

Lesson 2

Dig for Dirt



Lesson Summary



Overview

In this lesson, the garden detectives plant the garden and learn what plants need to grow and thrive.



Lesson Extensions

In the lesson extensions, the detectives monitor weather conditions and how they affect plant growth, as well as conduct an experiment to learn more about the conditions that seeds need for germination.



Key Message

Fruits and vegetables grow in the garden. Plants in the garden need food, water, and warmth to grow, just like people do.



Garden Connection

This is the core gardening lesson in the curriculum. Students will need to tend the garden—weeding and watering—on a regular basis throughout the unit. You may wish to invite parents, Master Gardeners, or Cooperative Extension representatives to help maintain the garden.

Be flexible with planting the garden. Ask your Master Gardener or garden coordinator about when to plant different vegetables in order for them to be ready to harvest for the Mystery Dinner. The fruit and vegetable plants mature at different times. For example, spinach takes less time to grow and mature than beets and carrots. See the Grow Sheets in Appendix C: Gardening Resources to estimate the growing time needed for each of the plants.

It is extremely motivating for the students to be able to prepare and eat the fruits and vegetables they are growing. Therefore, plan the timing of planting and harvesting the fruits and vegetables, so the garden produce will be ready to be used in the food preparation lessons (depending upon local/district health department policies) and the Mystery Dinner.

If the timing of the plant maturation does not allow for mature fruits and vegetables to be prepared for the Mystery Dinner or food preparation lessons, students may be able to take mature fruits and vegetables home and prepare them with their families later.



School Connection

If you are planting an outdoor garden on school grounds, put up a sign that explains to others what you are growing in your class garden. If you are planting an indoor garden in your classroom, invite other classes to visit your garden throughout the unit.

Have students prepare and deliver an announcement about your class garden for the school's morning announcements.



Home Connection

Have parent volunteers assist with planting the garden. Have a volunteer take photographs of the students planting their garden (check district photography policies and follow required guidelines). Send unidentified extra seeds home for students and families to plant in a pot. They can have fun solving the mystery of what kind of vegetable their plant will grow into. Send the *Garden Detective News* home to parents/caregivers; encourage students to complete the Eating From the Garden word search with their families.

If you have a digital camera, take a photograph of the students planting the garden to include in the family newsletter and/or in the classroom cookbook. (Again, check district photography policy.)



Community Connection

Invite a Master Gardener to help you plant the garden. Check with your local Cooperative Extension Service to find a Master Gardener near you.



Media Connection

Invite local media (newspaper, TV stations) to report on your class garden. Help them make the connection between the garden and encouraging students and their families to eat more fruits and vegetables.

Main Lesson: Dig for Dirt

Standards Addressed

Science

Standard C, Life Science: *Develop an understanding of the characteristics of organisms, life cycle of organisms, and organisms and environments.*

English/Language Arts

Standard 7, Reading Informational Text, Grade 3: *Use information gained from illustrations and the words in the text to demonstrate understanding of the text.*

Standard 7, Reading Informational Text, Grade 4: *Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which it appears.*

Learning Objectives

Students will be able to:

1. Demonstrate planting, watering, and weeding skills in the garden.
2. Explain what plants need to grow and thrive.

Time Required

90 minutes

- 45 minutes pre-gardening instruction
- 45 minutes in the garden

Materials

- White paper and glue
- Masking tape
- Seeds and/or seedlings
- Soil
- *Overhead/Slide 2.1, The Garden Detectives' Code of Conduct*
- Index cards, one per student
- Hand trowel(s)/hoes

- Plant markers or flat sticks for identifying the location and type of seeds planted (can use white plastic paddles available from nurseries; or flat paint stirrers from the paint store)
- Waterproof markers
- Digital camera, if available
- Graph paper, if digital camera is not available
- Seed packet for each fruit and vegetable you are planting
- Rulers for measuring how deep and how far apart to plant seeds
- Computer and LCD projector, if using *Overhead/Slide 2.1* as a slide, or overhead projector and screen, if using it as an overhead
- Screen or blank wall

Preparation

- Glue seeds for each vegetable on individual sheets of white paper. Number each sheet clearly on the seed side. Write the name of each seed lightly on the back of each sheet so you can correctly identify the seeds.

- Prepare garden bed for planting. Plan where each fruit/vegetable will go.
- Decide how to divide the class into small groups, one per fruit/vegetable.
- Make copies of seed packets/plant instructions so that each member of each small group has a copy for the fruit/vegetable assigned to them, plus one extra copy for the bulletin board.
- Prepare *Be a Garden Detective!* bulletin board (see Appendix D and CD-ROM).
- Make a transparency of *Overhead/Slide 2.1*, if needed.
- Remind students to bring a large T-shirt or smock to class on planting day to protect their clothes from getting dirty.

Instructional Process

STEP 1

Introduce the gardening activity. Tell students that vegetable gardening is a popular activity. In cities, there are community gardens where people can sign up to grow their own plants in a designated space within a large garden plot shared by other people. The United States Department of Agriculture helps communities establish “People’s Gardens” around the country. There have even been vegetable gardens at the White House!

Explain to students where your class garden will be (e.g., outdoors as part of a larger school garden, indoors in containers, etc.) and that you will be growing the fruits and vegetables chosen by popular vote in Lesson 1. Remind students that these fruits and vegetables grow from seeds. [If you are starting plants from seedlings, explain that seedlings are young plants started from seeds.]

Tape the white sheets of paper with glued-on seeds to the walls in different places around the room. Tell students that their task, as garden detectives, is to figure out which seeds go with which fruit or vegetable. Distribute an index card to each student. Have students write the numbers 1 to the highest number on a numbered seed sheet (i.e., if you are planting five vegetables, you should have five numbered seed sheets and students should write 1 to 5 on their cards). Working in small groups, have students visit each location where you have taped the seed sheets. Ask students to guess what vegetable will grow from this seed and to write their answers next to the number represented by the seed sheet. Give students an opportunity to examine all of the seed sheets.



Ask students:

- **Can you tell from looking at the seeds what plant will grow from them?** (Sometimes we can, because we can see the seeds in the fruit or vegetable as we eat it [e.g., oranges, cucumbers]. But in other cases, you can’t really tell unless you have planted the fruit or vegetable before and become familiar with the seeds. Carrot seeds, for example, are tiny. They are produced by tiny flowers in the stem after the plant has matured.)

STEP 2

Show the students the *Be a Garden Detective!* bulletin board. Explain to students that the bulletin board will be where they will track the growth of their plants over time. The bulletin board lists [number of] fruits and vegetables [you plan to plant]. These are the fruits and vegetables that the class will plant in its class garden. Glue the corresponding fruit/vegetable seed next to the name of the fruit/vegetable on the bulletin board background paper and a copy of the seed packet (instruction side) for that fruit/vegetable in the Week 1 column.

The bulletin board also has 10 columns, representing the 10 weeks or so that it will take these fruits and vegetables to grow from first being planted to being harvested, i.e., ripe and ready to be picked.



Tell the class:

- When we harvest the fruits and vegetables from our garden, we will have a special mystery dinner for our families and feed them a delicious meal from our garden.
- We will also be making some recipes using these fruits and vegetables over the weeks to come. We're going to put them together in a class cookbook that you will take home to your families to share tasty ways to eat these fruits and vegetables.

Explain to students that they will each be assigned to a small group that will be responsible for one of the fruits and vegetables listed on the board.

STEP 3

Explain to students what plants need to grow.



Tell the class:

- Before they can plant their garden, they need to understand something about how plants grow. Plants are living things, just like they are.



Ask students:

- What do you need to grow strong and healthy?
(Food, water, sleep, air, exercise)

Plants need some of the same things people need. But, they also need some different things. Ask students:

- What do you know about what plants need to grow? (Water, light, food [nutrients], right temperature, air, space)



Ask students:

- Where do plants get water from? (Rain, irrigation)
- Where do plants get light to grow?
(Sun, artificial lights)
- Where do plants get food or nutrients from?
(Seed, soil, compost, plant food called fertilizer)
- What kind of temperature do plants need?
(Most like warmth; some grow in cooler fall or spring temperatures. That's why most fruits and vegetables grow best in the summer months in most areas of the country. Things like greenhouses and artificial lights can extend the growing season.)

Explain to students that seeds contain enough nutrition for the plant until the plant has leaves. The leaves of the plant then become the food-making factory of the plant using a process called *photosynthesis*.



Ask students:

- **What color are leaves?** (Usually green [red in the case of red leaf lettuce])

The green color in leaves is chlorophyll (red leaf lettuce also contains *chlorophyll*). In photosynthesis, chlorophyll makes food for the plant from carbon dioxide (a gas in the air), water, nutrients, and energy from the sun (light).

The roots of the plant also help feed the plant. They push down into the soil to anchor the new plant and to absorb water and minerals from the soil. The plant's stem with new leaves pushes up toward the light.

Summarize the discussion by telling students that the fruit and vegetable plants in the school garden need food, water, and warmth to grow, just like people do.

STEP 4

Prepare students for working in the garden. *Project Overhead/Slide 2.1, The Garden Detectives' Code of Conduct* on the screen and review the rules by reading them aloud. Point out to students that they will be working in the garden at least twice a week and they must abide by the safety rules in the Code of Conduct. Have students wash their hands so that they are not transmitting any pests to the garden. Have students put smocks or T-shirts they have brought from home over their clothes to keep them clean.

STEP 5

Walk students to the garden. Introduce the steps in planting the garden.

- **Soil Preparation:** The soil should be firm, but not compacted. Compost or other materials that enrich the soil may need to be added. Work the soil with a hoe or hand trowel (depending on the size of the garden) to turn over the soil and prepare it for planting. Refer to the information on safety practices and garden resources in Appendix C.

- **Plant seeds or seedlings:** Hand out copies of the seed packets. Read the copy and carefully follow the instructions for how deep to plant the seeds and how far apart the rows should be.
- **Mark the rows:** Write the name of the plant using a waterproof marker on a flat stick (e.g., white plastic paddles available from nurseries; flat paint stirrers from the paint store). These labeled plant markers can be placed at the end of each row so that you know what plants will be growing in that row.
- **Water plants:** Plants need water to grow. Carefully water the garden. Check the seed packet and/or check the Grow Sheets in Appendix C for instructions on how often to water.
- **Fertilize plants:** Plants need food to grow. If compost or fertilizer was not added during the soil preparation phase, you may need to add commercial fertilizer to the garden to give seeds a good head start.

STEP 6

Plant the garden. Assign each small group an area of the garden space to plant their seeds, seedlings, and/or starter plants. Review with each group the specific planting instructions for their fruit or vegetable before planting, i.e.:

- **Leaf Lettuce:** Sow 10 to 20 seeds per foot in rows 8 to 12 inches apart. Sow seeds evenly, cover lightly with fine soil ($\frac{1}{4}$ inch), and use hands to gently firm the soil over the seeds.
- **Spinach:** Space seeds 3 inches apart in rows, or scatter seeds evenly in wide rows or beds. Spread soil with your fingers, barely covering the seeds and then pat down the soil with hands to ensure good soil to seed contact.
- **Carrots:** Plant seeds about $\frac{1}{2}$ inch apart in rows that are 12 inches apart or scatter seed evenly in wide rows or over a bed. Cover seeds with $\frac{1}{4}$ to $\frac{1}{2}$ inch of soil and then pat down the soil with hands to ensure good soil to seed contact.

- **Beets:** Space seeds 1-2 inches apart in rows, or scatter seed evenly in wide rows or beds. Cover seeds with about ½ inch of fine soil and then pat down the soil with hands to ensure good soil-to-seed contact.
- **Swiss Chard:** Space seeds 2 inches apart in rows, or scatter seed evenly in wide rows or beds. Cover seeds with about ½ inch of soil and then pat down the soil with hands to ensure good soil-to-seed contact.
- **Raspberries/Blackberries:** Dig a hole large enough to set the crown (the spot just above the roots from where the growth starts) halfway into the ground. Cover the plant and use hands to firm the soil around it.
- **Strawberries:** Plant June-bearing varieties 12 inches apart in rows 2 feet apart. Plant day-neutral varieties (those that flower and produce fruit when temperatures are between 35° F and 85° F, rather than just in June) 6-8 inches apart in rows 3 feet apart.

Detailed information about the planting and care of these fruits and vegetables is available in the Grow Sheets in Appendix C.

Water the garden thoroughly when planting is completed.



Optional: Have each student group take a photo of its area of the garden. Print photos for the bulletin board or journals.

Students should wash their hands again after the garden is planted. Remind students that washing your hands before and after they garden is part of the Garden Detectives' Code of Conduct.

STEP 7

Return to the classroom and write today's date on the first column of the bulletin board on the background paper below the Week 1 heading. If using a digital camera, post a photo of each section of the garden next to the name of the fruit/vegetable to show what the initial planting looks like.

Each week, students should take a photo of their plant and post it on the bulletin board to follow the pattern of growth of the garden plants. If a camera is not available, have each group draw a picture of their plant to scale using graph paper. NOTE: You will need to determine how large photographs or drawings should be, based on the size of the bulletin board in your classroom. Cut graph paper to the appropriate size and guide students in creating drawings that are scaled to the size available (e.g., 1 inch = 5 squares).

Each week, compare the growth of the different plants in the garden.

Invite students to look at other groups' seeds and seed packets during their free time.

STEP 8

Review the steps in maintaining the garden after it's been planted. (See the Grow Sheets in Appendix C for detailed instructions on how to care for each fruit/vegetable in the garden.)

- Water regularly.
- Thin seedlings as they appear according to directions on the seed packet so that plants have the room they need to grow well.
- Pull weeds so that plants don't have to compete with weeds for nutrients.

Each small fruit/vegetable group should visit the garden at least twice a week to care for the group's plants. Select 2 days per week for the garden care activity, and stick to the schedule. Remind students that they must abide by the Garden Detectives' Code of Conduct every time they visit the garden.

Teacher Background Information

How Does Your Garden Grow?

Vocabulary

Chlorophyll: The green color in plants that is necessary for photosynthesis to take place.

Compost: A mixture of decaying vegetation and manure that is added to soil to provide more nutrients to plants.

Fertilizer: Food for plants that helps them grow. Fertilizer contains nutrients, such as nitrogen, phosphorus, and potassium.

Garden Bed: A plot of earth or a raised bed that contains cultivated plants.

Germinate: To start to grow.

Harvest: Picking the fruits and vegetables when they are ripe.

Leaves: The food-making factory of a plant. Leaves are usually green, flat to catch light, and attached to a stem.

Photosynthesis: The process that plants use to make food from light, water, nutrients, and carbon dioxide.

Plant Nutrients: What living things need to grow. Plant nutrients include nitrogen, phosphorous, and potassium.

Root: The part of the plant that grows underground and anchors the plant. It moves nutrients and water from the soil to the leaves.

Soil: Earth, dirt.

Sowing: Planting seeds.

Thinning: Removing seedlings from the garden to give other plants more room to grow and more access to nutrients.

Gardens are a source of relaxation and pleasure for many in our contemporary world. In times past and in many parts of the world today, people's survival depends on their ability to grow food. Learning about plants and how to grow them is a fundamental survival skill for these populations. Yet for many of our students today, food comes primarily from the supermarket and they may give little thought to how or where it is grown or how it travels from the farm to the market. Teaching students about growing their own food gives them a closer connection to the earth.

What Do Plants Need To Grow?

Six basic things are the key, as shown in the picture on page 52: Air, water, nutrients, light, space, and warmth. Let's take a look at each one of these.

Air. Plants take carbon dioxide out of the air during *photosynthesis* to produce food for their growth. Photosynthesis is the process by which plants make food from light, water, nutrients, and carbon dioxide.

During photosynthesis, plants release oxygen into the air.

Water. Water carries nutrients and minerals from the soil up the plant's roots and into the leaves. Different plants need different amounts of water.

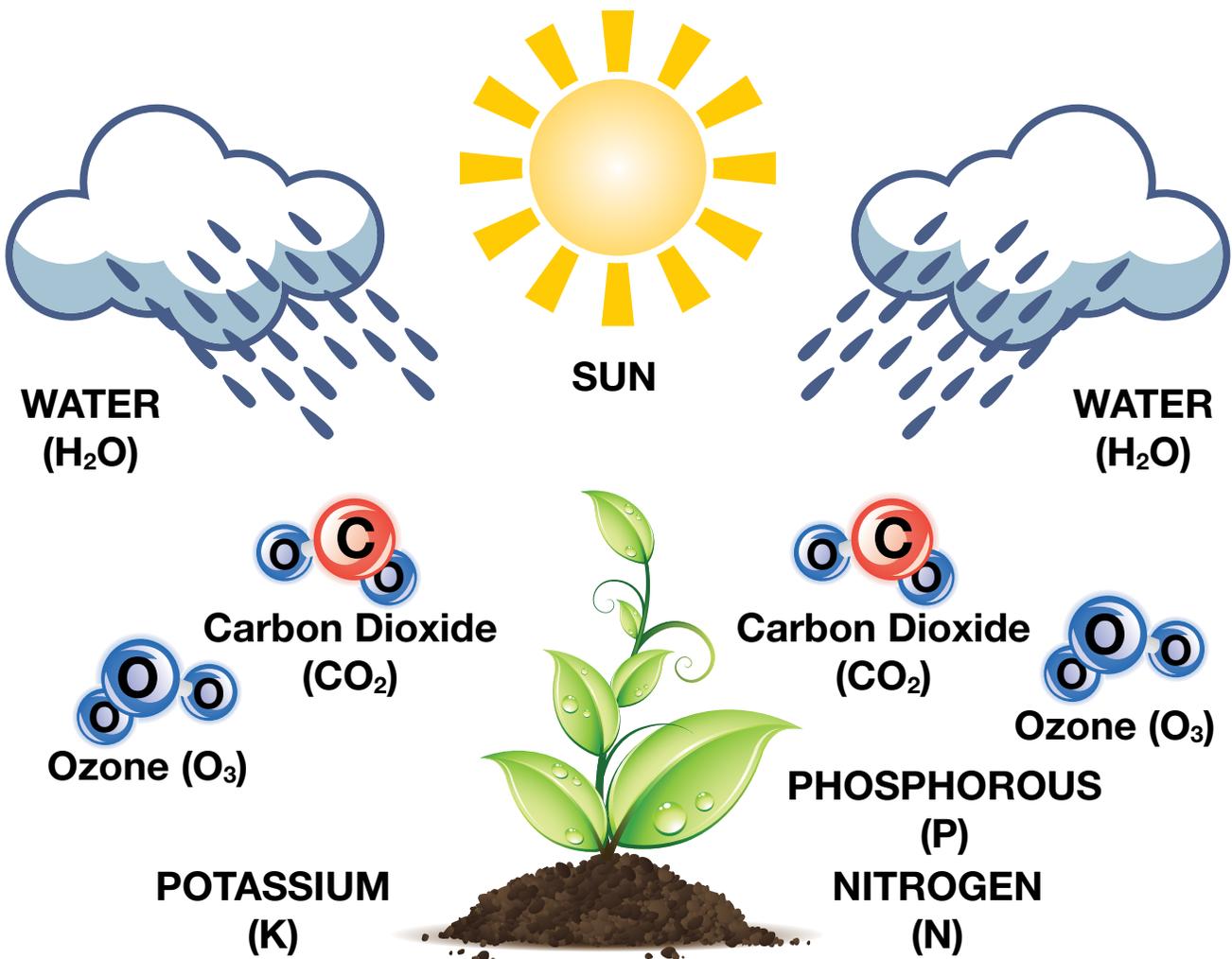
Nutrients. There are three main nutrients that plants get from soil: Nitrogen, phosphorous, and potassium. If the soil becomes depleted, compost or fertilizer should be added to ensure that plants get the food they need.

Sunlight. Plants use sunlight to convert carbon dioxide and water into food during photosynthesis. Plants that do not receive enough sunlight will grow poorly and may die before they are mature.

Space. Plants need to have enough room for their roots, stems, and leaves to spread and grow.

Warmth. Most plants require warmth in order to grow; that's why most vegetables are grown in the summer. Some vegetables—such as spinach and Swiss chard—are considered cool season vegetables and do well in the spring and fall.

See Appendix C for a list of gardening resources.



Eating From the Garden

Word Search Answer Key (Garden Detective News)

PHOTOSYNTHESIS
LEAVES

CHLOROPHYLL
VEGETABLE

ROOT
GARDEN

STEM
SUNLIGHT

FRUIT
SOIL

FLOWER
SEED

W G C L J X V W F Q F H O S F
D S M I N P S Y Y N G S Q V B
S I H K E E K G O N L X F X U
X K L O V L D A F L S B S I Z
X Q G A J E G R Y T L B L J S
F J E K V Q G D L A K L I O S
X L E W Y M M E T S Y M T D V
P H O T O S Y N T H E S I S A
O T P W J D A I P A U U T R K
C L Z K E Y U O T O B N H T N
J P G E B R R H F Q A L D L T
T O S R F O V U D K G I E F E
A M A P L O T C B J R G Q R H
F L Q H V T R L U H E H J B K
G V C K X M Y V V I J T Y Z X

The Garden Detectives' Code of Conduct



GARDEN DETECTIVE'S CODE OF CONDUCT

- Always wash your hands before and after working in the garden.
- Always walk when in the garden. Do not run.
- Always ask permission before using any tool or harvesting any plant.
- Always wipe your feet before returning to the classroom.

Garden Detective News



Encourage Your Child's Growth

Ask your child to share what he or she learned about growing fruits and vegetables.

2



United States
Department of
Agriculture



Garden Detective News

This week, we planted a class garden. We planted _____.

Ask your child to tell you about the garden.

What fruit or vegetable is your child responsible for growing? Serve it at a family dinner this week!

Help your child think like a garden detective! Solve the word search on the following page with your child.

Mystery Solved!

Ways To Help Your Child Eat More Fruits and Vegetables.

1. **Savor the flavor of seasonal vegetables.** Buy vegetables that are in season for maximum flavor at a lower cost. Check your local supermarket specials for the best in-season buys. Or visit your local farmers market.
2. **Plant your own.** Just like your garden detective, start a garden—in the yard or a pot on the deck—for fresh, inexpensive, flavorful additions to meals. Herbs, cucumbers, peppers, or tomatoes are good options for beginners.



Word Search

Eating From the Garden

PHOTOSYNTHESIS
LEAVES

CHLOROPHYLL
VEGETABLE

ROOT
GARDEN

STEM
SUNLIGHT

FRUIT
SOIL

FLOWER
SEED

W G C L J X V W F Q F H O S F
D S M I N P S Y Y N G S Q V B
S I H K E E K G O N L X F X U
X K L O V L D A F L S B S I Z
X Q G A J E G R Y T L B L J S
F J E K V Q G D L A K L I O S
X L E W Y M M E T S Y M T D V
P H O T O S Y N T H E S I S A
O T P W J D A I P A U U T R K
C L Z K E Y U O T O B N H T N
J P G E B R R H F Q A L D L T
T O S R F O V U D K G I E F E
A M A P L O T C B J R G Q R H
F L Q H V T R L U H E H J B K
G V C K X M Y V V I J T Y Z X



Lesson Extension: Weather Station

Standards Addressed

Science

Standard C, Life Science: *Develop an understanding of the characteristics of organisms, life cycle of organisms, and organisms and environments.*

Learning Objectives

Students will be able to:

1. Observe weather conditions.
2. Record observations.
3. Describe relationship of weather to garden conditions.

Time Required

5 minutes daily

Materials

- Indoor/outdoor thermometer
- Rain gauge
- Notebook (e.g., composition notebook), one per class
- Three-hole notebook paper



Preparation

- Establish a spot by the window to place the thermometer and notebook.
- Place rain gauge in the garden.
- Label four columns on the first notebook page: Date, temperature, sunlight, and rain.

Instructional Process

STEP 1

Introduce the weather station.



Tell students

- Tell students that you are creating a weather station in the classroom to record the conditions that will influence how well the garden grows.



Ask students:

- **Plants need sunlight, warmth, water, and food (nutrients, air, and space) to grow. Which of these can a weather station measure? (Warmth, water)**

Show students the thermometer, rain gauge, and notebook. Demonstrate how to read the outdoor temperature on the thermometer and read the rain gauge. Show students how to make a daily record in the notebook by recording the first set of observations yourself with them observing:

- Record today's date in the first column.
- Record the outside temperature in the second column.
- Record whether the day is sunny (S), partly cloudy (PC), or overcast (O) in the third column.
- Record the amount of any rain in the rain gauge in the fourth column.

STEP 2

Assign the daily weather observation task

to students. Assign each student 1 day to be responsible for making and recording weather observations in the notebook. Rotate responsibility among class members so that everyone has an opportunity to participate and all school days throughout the unit are assigned.

STEP 3

Review the weather observations weekly.

When posting plant growth photos/drawings on the bulletin board each week, review the weather observations recorded in the notebook. Discuss with students whether plants received enough warmth, sunlight, and water to grow well. Have students record their conclusions on notebook paper in their *Garden Journals*.



Lesson Extension: Conditions for Germination

Standards Addressed

Science

Standard C, Life Science: *Develop an understanding of the characteristics of organisms, life cycle of organisms, and organisms and environments.*

Learning Objectives

Students will be able to:

1. Predict the outcome of an experiment.
2. Record scientific observations.
3. Explain the conditions that plants need to grow.

Time Required

20-30 minutes

Materials

- 4 sealable plastic bags for each small group of students
- 4 paper towels for each group
- 12 seeds, all the same kind for each group (e.g., mung bean, lima bean, alfalfa, or radish)
- 4 labels for each group
- Markers
- Water for wetting paper towels, about $\frac{1}{2}$ cup per group
- Large bowl to hold water, one per class
- *Student Handout 2.1, Predict and Observe*

Preparation

- Obtain required materials.
- Organize students into small groups.
- Duplicate *Student Handout 2.1* on 3-hole-punch paper.

Instructional Process

STEP 1

Introduce the germination experiment.

Explain to students that they are going to conduct an experiment to find out what plants need in order to grow. It will be a group experiment. Organize students into small groups of four students and have them choose a name for their group.

STEP 2

Give each group four bags, labels, and markers.



Tell the class:

- Tell students to write their group's name on all the labels. Number the labels 1 through 4. Place one label on each bag.

STEP 3 Give each group four paper towels. Have them fold the paper towels in fourths.

STEP 4 Wet three of the towels. Place them in bags 1 through 3. Place the dry towel in bag 4.

STEP 5 Have students add three seeds to each bag.

STEP 6 Discuss where seeds can be placed to receive sunlight and no sunlight. Also select a cold dark spot where some seeds can be placed.

STEP 7 Place bag 1 in the sun. Place bag 2 in the dark. Place bag 3 in the cold dark place. Place bag 4 in the sun.

STEP 8 Distribute *Student Handout 2.1, Predict and Observe*.



Ask students:

- Ask students which bag of seeds they expect to grow the best. Next best? Worst? Have students write their predictions on the worksheet and put it in their *Garden Detective Journals*.

STEP 9 Check on the seeds in 4-5 days. Use the chart on *Student Handout 2.1* to record the results.

STEP 10 Review the outcomes of the experiment.



Ask students:

- Which bag did the best? What was it about the bag that helped the seeds grow? (Light, water, warmth)

Reinforce the fact that garden plants need light, food, water, and warmth to grow, just like people do.

Source: Adapted from *Biology of Plants*, © 2006, Missouri Botanical Garden, reprinted courtesy of Missouri Botanical Garden.

Student Handout 2.1

Predict and Observe



Name: _____ Date _____

Which bag of seeds do you predict will grow the best? _____

In 4-5 days, write your observation of what happened:

Bag	Conditions (For example: wet towel, sun)	Your Observations
1		
2		
3		
4		

**Fruits and vegetables grow in the garden.
Plants in the garden need food, water, and warmth
to grow, just like people do.**

