.5.f** – Anecdotal Record Sheet
- **BLM 1.5.g** – Rating Scale for Assessment of Seed Parts
- **BLM 1.5.h** – Student Reflection Notes
- **BLM 1.5.i** – Student Plant Log Book
- **BLM 1.5.j** – Rubric for Green Thumb Garden Activity
- **BLM 1.5.k** – Rubric for Seed Germination
- **BLM 1.5.l** – Checklist for Green Thumb Garden Graphing Activity

Preparation:

1. Photocopy all required Black Line Master sheets (**BLM 1.1.a, BLM 1.1.b, BLM 1.1.c, BLM 1.2.a, BLM 1.2.b, BLM 1.2.c, BLM 1.3.a, BLM 1.4.a, BLM 1.4.f, BLM 1.4.g, BLM 1.5.a, BLM 1.5.b, BLM 1.5.c, BLM 1.5.d, BLM 1.5.e, BLM 1.5.f, BLM 1.5.g, BLM 1.5.h, BLM 1.5.i, BLM 1.5.j, BLM 1.5.k, and BLM 1.5.l**)
2. Laminate appropriate activity cards (**BLM 1.1.a, BLM 1.1.b, BLM 1.1.c, BLM 1.2.b, BLM 1.4.a, BLM 1.4.f, and BLM 1.4.g**).
3. Designate a large squared area in classroom for the Maple Seed Survival Game. The four corners of the area will be used as designated posts where the students will stand.
4. Pre-soak large bean seeds for at least three hours before program (1 / child) or purchase a can of beans.
5. Review the safety procedures with students prior to the Maple Seed Survival Game (walking).
6. Label all small plant containers with students' name prior to the classroom garden activity if time is limited.
7. Print Plant Care Sheets (**BLM 1.4.a**) and Plant Labels (**BLM 1.4.b, BLM 1.4.c, BLM 1.4.d, and BLM 1.4.e**) ahead of time.
8. Grow some of the plants to seedling stage two weeks ahead of time. Ensure that the root system is adequate for viewing.

Vocabulary:

- | | |
|---------------------------|---------------------------|
| • Seeds | • Flowers |
| • Cotyledon seed leaves | • Micropyle |
| • Leaf | • Stem |
| • Nutrients | • Root |
| • Seed coat | • Radish |
| • Embryo | • Stamen |
| • Bud | • Rooting |
| • Positive growing factor | • Negative growing factor |
| • Germination | • Germination |
| • Hilum | • Endosperm |
| • Potato | • Spider plant |
| • Carrot | • Soil |

<p>able to do the learning task on their own.</p> <ol style="list-style-type: none"> 6. Ask students: <ul style="list-style-type: none"> • Why do you think seeds are important? (answers should include: seeds are how plants make more plants, they allow plants to spread, and people eat seeds) • What kind of seeds do people eat? • What are the parts of a seed? (the seed coat, a food source and an embryo or seed leaves) 7. Either show the laminated cards of the parts of a seed (BLM 1.1.c – Food, Baby Plant, and Coat Cards) to whole class for discussion or have students participate in a game. 8. For the game: students stand up and spread out an equal distance apart. 9. Each student receives a card with a picture on it (the pictures of the parts of a seed). 10. Students walk around to find other classmates with the same card. 11. Once each group is formed (one group for each type of card), students decide together on an action that best represents the picture on their card. 12. Students practice acting this out together for a few minutes. For example, <ul style="list-style-type: none"> Coat card = shivering and hugging yourself Food card = eating motion Baby card = crying or sucking thumb 13. Have each group come up to the front of the class to perform their action and explain why they selected this movement to represent their card. <p>Rooting: Questions led by teacher:</p> <ul style="list-style-type: none"> • Why do plants have roots? • How do roots help plants grow? • What does rooting mean? • Where do root vegetables grow? • Which vegetables are root vegetables? As students name various root vegetables display the corresponding pictures on the board (BLM 1.4.f – Pictures of Various Types of Vegetables). Discuss with students the process of rooting. • Display some of the plants with roots that have already been grown by the teacher (there should be enough plants grown for students to analyze, working in small groups). 	15 minutes		<p>seeds do people eat? f) What are the parts of a seed?</p> <p>a) Why do plants have roots? b) How do roots help plants grow? c) What does rooting mean? d) Which vegetables are root vegetables? e) Where do root vegetables grow?</p>
<p>B) Enhancing Activity: Hook What’s Inside a Seed Activity / Seed Labelling Activity / What’s all the Root About Activity</p>	Time	Assessment Techniques	Key Questions
<p>Dissecting Bean Seed:</p> <ol style="list-style-type: none"> 1. In order to understand the parts of a seed, students will work with their partner to dissect their own bean seeds. 2. Each pair is given a small container filled with bean seeds and two toothpicks. 3. As they locate each part of the seed students draw what the seed looks like on their “My Seed Worksheet” (BLM 1.2.a). 4. If students know any of the parts they can label their diagram. <p>Seed Labelling Activity: Individual or small group activity</p> <ol style="list-style-type: none"> 1. Organize small cooperative learning groups of 4-5 students. 	<p>55 minutes (in total)</p> <p>20 minutes</p>	<p>Observations</p> <p>Anecdotal Record</p> <p>Peer/Self Assessment</p> <p>Rating Scale</p> <p>Rubric</p>	<p>a) Do you know the names for any of the seed parts? b) Can you label any of these seed parts? c) What did you find in the bean plant?</p>

<ol style="list-style-type: none"> 2. Hand out a package to each group containing pictures of the parts a seed and the corresponding labels. 3. Students match the pictures to the correct labels. 4. Record responses in their Science learning log/journal. 5. Regroup as a whole class to discuss results. 6. Use a felt board or white board to show all the parts of the seed to class. Have individual students come up to attach the pictures and text. 	20 minutes	Science Learning Log/Journal	
<p>What's all the Root About Activity:</p> <ol style="list-style-type: none"> 1. Show pictures of different vegetables. Questioning led by teacher <ul style="list-style-type: none"> • Ask students to identify the vegetables in each picture. Discuss differences between growing plants from seeds and from roots. Which vegetables are grown from seeds? Which vegetables are grown from rooting 2. Working in small cooperative learning groups of 4-5, students analyze a jar containing a plant with roots (already grown by teacher). Students individually record their observations on their "My Root Worksheet" (BLM 1.3.a). 	15 minutes		
C) Culminating Activity (Wrap Up Activity): Green Thumb Garden	Time	Assessment Techniques	Key Questions
<ol style="list-style-type: none"> 1. Students write their name on a tray or small box using a permanent marker. 2. Each student fills up 4 pots with soil and packs it gently. 3. They place an appropriate label on each planting pot (Label 1 = carrot or radish or beet or yam, Label 2 = pepper or sesame or bean, Label 3 = spider, Label 4 = potato) 4. Students place a few carrot or radish or beet or yam seeds in one of the pots. 5. In the next pot students plant a small piece of potato. 6. The third pot contains a spider plant runner planted gently in the soil. 7. The fourth pot has green pepper, sesame, or other seeds in it. 8. Once all of the seeds have been planted, students water all of the plants and place them on the school window sill for weekly analysis or take them home. Students can work individually or in a small cooperative learning group to make weekly plant observations. 9. Record data in Science Learning Log/Journal. 10. Graph final results as a whole class. 	20 minutes	Rubric Science Learning Log/Journal Checklist Rating Scale	a) Which of the plants that we have here can be grown by seeds? b) Which of the plants that we have here can be grown by rooting?

Notes to Teacher:

Roots: Roots are the underground part of the plant and most often, you have to dig through the soil to see them. They do not grow in dry soil and they require lots of moisture. Roots have many functions. They anchor the plant and absorb water and nutrients from the surrounding soil, transporting them to the stem. Plants make their own food in their leaves but sometimes they make more than they need for the moment. In some plants this extra food is stored in the roots. Examples of roots that we eat are: carrots, radishes, turnips, beets, and parsnips.

The Planting Process:

When doing the Green Thumb Garden Activity a number of seed types will work well for beginners. Salad greens, herbs, and flowers are good plants for new planters. There are lots of different kinds of salad greens to choose from, such as red leaf lettuce or butter lettuce. Many herbs used to flavour foods are also easy to grow from seeds, such as chives, basil, oregano, parsley, and dill. As well, various flowers are quite easy to grow, for example alyssum, marigolds, and petunias. If you purchase seeds from a store read the back of the package to determine how deep to bury the seeds in the soil. If plant seeds are not buried at the correct depth, they will not sprout. Normally, small seeds, like carrot, radish, onion, and basil require shallow

depths while larger seeds, such as beans, grow better when planted in deeper soil. When selecting a pot for the plants you can use any kind of container. Clay pots are ideal for growing, but plastic or metal containers will also work. Using a hammer and nail, remember to make a hole at the bottom of the each container, for drainage. For additional drainage, small stones can be placed at the bottom of the pots, prior to adding the soil. If you find that most of the seeds are not sprouting, remove them from the container, to make room for the strongest seed to grow. It is always better to put at least four or five seeds of the same seed type in every container, ensuring successful sprouting. In general, it will take a week or two from the time that you plant the seed before any changes occur.

Additional Activities:

Sock Hop:

If possible, take your class outside for a seed search. Have your students visit a natural area, a garden, or school yard to look for different plants. Students wear fuzzy woollen socks over their shoes and walk in a grassy field or bushy area to pick up a variety of seeds. As students remove their socks, they can pick off the different seeds and place them on a tray (with white paper underneath) to be examined with a magnifying glass. Students can then compare the colour, shape, and size of the collected seeds. Questions to be asked are the following: How are the seeds the same? How are the seeds different? Which plants did the seeds come from? How did the seeds get around? What if the socks that you were wearing were an animal's foot or an animal's tail; what would happen to the seed? Why is seed dispersal important?

No Soil Please:

Students can conduct an experiment of growing various plants without soil. This process, known as hydroponics, has a number of advantages for a plant. If soil conditions are not good for growing plants, hydroponics can be used as an alternative method, usually resulting in larger, healthier crops. It also uses less water than conventional growing because the water is recycled, and weeds and pests are virtually eliminated. However, hydroponics is extremely expensive.

For this learning activity bean seeds, plastic containers or clay pots, water, masking tape, vermiculite, and hydroponic fertilizer are the materials needed. The following are a list of instructions:

1. Soak seeds (bean is ideal) overnight.
2. Wash containers out carefully and make a small drainage hole at the bottom of each container.
3. Use masking tape to cover a portion of the drainage hole, if using clay pots. The holes must be small to prevent the vermiculite from spilling out.
4. Plant the seeds into the pots according to appropriate depth indicated on the seed package.
5. Next have students wedge the pots into the larger container so that the water drains completely through the bottom holes, into the container.
6. Students water the plants once or twice a day in order to keep the plants moist, pouring water into the pots until it fills the pot almost to the surface of the vermiculite.
7. After a week, students will then mix some hydroponic fertilizer, according to the directions on the package and add to the plants. Fresh fertilizer solution should be added once a week for healthy plant growth.
8. When the seedlings sprout through the vermiculite, students should place them in bright light, (not direct sunlight) and watch them grow.
9. Get students to determine how vermiculite is different from soil.
10. Also, students can compare plants that were watered with tap water and plants that had hydroponic solution. Data can be recorded to determine which plants showed greater growth

Adaptations:

All accommodations must take into account the student's Individual Education Plan. All of the learning tasks and activities are created to accommodate the needs of students at different ability levels. The lesson plan includes pictures and/or examples of a step-by-step process, lists, and graphic organizers to enhance learning. The series of pictures provided are used to break tasks into easier to understand steps. Many of the learning activities offer opportunities for peer or group interactions, encouraging the use of cooperative learning / social skills and risk taking. Adaptations can be made in the following manner:

- Alternatives to written tasks (data sheet and question task), such as drawing, pointing to the correct answers, and fill-in-the blanks could be done as well. The use of keypads, word processors and writing software to support the writing task can also be used as alternatives.
- For cooperative learning tasks, students can take on a role that they are comfortable doing.
- Reduction in the length or number of written responses to the student worksheets.
- Students should be given extended timelines for task completion if required.
- All materials, equipment, and manipulatives should be labelled with text and visual aids.

Teacher Reflections: