Curriculum Goals

Our curriculum is designed to be co-taught by Garden Instructors and Classroom Teachers, with Garden Instructors preparing for and leading each lesson. Many lessons have several activities to choose from. Garden Instructors are encouraged to collaborate with teachers to decide the most appropriate activities to teach in each lesson, rather than teach them all at once. Many lessons can also be taught over several days of instruction to allow for scaffolding of concepts.

SCIENCE

Science is essential for understanding our world. Participating in Life Science experiments informs students and prepares them to be critical thinkers. We ask questions, such as: How do plants use energy from light to make their own food?

ENVIRONMENT

External conditions and factors make up our environment. Students explore connections to their environment by planting, harvesting, and participating in the natural world. We ask questions, such as: Where do living organisms get their food energy?

HEALTH

Knowing how and where food grows, how it affects our minds and bodies, and how to prepare tasty snacks encourages us to make healthy food choices. We ask questions, such as: Why is eating whole foods and less sugar important for health and how can we incorporate good nutrition into our daily lives?

LANGUAGE

Students practice speaking and listening, writing comprehension, and building knowledge within and across grades. We ask questions, such as: How do students prepare for and participate effectively in conversations and collaborations with diverse partners?
# Garden-Based Learning Curriculum

## Curriculum Map

### First Grade

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The 3 Be’s

Objectives/Assessment Targets

Students will:

● Share the rules that they will follow in the garden.
● Sort images of objects as living and nonliving garden objects.
● Share what they know about the garden and what they want to know this year.

Activity Preparation

This lesson introduces students to the garden, prepares them for participating in activities safely and respectfully, and connects the garden and expectations to their larger school-life.

Prepare a large piece of butcher paper. Divide it into sections lengthwise by drawing a line down the middle. Title one section “Is it a plant?” and the other “Why or why not?” Prepare another large piece of butcher paper and title it, “Questions we have about plants or the garden.”

Materials

● Garden tools
● Alive and not-alive organic materials
● The 3 Be’s poster or whiteboard to write down what students will do to help the garden

Activity 1: The 3 Be’s

Welcome students to the garden. Recall what was growing last year, what they may have planted, and what is growing currently. Write the 3 Be’s on the whiteboard. Here in Berkeley Unified School District, each school has its own set of principles that help with classroom management and student engagement. Remind students that we follow these same rules and practices in the garden.
Show students garden tools they will use, and show them how they will use them throughout the year. Demonstrate tool safety and handling. Ask a couple students to demonstrate for the whole class.

**Ask**, How will you use the shovel, rake, etc. in the garden?

Invite students to share ways they currently practice each one and how they will practice each one in the garden this year. Direct students to draw and list their practices on the cover of their workbook. Invite them to add their personal touches to make their workbooks their own.

**Ask:**
- How will we respect the garden and the living things that call it home?
- How will we be an ally to each other when we participate in garden activities?
- How will we be kind to our friends when we learn new things?

**Activity 2: Welcome to the Garden**

Introduce the garden to students by taking them on a tour of the garden. Show students the butcher paper divided into sections, “What I know about the garden” and “What I want to know about the garden” Tell them that they will be able to fill in the lists for both sections after they have toured the garden and observed their environment. Direct them to notice what is growing and not growing in the garden and why.

Point out new plants and invite them to taste new fruits and vegetables by demonstrating respectful harvesting and washing of produce. Students share what they learned on their garden tour.

**Ask:**
- What did you see?
- What is new from last time you were in the garden?
What would you like to learn more about?

Write their statements about what they know and their questions about the garden on the white board. Tell them that the class will revisit these lists throughout the year and will try and answer the questions about what they would like to learn more about.

NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems
Ask questions based on observations to find more information about the natural and/or designed world(s).

Student Reflection
Today we learned how to practice safety, respect, and responsibility in the garden. Tell your partner one behavior you learned. Share the cover of your workbook that you designed and share with the class how it describes how you will behave and learn in the garden.

English Language Learning (ELL) Focus on the 3 Be’s
- I am respectful
- I am safe
- I am responsible

Additional Information
Getting to know each student by name will help reinforce student engagement and classroom management. Add a fruit/vegetable name game to learn each student’s names.

It may be helpful to organize the lists that students have about what they would like to learn more about, such as, “Questions we have about plants” and “Questions we have about animals.”

Sources
NGSS Professional Development, Life Lab Science Program, 2015
First Grade
Celebration/Reflection

Describing Our Garden

Objectives/Assessment Targets
Students will:
- Write descriptive words about the garden.
- Draw different things found in the garden.
- Identify and document patterns in the garden.

Materials
- Worksheet, Describing Our Garden on page 2 in student workbooks
- Pencils and drawing materials

Activity Preparation
This is a reflective activity that helps students summarize what they learned in the garden. Use this lesson as a temperature check throughout the year or as a culmination at the end of the school year.

Activity 1: What Do You See, Hear, Smell, Feel
Test student understanding of lessons and activities explored already. Share several riddles with students and prompt them to guess the answer. For example, “I’m thinking of a plant that grows on vines. My plant provides us with large orange fruit, and you see my orange fruit in the month of October” (pumpkin).

Guide students on a Sensory Scavenger Hunt to explore the school garden using all five senses. Students observe what they find in the garden. Prompt students to discover patterns and think of words that describe what they see and what they have learned about what they see in past garden lessons.

Ask, What is a pattern, and where can we see a pattern in the garden?
Students write three words that describe the garden and draw two pictures of patterns they see in the garden in their worksheet, Describing Our Garden, page 2 in their
Ask:

- What do the plants in our garden look, smell, feel like?
- What do the insects and animals in our garden look like?
- What are other things you like that are in our garden?

**NGSS Crosscutting Concept: Patterns**
Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Record information (observations, thoughts, and ideas).

**Student Reflection**
What will you share about what you learned today at home? What was surprising about today’s lesson? What is the most surprising thing you learned this year in the garden?

**English Language Learning (ELL) Focus: Past Tense**

- In the garden, I saw ________.
- I heard ________.
- I planted ________.
- I ate ________.
- I made ________.

**Sources**
University of Missouri Extension, Eating from the Garden, 2010
Six Plant Parts

Objectives/Assessment Targets

Students will:

● Identify the six parts of a plant.
● Explain the function of each part.

Activity Preparation

This lesson recaps the kindergarten lesson on plant parts. The activities encourage students to recall and remember plant part names and functions.

Print seed packet labels below for students to write the name of their plant on it and place on their seeded plant. Draw a plant with each plant part on the whiteboard. Write the six plant parts on Post-its and place in a hat for students to pick from and place accordingly on the plant drawing. You may want to pick flowers with as many parts in-tact for a real-life model.

Materials

● Fruit and Vegetable cards
● My Seed labels (You may want to tape or glue these cards to Popsicle sticks for better access.)
● Newspaper for making seed containers
● Mason jars for shaping the newsprint containers
● Tape
● Soil
● Seeds
● Flower and plant part diagram
● Post-its
● Worksheet, 6 Plant Parts, page 3 in student workbooks
Activity 1: Review Plant Parts

Hold up a flower with the six plant parts. Describe the plant parts that are immediately visible. Pass around flowers for students to look more closely at. Prompt students to think about what each part may be called; get creative.

Ask:

● What are the different parts of this plant called?
● Where is the leaf, stem, flower, and seeds?

Show students the plant parts diagram on the whiteboard. Distribute Post-its with plant part names. Students place them on the plant part diagram to match the plant part.

NGSS Disciplinary Core Idea LS1.A: Structure & Function

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

Ask:

● Is there another part of the plant that we didn’t name yet?
● What is the function of each plant part you just placed a Post-it on?

The Six Plant Parts:

1. **Roots**: underground structure that feeds the plant and holds it in place.
2. **Stem**: part of the plant that carries water and nutrients.
3. **Leaf**: part of the plant that makes food.
4. **Flower**: colored and scented part of the plants that attracts pollinators.
5. **Fruit**: part of the plant that holds...
seeds.
6. **Seed**: part of the plant that can help grow a new plant.

**Activity 2: Dancing the Six Parts of a Plant**

Many students learn facts best through call and response associated and movement. Demonstrate the “Six-Part Plant Dance” and invite students to join in and repeat:

1. Pointing to your toes and saying, “Roots!”
2. Moving your legs and saying, “Stems!”
3. Aiming your hands toward the sun and saying, “Leaves!”
4. Placing your hands around your face and saying, “Flowers!”
5. Clasping your hands together and saying, “Fruit!”
6. Wiggling your fingers to the ground like rain or falling seeds and saying, “Seeds!”

Invite students to join you in the “Roots, Stems, Leaves” call and response song:

1. Everyone sings: “Roots, stems, leaves, flowers, fruits, and seeds” (four times).
2. Teacher: “Well, that’s six parts!”
3. Students: “That’s six parts!”
4. Everyone sings: “Six plant parts that plants and people need.”

**Activity 3: Planting Seed Start Pots**

If you have prepared the newsprint seed starts ahead of time skip the steps below for making newspaper seed containers.

1. Distribute small mason jars and newsprint to each student
2. Lay out the newspaper
3. Roll the container until the newspaper is a cylinder
4. Tape the edges
5. Fold the bottom like a present
6. Fill with soil
7. Plant seeds
8. Add water

*NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems*

Plants depend on water and light to grow.
Guide students in writing their name and the name of the seed they planted on the My Seed cards and place them in their seed start pots to take home.

**Student Reflection**

Which parts of the plants do we eat? (We can eat all of them, as long as they are edible)

**English Language Learning (ELL) Focus: Plurals**

**Regular plural:** Stems, Flowers, Roots

**Irregular Plural:** Fruit
### My Seed

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- Water daily, 1-2 Tablespoons.
- If it's in the house, put a plate under the pot so it doesn't leak.
- After 2-3 weeks, dig a hole in a sunny spot and put the whole pot in the ground. The pot will decompose!
- Don't forget to keep watering your plant to help it grow!

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Seeds

Objectives/Assessment Targets

Students will:

- Compare seeds by observing their characteristics (the sound they make when you shake them, feel, shape, texture, and color)
- Identify the difference between seeds for eating and planting.
- Plant seeds using a ruler to identify where and how deep to plant them.

Activity Preparation

This lesson invites students to observe and describe what they see, while learning about the different seeds we plant in our gardens.

Prepare one tray with mixed edible seeds (lentils, corn, wheat, garbanzos, amaranth, and poppy seeds) and one with mixed non-edible seeds.

Materials

- Mixed seed samples (use different seeds)
- Egg cartons for sorting the types of seeds
- Seeds and rulers for planting
- Worksheet, Seeds, on page 4 in student workbooks

Activity 1: Sorting Seeds

Show students the seeds in the trays. Discuss how to observe and describe the characteristics of the seeds. Invite students to use their senses to explore them as you pass the tray around. Introduce scientific drawings as a tool to observe plant and seed traits.

Ask:

- How can the seeds be grouped together?
- How are different?
- How they are the same?
**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Explain that some seeds are eaten by people and some are eaten by animals. Other seeds are used for planting only. Seeds that are eaten by people are called edible. All other seeds are called non-edible.

Students compare and contrast the how the seeds sound when they shake them (pods), what they feel like (texture), what they look like (color and shape) through careful observation. Students share their observations in pairs.

**NGSS Science/Engineering Practice 6: Constructing Explanations and Designing Solutions**
Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

**Activity 2: Planting Seeds**

Students plant seasonal seeds (roots, like carrots and beets are great seed starts) in garden beds using a ruler to space the seeds. Demonstrate how to reach inches on a ruler. Distribute the worksheets for students to list the four steps for planting seeds.

**Ask:**
- How many inches apart did you plant the seeds?
- How deep into the soil did you plant the seeds?

Figure 3 Rulers and shovels lined up for students to plant and measure at Oxford Elementary School Garden
Plants depend on water and light to grow.

Direct students to repeat the steps they took to plant a seed. Students list the steps in the worksheet, Seeds, on page 4 of their workbooks. Make sure they list the steps in order.

**Ask:**
- What will happen to the seeds that you have planted?
- What will be different the next time you are in the garden?

NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Make predictions based on prior experiences.

**Student Reflection**
How can we care for our new seedlings?

**English Language Learning (ELL) Focus: Prepositions and Future Tense**
- I planted my seed in the ground/soil.
- When we come back to the garden, I think we will see ______.
- I planted my seed in the ground.
- When I come back to the garden, I will see ______.

**Additional Information**
The story “A Seed is Sleepy,” by Dianna Hutts Aston.

**Sources**
Steven Hicks, “From Seed to Plant: A Unit to Help Grow Your Students’ Knowledge of Plants,” Scholastic
Tops and Bottoms

Objectives/Assessment Targets

Students will:

- Identify the tops and bottoms of plants as those that are underground and above ground.
- Repeat that plants need sun, soil, water, and air to live.

Activity Preparation

This lesson can be scaled up or down across grades. The activities review past lessons on plant parts and dives deeper into the idea that each plant part has a function, focusing on roots and leaves.

Prepare samples of roots and stems that we eat and those that we don’t eat. Consider sautéing or making a salad from the Monthly Recipes and inviting students to harvest each plant part and combine them for a snack.

Materials

- Plant part diagram found in the Six Plant Parts lesson
- Plant starts with roots, stems, leaves, and flowers
- “Tops and Bottoms,” by Janet Stevens

Activity 1: Reviewing Plant Parts

Read the book “Tops and Bottoms.” Show the plant starts students had previously planted. Review the six plant parts (roots, stems, leaves, flowers, seeds, fruits).

Ask, What are the functions of roots and leaves?
NGSS Disciplinary Core Idea LS1.A: Structure & Function
All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

Invite students to wonder what all living things need to grow. Review that all plants need sun, soil, water, and air to grow. Plants get their water and soil from their tops (leaves) and bottoms (roots). Students pair-share what they know about the function of roots and leaves.

All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Ask, What do plants need to live?

NGSS Crosscutting Concept: Structure and Function
The shape and stability of structures of natural and designed objects are related to their function(s).

Ask, How do the (leaves, roots, stems, seeds, fruits) help the plant live?

Activity 2: Getting to Know Plant Parts
Lead students on a tour through the garden. Invite them to identify parts of plants as either roots or leaves. Write on butcher paper, “Questions we have about plants.”

Ask, What do you want to know about plants?

Invite wonder by posting these questions in a place that can be seen throughout the year. Prompt students to consider the answers each time they are in the garden.

NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems
Ask questions based on observations to find more information about the natural and/or designed world(s).
Student Reflection

Plants need sun, soil, water, and air to live and grow. How are humans like plants?

English Language Learning (ELL) Focus: Asking Questions

- **What** are the parts of a plant?
- **What** do plants need to live?
- **Why** can’t plants live without water? Sun? Soil? Air?

Sources

Pondering Plants, First Grade Science Exploration, Life Lab
What’s in Soil?

Objectives/Assessment Targets

Students will:

● Identify the basic components of soil.
● Categorize parts of soil as living and nonliving.

Activity Preparation

This lesson invites students to experience soil and get to know the living critters that live in it, and the nonliving things that make up soil. These activities can be taught indoors with large butcher paper on the floors.

Fill plastic containers with mixtures of soil, compost, plant materials, and rocks. Fill water pitchers. Prepare a sample of amended soil from the garden in a mason jar.

Materials

● Plastic containers with mixtures of soil, compost, plant materials, and rocks
● Water pitchers
● Sample of amended soil
● Worksheet, What’s in Soil, page 6 in student workbooks

Activity 1: Sorting Soil

Show students soil samples.

Ask:

● What do you know about soil?
● What is soil made of?

Pull out the different components from the prepared soil sample. Invite students to feel the soil and share out what they observe: feel, see, smell, etc. Make a list on the whiteboard of all the items found.
**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Explain that soil is mostly composed of nonliving things, like clay, fine sand, tiny rocks, and dead plants.

**Ask**, Can you find the clay, rocks, and plants that are brown in the soil?
It also has some living things, like fresh leaves and bugs.

**Ask**, Can you find the insects in the soil?

**NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans**
There are many different kinds of living things in any area, and they exist in different places on land and in water.

Create a T-chart and have students share out the different materials they find in the soil:

<table>
<thead>
<tr>
<th>Non-Living</th>
<th>Living</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocks</td>
<td>Plant matter</td>
</tr>
<tr>
<td>Clay</td>
<td>Bugs</td>
</tr>
<tr>
<td>Sand</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
</tr>
</tbody>
</table>

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.

**Activity 2: Collecting Soil Samples**
Demonstrate how to collect a soil sample. Students’ pair up to collect soil samples in clear containers. Demonstrate how to sort out the living and nonliving items into separate containers. Students use the T-chart in the worksheet, What's in Soil, on page 6 of their workbooks to list what they find as living or nonliving.
Ask:

- What did you find?
- Is it living or nonliving?
- Did you find anything that isn't on our T-diagram?

**Student Reflection**

What is soil made of?

**English Language Learning (ELL) Focus: Listing Nouns**

- Soil is made of ______, ______, ______, and ______.
- ______, ______, ______, and ______ combine to make soil.
- The **four components** of soil are ______, ______, ______, and ______.

**Additional Information**

**Sources**

Space Travelers Lesson, Growing Classroom, Life Lab
Compost Critters

Objectives/Assessment Targets
Students will:

- Add organic materials to the compost piles.
- Identify living things in compost.
- Identify the role insects play in maintaining healthy soil.

Activity Preparation
Prepare containers of amended soil and non-amended soil samples (add rocks of different sizes, wood chips, plants, and some worms).

Materials
- Buckets of amended soil and non-amended soil
- Magnifying lens for looking more closely
- Worksheet, Compost Critters, on page 7 in workbooks

Activity 1: Digging for Compost
Show the compost samples. Invite students to explore the samples using their senses. Discuss the different critters found in healthy soil. Students shovel out scoops of compost from a bucket, pull out items they find and talk about why they are in soil and why they are important to soil.

Ask:

- What kind of critters did you find?
- Why are insects so important to our compost? (Digest our left over food, water/air, burrows or tunnels, and mixing soil).
**NGSS Disciplinary Core Idea ESS3.A: Natural Resources**
Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

**Ask,** What does compost have that soil doesn’t?

**NGSS Science/Engineering Practice 6: Constructing Explanations and Designing Solutions**
Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

Students use the worksheet, Compost Critters, on page 7 in their workbooks to circle and color the critters they find. Some students need extra challenges to stay engaged. Ask these students to count the number of each critter they find.

**Student Reflection**
What did you find in the soil that surprised you?

**English Language Learning (ELL) Focus: Science Verbs**
- Sorting
- Examining

**Additional Information**
Use grade appropriate descriptive vocabulary to invite students to use their senses to observe living things in compost, such as sticky, moist, moldy, fresh, etc. If students struggle to describe what they see, prompt them with examples.

**Sources**
Kids Grow CA
Color and Count Critters Found in Soil

Ladybug adult & larva

Lacewing adult & larva

Praying mantis

Ground beetle
Worm Anatomy

Objectives/Assessment Targets

Students will:

- Identify basic worm anatomy.
- Safely handle and observe worms.
- Compare worm anatomy with human and/or animal anatomy.

Activity Preparation

Set up work workstations for small groups with the materials below. Consider making a worm bin for each classroom with students for them to observe throughout the year.

Materials

- Worm anatomy worksheets found on page 8 in student workbook
- Wet and dry paper towels
- Butcher paper or newspaper if working inside
- Microscopes and/or magnifying lens
- Soil samples

Activity 1: Identifying Worm Anatomy

Remind students that organic material is “living” material (aerobic). That includes dead plants and many kinds of creatures, such as bugs and worms. Show students the worm anatomy drawing. Explain that worms help the soil in two ways:

Figure 4 Worm anatomy diagram created by Colette Rowe, Garden Instructor
● They mix the soil by making holes and tunnels in it.
● Their castings (worm poop) enable decomposition.

Worms and other creatures, such as beetles and spiders, are called invertebrates, because they do not have a backbone. Prompt students to feel their own backbones for reference.

**NGSS Disciplinary Core Idea LS1.A: Structure & Function**
All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

Ask, What is an example of other invertebrates we can find in the soil?

Share more facts about worm anatomy:

● Worms have a mouth at one end and an anus at the other end. In between they have segments (setae).
● Worms move by retracting and expanding their muscles.
● Worms have 150 segments (setae).
● Unlike other invertebrates, worms don’t have any eyes, teeth, pincers, or stingers.

**NGSS Disciplinary Core Idea LS1.D: Information Processing**
Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.

**Activity 2: Worm Observation**
Demonstrate how to gently handle worms by placing several of them on the back of your hand. Demonstrate how to observe the worms with microscopes. Students label the parts of a worm’s anatomy in the worksheet, Worm Anatomy, on page 8 of their workbooks.

**NGSS Disciplinary Core Idea LS3.B: Variation of Traits**
Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.
**Ask**, Why are worms important for the garden?

Direct students to think about all the things they know about worms. Prompt them to now think about all the things they would like to know about worms. Write down their worm questions on post-its and collectively answer these during the closing circle.

**Student Reflection**

Some students need additional demonstration on how to safely handle worms. Emphasize that worms will not hurt you.

**English Language Learning (ELL) Focus: Conjunctions**

- Worms have segments, **but** they do not have backbones.
- Worms have mouths and anuses, **but** they do not have eyes and or teeth.
- Worms have segments, **but** they do not have legs.
- Worms have ________, **but** they do not have ________
- Humans have backbones, **but** invertebrates do not.

**Additional Information**

Reading list: “Diary of a Worm,” by Doreen Cronin.

**Sources**

Growing Minds, Appalachian Sustainable Agriculture Project, Farm to School Program

Modern Steader, Anatomy of the Red Wiggler Worm, December 22, 2015 by Dave Creech
Investigating Insects

Objectives/Assessment Targets

Students will:

- Identify examples of things that help the garden grow and things that do not.
- Present an argument for why certain things help the garden grow and others do not.
- Cite specific examples of how insects help the garden stay healthy.
- Match insects found with those on the insect worksheet.

Activity Preparation

Collect soil samples in a large container. Collect insects from the garden or purchase some of the recommended insects from your local horticulture stores.

Materials

- Amended soil samples with added insects (spiders, praying mantis, ladybugs, worms, beetles, roly-polies)
- Investigating Insects worksheet found on page 9 in student workbooks
- Small cups for each student to sort what they find

Activity 1: Identifying Insects in Soil Samples

Explain that insects and soil need each other to survive. Helpful insects mix the soil up by making tunnels and holes.

NGSS Disciplinary Core Idea ESS3.A: Natural Resources

Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

Ask:

- What other ways do insects help the soil? (Eat organic matter and excrete worm castings that fertilize our soil)
- What other insects help our garden? (Bees!)
- What do they do? (They pollinate)

Insects need the soil, because it provides them with food and a warm, wet place to live. Some insects don't help the garden because they eat garden plants.

**NGSS Disciplinary Core Idea ESS2.E: Biogeology**
Plants and animals can change their environment.

**Ask,** What are examples of insects that do not help the soil, and how don't they help? (slugs and snails)

Make a T-chart of helpful and unhelpful insects:

<table>
<thead>
<tr>
<th>Helpful insects (Garden friends)</th>
<th>Unhelpful insects (Garden foes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bees</td>
<td>Aphids</td>
</tr>
<tr>
<td>Butterflies</td>
<td></td>
</tr>
<tr>
<td>Worms</td>
<td></td>
</tr>
<tr>
<td>Beetles</td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td></td>
</tr>
<tr>
<td>Ladybugs</td>
<td></td>
</tr>
<tr>
<td>Roly-polies</td>
<td></td>
</tr>
</tbody>
</table>

Help students scoop soil samples into their small cups. Students use their worksheets to match the insects they find in the soil samples and categorize them as helpful friends or harmful foes.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.

**Activity 2: Finding Insects in the Garden**

Some plants will attract beneficial insects into the garden, such as dill, butterfly weed, fennel, coriander, and marigold. Guide students on a tour of the garden noting the plants and flowers that the insects like.
Ask:

- Why do these insects like that plant or flower?
- How does this specific insect support this specific plant or flower?

**English Language Learning (ELL) Focus: Adjectives and Conjunctions**

- Some insects, like _______ and _______, are helpful for the soil.
- Other insects, like _______ and _______, are unhelpful for the soil.
- These insects are helpful.
- Those insects are unhelpful.

**Additional Information**


**Sources**

Friends Found in Soil

Butterfly
Assassin Bug
Hover Fly
Lacewing
Earthworm
Ladybug
Lacewing Larva
Honeybee
Ladybug Larva
Wasp
Ground Beetle
Spider
Dragonfly
Hummingbird
Frog
Bat
Figure 5 Dead Snails Leave No Trails, Loren Nancarrow and Janet Hogan Taylor, Ten Speed Press and The Bug Book, Barbara Pleasant, Story Communications, Inc.
Introducing FBI

Objectives/Assessment Targets

Students will:

- Dissect soil and compost samples
- Identify fungi, bacteria, and invertebrates as necessary decomposers

Activity Preparation

This lesson builds upon past lessons on decomposition, including introduction to compost, worms, and critters commonly found in soil. These activities identify decomposers with scientific names and invites students to get to know the three critical categories of decomposers better.

Collect samples of compost in various stages of decomposition. Students will observe and identify different FBI in these samples. Collect various examples of FBI in clear jars so students have examples of what to look for.

Materials

- Examples of fungi, bacteria, and invertebrates
- Samples of half-decomposed compost
- Magnifying lens and forks or spoons to use as digging tools
- Paper plates or paper towels for students to hold the FBI and compost samples
- Worksheet, What is the FBI?, on page 10 of student workbooks

Activity 1: Finding the Decomposers

Show students the compost pile to observe the leftover food scraps and dry leaves or straw layers.

Ask, What is decomposition?

Review that compost turns back into soil through decomposition. Review key ideas about the relationship between soil and worms. Worms are just one of the three things necessary
for turning compost into soil. Compost needs a mixture of FBI.

**NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans**
There are many different kinds of living things in any area, and they exist in different places on land and in water.

**F**—**Fungi**, such as mold and mushrooms, produce powerful chemicals (enzymes) that break down organic matter.

**B**—**Bacteria** are living organisms so small that you need a microscope to see them. Bacteria warm the compost pile and also break down organic matter.

**I**—**Invertebrates**, such as worms, beetles, and spiders, are animals that do not have a backbone. They eat decomposing organic matter, like plants and food scraps.

**FBI** are decomposers because they break down organic matter and turn it into soil. Soil bacteria along with fungi are the primary decomposers in the soil. That means they break down virtually everything.

**NGSS Disciplinary Core Idea ESS2.E: Biogeology**
Plants and animals can change their environment to meet their needs.

**NGSS Crosscutting Concept: Energy and Matter**
Objects may break into smaller pieces and be put together into larger pieces, or change shapes.

Show students examples of fungi and invertebrates. Hold up each example and describe how it helps decomposition. Remind them that bacteria are necessary, but they are too small to see without a microscope.

Distribute trays with half decomposed compost samples, spoons or forks, and magnifying glasses. Students look for fungi and invertebrates. Prompt them to draw examples of each and label them in the worksheet, What is the FBI?, page 10 in their workbooks.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Record information (observations, thoughts, and ideas).
Student Reflection
Are there other organisms that break down organic matter like the FBI do? Are there other examples of this type of breaking down in our bodies?

English Language Learning (ELL) Focus: Verbal Phrase
To decompose means to break down.

Additional Information
The FBI song is fun to sing with students at the end of class: “FBI (Fungus, Bacteria, and Invertebrates)” by the Banana Slug String Band (www.BananaSlugStringBand.com).

Sources
Project EAT
Plants and Animals

Objectives/Assessment Targets

Students will:

- Collect items that are not alive.
- Sort living and nonliving things according to what they need to survive.
- Compare and contrast the needs of plants, animals, humans, and other organisms using a Venn diagram.

Activity Preparation

Many students in first grade will have studied Venn diagrams. Check in with the teacher to time this lesson right after they learn about Venn.

Draw a Venn diagram on the whiteboard with the title, “What Do Animals, Plants, and Humans Need?” Label the three circles: plants, both, and animals.

In this lesson, students will get more comfortable using a Venn diagram to categorize what living things need to survive.

Materials

- Living and nonliving things to classify
- Containers to collect objects in and sort
- Worksheet, What do Plants and Animals Need to Survive, on page 11 of student workbooks
Activity 1: Describing Living and Nonliving Things

Ask:

- What is living and nonliving mean?
- What are examples of living things found in the garden?
- What are examples of nonliving things found in the garden?

Every living thing has basic needs. Living things can grow, but require energy in the form of food, water and sunlight. Living things are found in the garden are often colorful and feel like there is water inside them. Nonliving things don’t grow, therefore, don’t require food or water. They also may be dried up and show signs of having no water in it.

All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Humans need food, water, shelter, oxygen, space, and appropriate temperatures to live. Plants need carbon dioxide and can make their own food. Other living things may have the same needs. Most living things also need a habitat, which is the environment where living things thrive and includes food, water, and shelter.

NGSS Disciplinary Core Idea ESS3.A: Natural Resources
Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

Instruct students to collect nonliving and living items throughout the garden in small containers. Bring them back to the circle to sort living and nonliving.

Introduce the Venn diagram as a tool that helps scientist classify things, like plants and animals, and living and nonliving things. Tell students that they will categorize the items they collected based on what they need to survive.

NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.
Ask:

- What did you collect in the garden?
- Is it alive or not alive?
- How did you know that it was alive or not alive?
- Did you collect anything that was once living, but is not alive anymore?

Model how to classify the found items in the Venn diagram. Students draw a Venn diagram in their workbook and fill in the circles according to the needs of plants, animals, and both.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**

Record information (observations, thoughts, and ideas).

**Student Reflection**

What do humans and animals need to live? What do plants need to live? What needs do they share?

**English Language Learning (ELL) Focus: Synonyms**

- Living things = organisms
- Survive = thrive = live

**Additional Information**

The Venn diagram provides the necessary conceptual visual to think about classification.

**Standards**

**Sources**


“Plant and Animal Needs,” Manitoba Government
Microhabitats

Objectives/Assessment Targets
Students will:

● Describe microhabitats found in the garden.
● Create microhabitats.

Activity Preparation
This lesson builds on the lesson on plants and animals and what they need to survive. The activities explore microhabitats in the garden and identify habitats as a necessary need for many animals and humans.

Clean the recycled containers for the microhabitats to avoid mold, etc. For the recycled container biome, cut the bottom off the plastic bottle, leaving at least five inches remaining on the bottom portion. Alternate options for terrarium containers include glass jars, fish bowls, plastic baggies, and food containers. You could also use one large container to make a single terrarium for the whole class to create and observe.

Materials

● Clear recycled containers (large enough to hold at least one liter)-liter plastic bottles work great
● Examples of living (plants) and nonliving things (rocks)
● Scissors
● Clear tape
● Soil or potting soil mix
● Small plants
● Filtering charcoal (optional)
● Plants for terrariums
● Worksheet, Microhabitats, page 13 in student workbooks
Activity 1: Describing Microhabitats

Review that a habitat is the natural environment where living things thrive. The living things in the habitat find everything they need in their habitat: food, water, and a home.

**NGSS Disciplinary Core Idea ESS3.A: Natural Resources**
Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

**Ask:**
- What is your habitat?
- What do you need to survive?

A microhabitat is a habitat within a habitat. It’s an extremely small environment, like a tree stump, a dead animal, or the crannies in a rock where animals and plants live. Some microhabitats are formed naturally. Others are constructed to protect plants and animals.

**NGSS Crosscutting Concept: Scale, Proportion, and Quantity**
Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).

Activity 2: Constructing a Microhabitat

Explain that terrariums are miniature gardens—or microhabitats for small plants—that are enclosed in a clear container.

**Ask,** What kind of plants will fit best in our terrarium? Why?

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make predictions based on prior experiences.

Guide students as they set up terrariums using seeds and plants by following these steps:

1. Distribute the containers (plastic liter bottles work great).
2. Add the charcoal to help with moisture (optional).
3. Fill the container approximately one-third full with moist potting mix, providing enough room for plants to root. The amount of soil you put in will depend on the size of the container.
4. Add a sterilized potting soil mix that is moist to avoid problems with mold and fungi. If water drips from the soil when pressed into a ball, then it is too wet. Add more dry potting soil to your mixture.
5. Add plants with the roots in the soil.
6. Add rocks and other found creatures, such as snails, isopods, and worms.
7. After planting, attach the container lid or cover the opening of the terrarium with plastic. Place the terrarium in a windowsill with indirect lighting or under grow lights. Do not place it in strong direct sunlight or water will evaporate too quickly and the plants may burn.

Figure 6 A unit on the Interdependence of Living Things, By Nancy VandenBerge, Firstgradewow.blogspot.com, Graphics by djinkers, scrappindoodles

Prompt students to observe their terrariums closely for the first few days to make sure they have the proper moisture level. The top and sides of the terrarium should get misty
with water droplets when in bright light, indicating the proper moisture level. If there is no moisture along the sides, then add more water. If the top and sides remain very wet continuously, making it hard to see the plants, remove the cover for a few hours. This will allow the water vapor to escape (evaporate). Once the terrarium has the proper moisture level, it should not need frequent attention.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**
Plants depend on water and light to grow.

**Student Reflection**
What do you think will happen to your microhabitat over time? How will you take care of your microhabitat and the living things inside them?

**English Language Learning (ELL) Focus: Synonyms**
- Wet
- Humid
- Moist

**Additional Information**
This lesson can segue into interdependence and other natural cycles. Plants release water vapor into the air (transpiration) when there is light and heat present. Since the terrarium is an enclosed environment, when the water vapor leaves the plant (evaporation) and comes in contact with the side of the container, it forms droplets of water on the inside of the container (condensation). Once enough water accumulates or the temperature decreases, the condensation will then fall back down the sides of the container into the soil (precipitation). The water gathers on the ground, whether in the soil, a body of water, or elsewhere (collection), until it evaporates and the water cycle continues. The moisture level of the soil put into the terrarium is very important.

**Sources**
Kids Gardening: Helping Young Minds Grow
Plants, Animals, Wildlife, FOSS
Microhabitats

You made a microhabitat today. List three things that you made it out of.

1. ______________________________________________________

2. ______________________________________________________

3. ______________________________________________________

What do you think will happen to your microhabitat over time?

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
Earth’s Patterns

Objectives/Assessment Targets

Students will:

● Describe the day’s weather.
● Compare today’s weather with yesterday.
● Forecast tomorrow’s weather.
● Model weather patterns.

Activity Preparation

This lesson reaffirms previously learned concepts about seasonality and associated weather conditions. This activity is great to repeat throughout the year to allow students to observe and compare many different patterns in weather.

Set up cups or a rain gauge around the garden during rainy weeks to collect rain for students to count the amount of rain received. Draw the symbols for each season on the whiteboard.

Materials

● Rain gauge
● Object to model Sun and Earth for students to practice Earth’s rotation around the sun
● Worksheet, Changing Seasons, on page 14 in student workbooks

Activity 1: Observing Weather

Prompt students to look outside and notice the weather.

*NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems*

Ask questions based on observations to find more information about the natural and/or designed world(s).
Ask:

- Is it sunny or cloudy?
- Are the clouds big or small?
- Is it windy?
- In what direction is the wind blowing?
- Is it raining?
- Does the temperature feel hot, cold, cool, or warm?
- What season is it?
- What was the weather like yesterday?
- What do you think the weather will be tomorrow?

**NGSS Disciplinary Core Idea ESS2.D: Weather and Climate**

Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.

**Activity 2: What Season Is It?**

Review the Earth’s cycle and the four-season symbols for spring, summer, fall, and winter. Model how the Earth rotates around the sun, so the amount of sunlight hitting each part of the Earth changes as it moves. Invite a student to hold an image of the sun, invite another to hold a globe and circle around the sun. Different weather is caused by different combinations of sunlight, air, temperature, and moisture in a particular place during a certain time of the year.

**NGSS Disciplinary Core Idea ESS1.A: The Universe and its Stars**

Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

**NGSS Disciplinary Core Idea ESS1.B: Earth and the Solar System**

Seasonal patterns of sunrise and sunset can be observed, described, and predicted.
NGSS Science/Engineering Practice 2: Developing and Using Models
Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).

Students use the worksheet, Changing Seasons, on page 14 in their workbooks to draw an object that represents each season. Direct them to write the current and next season at the bottom of their worksheets.

Ask:

- What happens to plants in the garden during spring, summer, fall, and winter?
- Why is it important for gardeners to know what happens in each season?

NGSS Disciplinary Core Idea ESS2.A: Earth Materials and Systems
Wind and water can change the shape of the land.

Students collect objects in the garden (if done outside) that represent the current season. If the lesson is taught inside, provide students with objects to choose from for each season. Students share the objects they found and describe why they represent a particular season.

Students Reflect on the Lesson
How does the weather change when the sun comes up or goes down? How does the sun feel on your skin?

English Language Learning (ELL) Focus: Weather Adjectives

- Hot, warm
- Cold, cool
- Rainy, cloudy, sunny, clear
- Fast, slow
- Heavy, light
Additional Information

The sun gives us light and heat. The sun warms the sky (air), ocean (water), and sand (land). Light from the sun or its absence causes the weather.

Sources

Brain POP Jr.

Changing Seasons

<table>
<thead>
<tr>
<th>FALL</th>
<th>SUMMER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Leaf" /></td>
<td><img src="image2" alt="Sun" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WINTER</th>
<th>SPRING</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Snowflake" /></td>
<td><img src="image4" alt="Rain" /></td>
</tr>
</tbody>
</table>

Figure 7 Worksheet designed by Colette Rowe, garden Instructor

The current season is: _________________________

The next season is: _________________________
Weather and Clouds

Objectives/Assessment Targets

Students will:

- Observe clouds in the sky.
- Describe the clouds in the sky.
- Make a wind or weather instrument.

Activity Preparation

This lesson is perfect for an overcast, windy, or cloudy day. It builds upon past lessons on seasonality and weather, focusing on the natural resource, wind. The activities help students measure and observe weather patterns.

Materials

- Sleeve of a large, old long-sleeved shirt
- Needle and thread
- String
- Wire
- Small rock
- Worksheet, Weather and Clouds, on page 15 in student workbooks

Activity 1: Weather Experiments - Tracking Wind

Gardeners observe weather, specifically the wind to plan for important garden activities.

NGSS Disciplinary Core Idea ESS2.A: Earth Materials and Systems

Wind and water can change the shape of the land.

Help students make windsocks to specify wind speed and direction. Follow these steps to guide student groups in making windsocks:

1. Cut one sleeve off an old long-sleeved shirt.
2. Bend the wire into a circle. Make sure it is the same size as the top of the sleeve.
3. Place the wire into the top end of the sleeve. Take the needle and thread and stitch it, so the wire will stay in place.
4. You have just now made the mouth of the wind sock.
5. Now, place the rock in some cloth on one edge of the wire. Sew it on tight to hold it in place.
6. Tie the string onto the wire opposite the rock.
7. Tie the other end of the string to a branch where it can move freely. The rock will keep the windsock facing into the wind.

Activity 2: Observing Clouds - Tracking Weather

Gardeners can also observe the clouds to help them plan for activities. Noticing a cloud’s qualities, including shape, position, and movement, can help gardeners predict the weather. For example, if a gardener notices a rain cloud in the sky they will not have to plan for watering their fruits and vegetables.

NGSS Disciplinary Core Idea ESS2.D: Weather and Climate
Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.

NGSS Disciplinary Core Idea ESS3.B: Natural Hazards
Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.

Review the different types of clouds and the types of weather associated with each one. Students complete the worksheet, Weather and Clouds, on page 15 in their workbooks. Instruct students to look up in the sky and notice the clouds. Write or draw what they notice in each cloud box.

Student Reflection
What is necessary for a cloud to form?

English Language Learning (ELL) Focus: Adjectives
- Cool
Additional Information

High Clouds

- Cirrus
- Cirrostratus
- Cirrocumulus

Detached clouds in the form of white, delicate filaments, mostly white patches or narrow bands. They may have a fibrous (hair-like) and/or silky sheen appearance.

Cirrus clouds are always composed of ice crystals, and their transparent character depends upon the degree of separation of the crystals.

As a rule, when these clouds cover the sun's disk they hardly diminish its brightness. Before sunrise and after sunset, cirrus is often colored bright yellow or red. These clouds are lit up long before other clouds and fade out much later.

Transparent, whitish veil clouds with a fibrous (hair-like) or smooth appearance. A sheet of cirrostratus which is very extensive, nearly always ends by covering the whole sky.

A milky veil of fog (or thin Stratus) is distinguished from a veil of Cirrostratus of a similar appearance by the halo phenomena which the sun or the moon nearly always produces in a layer of cirrostratus.

Thin, white patch, sheet, or layered of clouds without shading. They are composed of very small elements in the form of more or less regularly arranged grains or ripples.

In general Cirrocumulus represents a degraded state of cirrus and cirrostratus both of which may change into it and is an uncommon cloud. There will be a connection with cirrus or cirrostratus and will show some characteristics of ice crystal clouds.

Figure 8 Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service

Sources

National Weather Service Weather Forecast Office, Honolulu, HI
Temperatures in the Garden

Objectives/Assessment Targets

Students will:

- Observe temperatures in the garden.
- Read a thermometer.
- Explain why temperature varies in the garden.

Activity Preparation

This lesson teaches students how to measure weather, focusing on temperatures using thermometers.

Set up three to four thermometers in hot and cold locations throughout the garden. Consider areas with varying degrees of sunlight and whether the thermometer is close to the ground or up in a tree. Draw a large diagram of a thermometer on the whiteboard that demonstrates the degrees of temperature.

Materials

- Thermometers
- Diagram of a thermometer
- Portable whiteboard and markers.

Activity 1: Taking the Garden’s Temperature

Review lessons about the weather and seasonality. Prompt students to pair-share characteristics of each season. Review the current season. Display the thermometer on the whiteboard and demonstrate how to read a thermometer. Lead the class in counting by ones, twos, and fives using the thermometer on the whiteboard.
Guide students on a tour of the garden and point out places with different temperatures.

**Ask**, Why would these places have different temperatures?

Student groups find the thermometers and read the temperatures. Bring the whiteboard around to the different locations to illustrate how to count and read the temperature on the thermometers throughout the garden.
Ask, Why are these places colder or warmer?

Write down student observations next to the temperature readings on the whiteboard. Students use the worksheet, Temperatures in the Garden, on page 15 in their workbooks. Assist students in calculating the difference in temperature between the hottest and the coldest locations in the garden.

**NGSS Science/Engineering Practice 6: Constructing Explanations and Designing Solutions**
Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

**Students Reflect on the Lesson**

What happens when you stand in the shade? When you stand in the sun? Which part of the garden is the coldest? Which part of the garden is the warmest?

**English Language Learning (ELL) Focus: Comparatives**

- This part of the garden is colder than _____.
- The other part of the garden is warmer than ________.

**Sources**

Temperature Hunt, Life Lab
Eat a Rainbow

Objectives/Assessment Targets

Students will:

- Name the health benefits of the different colored fruits and vegetables.
- Taste different fruits and vegetables growing in the garden.
- Assemble cutouts of fruit and veggie cards to represent a rainbow.

Activity Preparation

This lesson introduces students to the importance of eating many different types and colors of fruits and vegetables. The activities invite students to taste new flavors and understand the natural sweetness of fruits and veggies, inciting them to reconsider eating or adding sugar to other foods.

Set up workstations with collage materials for small students groups. Prepare ingredients for recipe, Eat A Rainbow, in the Monthly Recipes under 6 Part Plants. You may want to pre slice colorful fruits and veggies for students to assemble their own rainbows using seasonal produce.

Materials

- Fruit and veggie cards
- Large butcher paper
- Pencils
- Scissors
- Colored construction paper
- Samples of fruits and veggies of different colors

Figure 10 Riva Mason, Garden Instructor, demonstrating her Eat A Rainbow poster created by students
• Small bowls for tasting and large bowls for mixing the salad

**Activity 1: Health Benefits by Color**

**Ask:**

• Have you ever eaten a rainbow?
• Can you name fruits and veggies and their color (ex. Beets are purple)?
• Show students the fruit and vegetable cards (or samples of fruits and vegetables).

Distribute the color cards that list the colors of common fruits and veggies and the health benefits for each. Students share their favorite fruit or veggies and its color. Prompt them to describe how it helps their health.

<table>
<thead>
<tr>
<th>CA Health Standard 5.1.P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use a decision-making process to determine personal choices that promote personal, environmental, and community health.</td>
</tr>
</tbody>
</table>

Tell students that they will make a rainbow they can eat. Invite a student or teacher to have their bodies traced on a large sheet of butcher paper. Fix this outline on a wall. Each student places a fruit or veggie image or card on the outline in the place where it has the most health benefits.

<table>
<thead>
<tr>
<th>Different COLORS help different parts of our body!</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
</tr>
<tr>
<td>Good for our:</td>
</tr>
<tr>
<td>HEARTS</td>
</tr>
<tr>
<td>MEMORIES</td>
</tr>
<tr>
<td>Keeps us from getting Cancer</td>
</tr>
<tr>
<td>Fruits and Vegetables: apples, tomatoes, strawberries watermelons, beets, cherries</td>
</tr>
</tbody>
</table>
DARK ORANGE

Good for our:
EYES
HEART
IMMUNE SYSTEM

Fruits and Vegetables: carrots, oranges, melon, squash, sweet potatoes, orange peppers

GREEN

Good for our:
BONES and TEETH
EYES
STOMACH

Fruits and Vegetables: leafy greens, broccoli, cabbage, lettuce, avocado, kiwi

BLUE / PURPLE

Good for our:
MEMORY
AGING PROCESS

Fruits and Vegetables: grapes, raisins, purple cabbage, eggplant, plums, blackberries, blueberries

BROWN and WHITE

Good for our:
HEART
IMMUNE SYSTEM

Fruits and Vegetables: cauliflower, onions, garlic, bananas, jicama, corn, potatoes

Activity 2: Fruit and Vegetable Rainbows

Present small groups of students with sliced fruits and veggies of many different colors. Instruct them to create a Super Hero that uses all of the colors. Prompt them to consider placing the fruit or veggie according to the health benefit, such as carrots for the eyes, because they help you see better. Invite students to eat their Superhero when they are done.


All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.
Ask:

- What does that color taste like?
- Why did you place that fruit or veggie where you did?

**CA Health Standard 7.2.N**
Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices.

**Student Reflection**
How do these different fruits and veggies help us grow? Have you tasted any of these fruits and veggies before? Can you think of a fruit or veggie that comes in more than one color?

**English Language Learning (ELL) Focus: Formal/Informal**
Vegetable/veggie

**Sources**
Plant It, Eat It, Grow It Lessons, Garden Enhanced Nutrition Education, Life Lab
Whole Kids Foundation
GotVeggies, No Kid Hungry, Cooking Matters
Be Sugar Savvy

Objectives/Assessment Targets

Students will:

- List foods that contain natural and added sugars.
- Identify the difference between added and natural sugars.
- Create a poster to compare foods that contain natural and added sugars.
- Explain why foods with added sugar should be eaten in moderation.

Activity Preparation

This lesson teaches students about the health detriments of eating too much sugar, especially the added sugar found in sugar sweetened beverages. These activities bring to life the actual quantifies of sugar in many commonly eaten and drunk items.

Set up a demonstration station with sugar, water, teaspoons, and a cup.

Materials

- Worksheet, Be Sugar Savvy, Added Sugar on page 20 in student workbooks
- Teaspoons and sugar
- Coloring materials

Activity 1: Sorting Natural and Added Sugar

Review the following facts with your students and engage them in a discussion about foods that have added sugar (candy, cookies, etc.) compared to foods that are naturally sweet (fruit, milk, etc.).

Naturally sweet means that a food naturally contains sugar. Foods like fruits, vegetables, and dairy products contain natural sugar, along with vitamins, minerals, and fiber. Many foods contain natural sugars, including apples, carrots, mangos, sweet peas, bananas, and milk.

Added sugar means that sugar was added to the food. Many treats, like candy and soft
drinks, are sweet because the sugar is added. Many foods contain added sugars, including crackers, cookies, cakes, and cereals, to name a few. The number-one source of added sugar in our diet is soft drinks (cola, soda pop). These foods are high in sugar and may also be low in vitamins, minerals, fiber, and other healthful things that your body needs to grow. Also, eating sugary foods can lead to cavities.

**CA Health Standard 1.6.N**
Differentiate between more nutritious and less nutritious beverages and snacks.

That is why foods with added sugar should **not** be an everyday food. They should be special treats, eaten once in a while.

Have students reference Added Sugar worksheets in their workbook. Students cut out pictures of food they find in magazines. In their workbook, have them place foods with “natural sugar” on one side and foods with “added sugar” on the other side. Prompt students to label their posters and present them to the class.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Use and share pictures, drawings, and/or writings of observations.

**Activity 2: Counting Out Sugar**

Show your students a teaspoon of sugar. Measure out piles of sugar to represent each item on the Added Sugar worksheet on page 20 in their workbooks. Prompt students to count aloud as you measure each teaspoon.

Students color in the number of spoons of sugar, and then discuss the higher-sugar foods versus the lower-sugar foods. Clarify the meaning of “added sugar.” Discuss where different sweeteners come from:

- Honey comes from bees.
- High-fructose corn syrup comes from corn.
- Granulated sugar comes from sugar beets or sugarcane.

None of these sugars are found naturally in foods; these are all **added** sugars.
Student Reflection

How do you think your body would feel if you had too much added sugar in foods or drinks?

How do you think your body would feel if you had healthy foods to eat and water to drink instead?

English Language Learning (ELL) Focus: Series

Apples, carrots, mangos, sweet peas, bananas, and milk contain natural sugars.

Crackers, cookies, cakes, cereals, and soda contain added sugars.

Additional Information

Have students hold and manipulate utensils; pour, stir, and shake; put things in the “right” place; and sort vegetables and fruits. Encourage children to eat a greater variety of foods for better nutrition and explore different foods with senses. Talk with students about their preferences and the characteristics of a variety of foods, such as color, shape, texture, and taste.

Sources

California Department of Public Health, Network for a Healthy California
Healthy Living for Life, Alameda County Public Health Department—Nutrition Services
Rethink Your Drink
Count the Sugar Spoons

20 oz. Soda  
17 teaspoons

16 oz. Flavored Milk  
15 teaspoons

16 oz. Energy Drinks  
13 teaspoons

16 oz. Sweetened Iced Tea  
12 teaspoons

12 oz. Coffee Drinks  
8 teaspoons

20 oz. Sports Drinks  
8 teaspoons

20 oz. Sweetened Bottled Water  
8 teaspoons

6 oz. Fruit Drinks  
6 teaspoons
The 3 Be’s

Objectives/Assessment Targets
Students will:
- Model garden rules.

Activity Preparation
This is the first lesson students get in the garden. It introduces students to the garden grounds, what’s growing, the tools they will use, and expectations for using them and being in the garden.

Write the 3 Be’s on the whiteboard. Connect with teachers so the expectations match the school’s culture.

Materials
- Examples of garden tools students will use throughout the year
- Materials to make a 3 Be’s poster
- Cover worksheet, page 1 in student workbooks

Activity 1: Our 3 Be’s
Remind students that:

1. The garden, like our school, is full of diversity and respecting other people and living things is important.
2. We have the same expectations in the garden as in the classroom.

Invite a student to read the 3 Be’s practiced at the school on the whiteboard.

Ask, how will you practice each Be?

1. *Be Respectful*: Respect all living things, including plants, animals, insects, and each other. Point out that some students may be frightened by certain insects and spiders in the garden and review appropriate ways to deal with fear. Demonstrate how to
walk on paths respectfully in the garden. Explain that there will certainly be moments when students will be able to run in the garden, but in general walking is the safest way to get around in the garden.

2. **Be Safe**: Use tools safely and responsibly (real tools for real jobs). Explain that we will work together throughout the year to care for the garden, which will require the use of real tools. Students will learn where the toolshed is so that they know where to find tools, clean tools, and put tools back.

3. **Be Responsible**: Prompt students to think about this phrase and how it ties into being safe and respectful. Point out that not all plants are edible. Demonstrate how to ask before picking and when we do harvest fruits and vegetables they are ripe and ready. Explain that many fruits and some vegetables appear to be ready and mature when, in fact, they are still unripe. Picking responsibly and safely means not throwing our bounty or hoarding garden favorites (e.g., strawberries).

### CA Health Standard 1.5.S
Identify ways to reduce risk of injuries at home, at school, and in the community.

### CA Health Standard 7.4.N
Practice how to take personal responsibility for engaging in physical activity.

### CA Health Standard 8.1.N
Support others in making positive food and physical activity choices.

### Activity 2: Making Your Workbook Your Own

Students use the first page in their workbooks to write their name and classroom teacher. Invite them to personalize their workbooks. Prompt them to draw or write ways they will practice the 3 Bes in the garden throughout the year. If students need additional prompts, encourage leaf rubbing or trying to draw what they see growing in the garden with a careful, scientific eye. Students write their first journal entry.

**Ask:**
- What is growing in the garden now?
- What do people do when they are being safe in the garden?
• What do people do when they are being respectful in the garden?
• What do people do when they are being responsible in the garden?

Student Reflection

Ask questions: Explain that asking questions can help students be respectful, safe, and responsible. Encourage students to ask questions to a peer or teacher whenever they are unsure about something. Emphasize that the garden is a place to ask all sorts of questions about curiosities!

**NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems**

Ask questions based on observations to find more information about the natural and/or designed world(s).

Practice teamwork: Prompt students to think about what teamwork means and why it is so important in the garden. Explain that the garden only exists because of the student and teacher teamwork and collaboration that go into maintaining it.

“Try it!”: Emphasize that we always try a little of whatever is offered. It’s okay if we don’t like it. We make sure not to yell out how much we don’t like something; instead, we can quietly put our food in the compost.

**English Language Learning (ELL) Focus: Routine Statements**

- When I’m being safe in the garden, I ______________.
- When I’m being respectful in the garden, I ______________.
- When I’m being responsible in the garden, I ______________.

**Additional Information**

*Tips from our garden educators:* Begin each class with observation questions for students as they enter the garden. Get to know each student’s name by playing name games. Students will respect the garden and your instruction more if you know their name.

Observational questions could be:
- What fruits and vegetables are ready to eat in the garden right now?
- Can you find flowers of every color of the rainbow?
- What is new in the garden? What do you see that you’ve never seen before?
- What is missing? What have you seen before in the garden that you don’t see anymore
Garden Reflections

Objectives/Assessment Targets

Students will:

- Make leaf and flower presses.
- Write poems, stories, or drawings reflective of garden experiences.
- Recall favorite garden lessons.

Activity Preparation

This lesson can be used throughout the year as a way to check-in with students on what they have learned in the garden. Apply this lesson throughout the year, at halfway points, or as part of a reflection exercise for the end of the year.

Materials

- Construction paper
- Art sponges
- Paint
- Drawing materials
- Glue or tape
- Heavy objects to help seal the flower and leaf presses
- Worksheet, Garden Reflections, on page 2 in student workbooks

Activity 1: Making Leaf and Flower Presses

Prompt students to think about what they learned thus far in the garden. Review best practices for harvesting and gathering garden objects. Students collect leaves and flowers found in the garden. Demonstrate how to make leaf and flower prints:

1. Use a sponge lightly dipped in paint to cover the leaf. Press the painted leaf onto the paper.
2. Press flowers between paper towels and place a heavy object over them.
3. Remove the heavy object and layered paper to reveal a pressed flower or leaf.
4. Add glue to the plant and place it on a piece of construction paper.
5. Glue other garden objects onto the paper.

**Activity 2: Reflective Words**

Direct students to add to their flower and leaf press to their worksheet, Garden Reflections, on page 2 in their workbooks. Prompt them to think about what they learned about leaves and flowers:

1. A poem that describes the parts of a leaf and/or a flower.
2. A diagram/drawing to show what plants need in order to survive.
3. Instructions on how to make compost.
4. An imaginary conversation between a flower and a pollinator.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**

- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**

Use and share pictures, drawings, and/or writings of observations.

**Student Reflection**

What was the most interesting thing you learned about the garden this year? What did you add to your worksheet and why? What do you want to know more about?

**English Language Learning (ELL) Focus: Superlatives and Past Tense**

- The most interesting thing I learned was ________.
- The most surprising thing I learned was ________.
Seed Saving

Objectives/Assessment Targets

Students will:

- Model the plant cycle from seed to seed.
- Break down seed pods and collect seeds to save later for planting.

Activity Preparation

If you do not have cards that represent each cycle of the plant’s life, then you can make them by drawing each of the 7 stages in the plant cycle on cards: 1) seed, 2) sprout, 3) leaves growing, 4) plant with edible parts (broccoli heads), 5) flowering plants, 6) seed pods form, 7) dried out plant with seed pods ready to harvest. It’s helpful to have tape or magnets to secure these on a white board when reviewing the seed to seed cycle with students.

Materials

- Seed to seed cards
- Blank paper for seed container origami
- Masking tape and markers
- Seed pods
- Small bowls or cups

Figure 13 Diagram created by Colette Rowe, Garden Instructor
Activity 1: Seed to Seed Cycle

Review seed to seed cycles using seed to seed cards. Arrange them in a circle on the whiteboard when you review each step.

NGSS Disciplinary Core Idea LS1.A: Structure & Function
All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

Plants depend on water and light to grow.

Ask:

- What is a seed?
- Where does it come from?
- What do we use them for?
- How do we harvest seeds?
- How does this relate to other cycles (water cycle, plant cycle, life cycle)?

Show students a dried plant with seed pods ready to harvest. Demonstrate how to crack open seed pods in small containers to collect seeds.

NGSS Disciplinary Core Idea LS3.B: Variation of Traits
Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

NGSS Crosscutting Concept: Patterns
Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
Activity 2: Making Seed Packets

Demonstrate how to make an origami seed packets. Students write their name and date on the packets. Invite them to get creative with the name of their seed packets using descriptive words based on their observations of the seed or what they know about the plant. Students place the seeds collected into these packets and label them by the plant seeds inside.

Student Reflection

Where do seeds come from? What are seeds? How do (name your plant) seeds get from the pod to a plant? What are other ways seeds can get from the pods to turn into plants? (Reference the next lesson on seed travel!)

English Language Learning (ELL) Focus: The Language of Science

- We **describe** the plant cycle when we talk about how each part happens.
- We **compare** seed types when we say what is the same or different about them.

Figure 14 Canada’s Deeds of Diversity, "How to Save Your Own Seeds."
Seed Travel

Objectives/Assessment Targets

Students will:

● Experiment with modes of seeds travel.
● Compare the modes, noting different speeds and distances.

Activity Preparation

This lesson introduces students to natural phenomena that get seeds from point A to point B. The activities also present opportunities for students to experiment with design and engineering concepts.

Prepare a collection of seeds (coconut, popcorn, milkweed, etc.), a slope for seeds to travel down, fabric or faux fur, and shallow containers of water for floating seeds. Write a list of the seven types of seed travelers on a whiteboard.

<table>
<thead>
<tr>
<th>Seven types of seed travelers</th>
<th>Examples</th>
<th>Seed helpers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diggers</td>
<td>Acorns</td>
<td>Animals/people</td>
</tr>
<tr>
<td>Droppers</td>
<td>Ehrharta grass</td>
<td>Gravity</td>
</tr>
<tr>
<td>Poppers (exploders)</td>
<td>Broccoli seeds</td>
<td>Wind</td>
</tr>
<tr>
<td>Processors</td>
<td>Blackberries</td>
<td>Animals/people</td>
</tr>
<tr>
<td>Flyers</td>
<td>Dandelions</td>
<td>Wind</td>
</tr>
<tr>
<td>Floaters</td>
<td>Coconuts</td>
<td>Water</td>
</tr>
<tr>
<td>Stickers</td>
<td>Foxtails</td>
<td>Animals/people</td>
</tr>
</tbody>
</table>

Materials

● Samples of mixed seeds
● Worksheet, How Do Seeds Travel, page 4 in student workbooks
● Buckets of water
● Slope
● Samples of clothing or faux animal fur
Activity 1: Seven Ways a Seeds Can Travel

Invite students to share everything they know about seeds. Prompt them to think about all the different types of seeds.

Ask:

- How does a seed get planted in the ground? (People plant them)
- What are other ways that they can get planted? (Animals, wind, water, slopes, etc.)

Review the seven types of seed travel on the whiteboard: diggers, droppers, poppers (exploders), processors, flyers, floaters, and stickers. Explain that we can test this information by creating an experiment.

Plants depend on animals for pollination or to move their seeds around.

NGSS Disciplinary Core Idea LS1.B: Growth and Development of Organisms
Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.

Ask, How do animals help seeds travel? (Diggers, Processors, and Stickers)

Activity 2: Experimenting with Seed Travel

Show the different seeds, and the different stations set up for students to conduct their experiments. The bucket of water will demonstrate how seeds float; the fabrics will demonstrate how seeds can stick to animals or us; the sloped material will show us how seeds accelerate speed; the cup of dandelions are for us to pretend we are the wind and blow the seeds around. Distribute several types of seeds for students to experiment with at each station. Students record their observations in the worksheet, How Do Seeds Travel, on page 4 of their worksheets.

NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Make observations (firsthand or from media) to collect data that can be used to make comparisons.
**NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans**  
There are many different kinds of living things in any area, and they exist in different places on land and in water.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**  
Record information (observations, thoughts, and ideas).

**NGSS Science/Engineering Practice 2: Developing and Using Models**  
Distinguish between a model and the actual object, process, and/or events the model represents.

**Student Reflection**
- Which seed traveled the fastest and why?
- Which seed traveled the farthest and why?
- Which seed needed other creatures, such as animals or humans, to travel?
- How is what we did different from what might actually happen in nature?

**English Language Learning (ELL) Focus: Prepositions**
- Some seeds burr into fur or attach to clothing when animals or people walk by.
- Wind blows some seeds over land.
- Some seeds travel down slopes or hills.
- Some seeds are eaten by animals.
- Some seeds float across the water.

**Additional Information**
Below is a list of seed the different types of seed travelers, examples of each traveler, and the entity that helps them travel.

**Sources**
Arizona State University, School of Life Sciences
From Beans to Plants

Objectives/Assessment Targets

Students will:

- Name the six plant parts (seed, roots, stems, leaves, flowers, fruits).
- Germinate beans for planting.
- Identify the life cycle of a plant (seed, roots, stems, leaves, flowers, fruits).

Activity Preparation

This lesson recalls past lessons on plant parts. It reinforces the concept that there are many natural cycles, focusing on the plant cycle.

Draw an outline of a plant (roots, stems, leaves, and flowers), marking the soil line according to the diagram below. Prepare glass jars or plastic bags to hold the seeds with soil. Prepare the cotton balls to keep the soaked beans moist. Suggestions for beans that work best are Lima or fava beans.

Materials

- Cotton balls, wool pieces, or paper towels
- Small containers of water
- Glass jars or plastic bags
- Dried lima beans, bean sprouts, or other sprouting beans
- Worksheet, From Beans to Plants on 6 plant parts, page 6 in student workbooks

Activity 1: Germinating Beans

Review the six parts of a plant.

NGSS Crosscutting Concept: Systems and System Models

Objects and organisms can be described in terms of their parts.

Demonstrate how to germinate a dry bean that has been soaked to spout following these
steps:

1. Moisten several cotton balls or other cotton material with warm water. Allow any excess water to drip off, but do not squeeze it to speed up the process; squeezing the cotton can remove too much water and reduces the surface area of the cotton available for the beans’ roots.

2. Place the cotton in a clear plastic bag or glass jar. The size of the jar or bag will depend on the amount of cotton you’re using and how many beans you hope to germinate.

3. Place the beans you wish to germinate on top of the cotton in the bag. You don’t need to press the beans into the cotton; just make sure they are in contact with it and not on top of other beans.

4. Seal the plastic bag and place in a location where it will receive direct sunlight. Take care not to shift the beans around while moving the bag; you want them to remain on top of the cotton at all times.

Plants depend on water and light to grow.

NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Make predictions based on prior experiences.

Invite students to be scientists and make predictions about what will happen to the bean seeds.

Ask:
- What will our beans need over the next couple weeks in order to grow into healthy plants?
- What will happen to our beans if our experiment doesn’t work out?

Nominate students to check on the beans each day until you notice germination beginning, after which you should open the bag to allow extra oxygen to reach the seed. Allow the beans to grow for several days until they are two to three inches long. This should be large enough to use in recipes or to transplant to your garden if you wish to grow full bean plants. Beans don’t tolerate transplanting well, so plant them in the garden before they
begin to form roots.

**Student Reflection**

Prompt students to check on the beans each day and look for plant parts as they begin to emerge. Lead a discussion about what will happen to the beans over the next several days.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**

Compare predictions (based on prior experiences) to what occurred (observable events).

**NGSS Science/Engineering Practice 6: Constructing Explanations and Designing Solutions**

Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

**Ask:**

- What will our beans need in order to grow into healthy plants?
- What will happen once they seed?
- How will they create more seeds to complete this cycle?

**English Language Learning (ELL) Focus: Would, Should**

- What **would** happen if our beans didn’t get sunlight? They **would**__________.
- What **would** happen if our beans didn’t get enough water? They **would**__________.
- What **should** we do if the beans get dry? We **should**__________.
- Why **shouldn’t** we give the beans too much water? We **shouldn’t** give the beans too much water because ________.

**Sources**

Science of Life Explorations

Center for Online and Distance Learning, Los Angeles County Office of Education, “Bottle Composting.”
From Beans to Plants

Name the 6 parts of the plant. Use the key words below.

Parts of a Plant

Name:____________________

flower          stem          roots

leaves
The Compost Pyramid

Objectives/Assessment Targets

Student will:

- Identify the types of materials used to create a compost pile.
- Gather and assemble appropriate materials to build a compost pile.
- Explain why using organic materials to create compost can reduce waste.

Activity Preparation

This lesson reinforces past lesson on compost and decomposition. It builds best practices for composting.

Prepare a collection of apple cores at different stages of decomposition in advance. Draw the compost pyramid or cycle on the whiteboard.

Materials

- Apple cores at different levels of decomposition
- Food scraps from past garden tastings
- Clippers (used for cutting compost materials)
- Worksheet, Compost Pyramid, page 7 in student workbooks

Activity 1: Organic vs. Inorganic

Recall the 4Rs and the importance of rot, reinforcing the practice of placing food scraps in the compost so they do not add to the landfill. Students share what they know about compost. Explain that food scraps are organic material because they were once alive. Organic material is also called biodegradable, because it decays. “Decay” means the same thing as “rot” or “decompose.” Show the decomposing apple cores. Invite students to arrange the apple cores in order from least decomposed to most decomposed.
NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

NGSS Crosscutting Concept: Energy and Matter
Objects may break into smaller pieces and be put together into larger pieces, or change shapes.

Ask, What else do we use in school that can be put into the green compost bins or garden compost?

Activity 2: Making Compost Piles
Take students to the compost piles and invite them to touch and smell the compost.

NGSS Disciplinary Core Idea ESS2.E: Biogeology
Plants and animals can change their environment.

Demonstrate the ideal compost pile using the compost pyramid. Point out that food scraps are in the green section of the pyramid. Highlight the importance of layering wet and dry materials. Review the following points:

- Worms use brown materials, such as trees, that will decompose.
- All fruits, vegetables, small pieces of eggshells, teabags without staples, and coffee grounds are great food for decomposers.
- Do not add dairy, meat, citrus fruits, or lots of oily food, which will cause the pile to smell bad and can attract unwelcome animals.
- When adding your browns, avoid weeds. Their seeds usually don’t decompose and can cause a weed problem in your compost.
and garden beds.

Students collect “browns” and “greens” in the garden to build the ideal compost:

1. Chop or break pieces into six inches or less.
2. Mix browns and greens so that there is half of each by volume.
3. Water the pile to keep it as wet as a wrung-out sponge.

NGSS Disciplinary Core Idea ESS3.C: Human Impacts on Earth Systems
Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.

Select a student to finish the pile with a layer of browns (finished compost or soil) to prevent flies from nesting.

Student Reflection
Encourage students to add food scraps from garden tastings throughout the year.

English Language Learning (ELL) focus: Verbs

- Chop, chopping
- Mix, mixing
- Sort, sorting
- Water, watering

Additional Information
Non-Biodegradable products can be recycled or reused, such as a plastic bottle cut in half and filled with soil to create a plant container. Food scraps, used napkins, and other biodegradable material decay and can be composted, reducing the amount of trash we add to our landfills. See the Story of Stuff video at http://storyofstuff.org/.

Sources
Do the Rot Thing
FBI

Objectives/Assessment Targets
Students will:

● Define FBI as fungus, bacteria, and invertebrates.
● Observe and document evidence of fungus, bacteria, and invertebrates in soil samples.
● State at least one way FBI contributes to healthy soil.

Activity Preparation
This can also be an indoor activity if it’s a rainy day. Set up workstations with butcher paper on the floor or tables and distribute scoops of compost with FBI on paper towels or plastic trays. Students use their worksheet, What’s the FBI, on page 8 in student workbooks to document what they observe.

Materials

● Samples of FBI found in the garden
● Wet and dry paper towels and butcher paper
● Microscopes
● Hand sanitizer wipes
● Samples of half-finished compost
● Worksheet, What’s the FBI, on page 8 in student workbooks

Activity 1: Introducing Bacteria, Fungi, and Invertebrates to Compost
Review past lesson on compost and decomposition.

Ask:

● Why do we compost in the garden?
● What is the perfect compost pile made of?

Show students the containers of compost at different stages of decomposition. Invite them
to use their five senses to observe and describe what they notice. The garden has its own decomposers we call FBI: fungus, bacteria, and invertebrates.

**Ask:**

- What are decomposers?
- Where can you find them?

---

**NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems**

Ask and/or identify questions that can be answered by an investigation.

Students share what they observe in the compost and what they know about FBI. Discuss why FBI are important for healthy soil.

**Ask**, What does FBI stand for?

Direct them to document their observations in their worksheet, What is the FBI, on page 7 in their workbooks. Direct students to list the types of FBI you found in the compost samples, then draw what you found.

---

**NGSS Disciplinary Core Idea ESS2.E: Biogeology**

Plants and animals can change their environment.

---

**Student Reflection**

What materials would you add to the compost pile, and why? How fast will the FBI decompose them?

---

**NGSS Crosscutting Concept: Stability and Change**

Things may change slowly or rapidly.

---

**English Language Learning (ELL) Focus: The Vocabulary of Decomposition**

- Fungi
- Bacteria
- Invertebrates
**Additional Information**

FBI’s role in decomposition is to help bring in water and air to soil by making burrows or tunnels, which mixes the soil up.

1. **Fungi**, such as mold and mushrooms, produce powerful chemicals called enzymes that break down organic matter.
2. **Bacteria** are living organisms that are so small you need a microscope to see them. They heat up the compost pile and break down organic matter.
3. **Invertebrates**, such as worms, beetles, and spiders, are animals that do not have a backbone and eat decomposing plant material and food scraps.

**Sources**

Gardening for the Environment

Project Eat
What’s the FBI?

1. What does FBI stand for?

F _________________________
B _________________________
I _________________________

2. What kind of FBI did you find? List all the decomposers you found.

____________________________________

____________________________________
Rocks to Soil

Objectives/Assessment Targets

Students will:

- Collect soil samples.
- Model how water moves through different amounts and sizes of rocks in soil.
- Compare different soil samples.

Activity Preparation

This lesson reviews the role soil composition plays in supporting water and nutrient retention for plants. Students model water and nutrient retention in different samples using strainers or sieves.

Prepare samples of sand, silt, and clay to demonstrate the different consistencies and how water drains faster through bigger rocks than clay or lots of smaller rocks.

Materials

- Small containers for collecting soil samples
- Strainer or sieve
- Watering cans
- Samples of sandy and clay soils for demonstration with added rocks of varying sizes
- Worksheet, Rocks to Soil, page 10 in student workbooks

Activity 1: Why Are Rocks in Soil?

Provide students with a handful of dirt and a handful of soil. Direct them to try and break down the soil and dirt in their hands.

Ask:

- What’s in Soil? (Minerals, water, air, and organic material)
- What’s in Dirt? (Grains of sand, clay, and rocks)

Students identify the different contents. Students use the worksheet, Rocks to Soil, on page
10 in their workbooks to document what they observe.

Ask:

- What did you find in your soil sample?
- What is it made of?
- What does it feel like?
- What does it smell like?

Explain that there are different types of soil. Each one has different color, texture, capacity to retain water and nutrients for plants. Soil with smaller rocks support plants by giving their roots something to hold onto and allow more nutrients to stay in the soil.

**NGSS Crosscutting Concept: Structure and Function**
The shape and stability of structures of natural and designed objects are related to their function(s).

Show students the soil samples with different sizes of rocks that you collected from the garden. Demonstrate how water moves through various soil compositions. Invite students to add a handful of dirt and a handful of healthy soil to a sieve.

**Ask**, What do you think will happen?

Pour water over each of the soil samples with varying amount of rocks. Repeat this exercise for other students get a chance to create soil and rock mixtures in the sieves and then add water to observe the results.

**NGSS Disciplinary Core Idea ESS2.A: Earth Materials and Systems**
Wind and water can change the shape of the land.

**Ask**, What are other ways that rocks can be broken down? (Wind, rain, ground chemicals)

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.
Ask:

- Why do you think there are rocks of different shapes and sizes?
- What would happen if the wind picked up and blew over our soil samples?
- What would happen if a flood came through our soil samples?

**Activity 2: Collecting Soil Samples**

Students work in pairs as they collect their own soil samples. Assist them as they use a sieve to sort the different components of the soil and document what they’ve found. Prompt them to look for organic matter, sand, silt, clay, and small rocks. Students use their worksheets to record information about their soil samples, including where they found it, what it feels and smells like, and other characteristics. Direct students to use descriptive words that are not obvious, like dirty.

**Student Reflection**

Dirt:

1. Is broken-down rocks.
2. Is Not soil until it has organic, living material in it.
3. Breaks down and turns to dust or mud when it’s wet.

**English Language Learning (ELL) Focus: The Language of Science**

- We **analyze** dirt and soil when we take it apart to look at the different components.
- We **compare** soil types when describe what is the same and different about types of soil.

**Sources**

Nitty Gritty, The Growing Classroom, Life Lab
Graphing Decomposition

Objectives/Assessment Targets

Students will:

- Observe and document varying stages of decomposition.
- Compare organic and inorganic material.

Activity Preparation

This lesson builds upon Rocks to Soil, focusing on natural phenomena influence on decomposition. Students plant seeds in different soil compositions either in containers or throughout the garden and track their development over time using a chart.

Collect items for decomposition trivia, such as wood chips and plant material, non-decomposed food, glass, plastic, metal, and ceramics.

Materials

- Different types of soil in containers for students to plant seeds in
- Decomposition trivia items
- Glass jars with soil from Rocks to Soil lesson
- Flower or vegetable seeds for planting
- Worksheet, Graphing Decomposition, on page 11 of student workbooks

Activity 1: Reviewing Rocks to Soil

Review how rocks break down with help from natural elements, like wind and water, to make soil. Demonstrate how to plant flower or vegetable seeds in the different types of soil.
Ask:

- What is the difference between the soil samples?
- Can you determine which soil type is better for plants to grow in?
- Why is this soil type the best for this?

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

**NGSS Disciplinary Core Idea ESS2.A: Earth Materials and Systems**
Wind and water can change the shape of the land.

**Activity 2: Decomposition Trivia**
Show students the items collected for the decomposition trivia.

Ask:

- Which items will decompose?
- Which will not?
- Which will decompose the fastest?

Students use the worksheet, Graphing Decomposition, on page 11 of student workbooks to make a list of the objects they find, count how many of each object, and place an X in the box if they will decompose.

**NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking**
Use counting and numbers to identify and describe patterns in the natural and designed world(s).

**NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking**
Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
Student Reflection

What objects did you collect and how many? Will they decompose? How long will it take them to decompose?

English Language Learning (ELL) Focus: Vocabulary

- Rot
- Decay
- Decompose
- Organic
- Inorganic

Sources

Capital City Public Charter School, Washington DC
**Graph Decomposition**

**Instructions:** List the object by name, count how many of each object, and place an X in the box if they will decompose. Does the object do something else to support the garden? If so, fill in the box, What else will they do?

<table>
<thead>
<tr>
<th>Objects</th>
<th>How many?</th>
<th>Will they decompose?</th>
<th>What else will they do?</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>
Objectives/Assessment Targets

Students will:

- Model each step in the water cycle.
- Compare moisture, temperature, and texture in soil samples.
- Describe and document water content found in soil.

Activity Preparation

This lesson may be best implemented on a very dry and hot day when students need to do a lot of watering or on a rainy day where students can measure existing water that has fallen.

This lesson reinforces that there are many cycles in nature, focusing on the water cycle. The activities teach students about where water comes from, how to use it, and why we need it. They also introduce measurement tools for gauging water that has come down as rain and has absorbed into the soil.

Materials

- Watering can
- Two or more plant starts
- Dry and wet soil samples
- Worksheet, Water Hunt, on page 13 in student workbooks
- Rain gauge to show students how much rain has fallen lately

Activity 1: Water Cycle Motion

Guide students through each step in the water cycle. Draw each step on the whiteboard as students share out what they know about the water cycle. If students need additional help, engage them in hand motions to review the water cycle following these steps:

1. Water starts in the clouds and falls to the earth as rain, snow, or hail.
2. Once the water reaches the ground, it is absorbed by the soil.
3. Plants take in water from the soil through their roots.
4. The water is *absorbed* from the roots and into the stem, leaves, flowers, or fruit.
5. The sun causes water to *evaporate* back into the air.
6. Clouds *form* when the air has a lot of water.
7. The clouds *hold* rain that *falls* back down onto the soil.

**NGSS Crosscutting Concept: Systems and System Models**
Systems in the natural and designed world have parts that work together.

**NGSS Disciplinary Core Idea ESS2.C: The Roles of Water in Earth’s Surface Processes**
Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

**NGSS Disciplinary Core Idea ESS1.C: The History of Planet Earth**
Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

**Ask**, What other cycles happen in nature? (Seasons, decomposition, seeds, etc.)

**Activity 2: Testing Soil for Dampness**
All the water we have now is all the water we will ever have here on Earth. We want to use it wisely in the garden, which means not overwatering plants that do not need it. Show two or more plant starts with varying degrees of dampness.
1. Help students take turns feeling the dry soil and the wet soil with their fingers before and after watering.
2. Prompt students to describe the difference between damp and wet soil.

Ask:
- Does it feel cool, warm, crumbly, or clumpy?
- Does the soil look light or dark?
- What would it mean if the soil felt squishy or muddy? (Too much water.)

Guide students in testing the garden soil using the worksheet, Water Hunt, on page 13 in their workbooks. Invite students to explore the garden looking for various degrees of moisture or wetness found in different places throughout the garden. Direct them to use their fingers to feel for degrees of wetness.

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Direct them to write down the location, the type of plants they see (descriptive words if they do not know the names), and how wet the soil and surrounding area is. Students can pair up to identify plants that need water based on their water hunt and use watering cans to direct water to those specific plants.

**Extra Credit!** Students use their worksheet, Water Cycle, on page 14 to recall the steps in the water cycle. Direct them to cut out the words along the dotted lines and glue them so they are in the right order.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Record information (observations, thoughts, and ideas).

**Student Reflection**
How do we know when to water the garden? How do we know when to water certain plants? How did we use our Water Hunt worksheet to identify places that may need more or less water?
English Language Learning (ELL) Focus: Adjectives of Texture

- Clumpy
- Crumbly
- Dry
- Smooth
- Rough
- Muddy
- Squishy

Additional Information

Water is essential to life on Earth. We observe water in three phases (liquid, gaseous, and frozen). Water is a main part of the Earth/climate system: air, clouds, ocean, lakes, vegetation, snowpack, and glaciers. It influences the intensity of climate variability and change. It is the key part of extreme events such as drought and floods. Its abundance and timely delivery are critical for meeting the needs of society and ecosystems.

Sources

Kean University Continuing Education, Implementing Science Standards K-4, Water Cycle
The National Oceanic and Atmospheric Administration (NOAA) Education Resources

Water Hunt Worksheet

Instructions: Explore the garden. Find places that have different soil and plants. Note whether they are moist, damp, or wet.

<table>
<thead>
<tr>
<th>Location in the garden Ex. Under the apple tree</th>
<th>Plant name/picture and how many Ex. 3 Kale, 5 dandelion</th>
<th>Water observations Ex. Wet, damp, dry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
Measuring Our Garden

Objectives/Assessment Targets

Students will:

● Practice using a ruler to measure things found in the garden.
● Use a rain gauge to calculate how much rain the garden received over a period of time.
● Determine whether to add water to plants based on measurement tools.

Activity Preparation

This lesson reinforces what students have learned about watering the garden and testing for wetness in the soil to know when and where to water. The activities introduce other measurement tools used in the garden.

Place dry garden soil in shallow buckets or containers. Add water to only one bucket and mix until the soil is very damp. Draw a diagram of a rain gauge on the whiteboard. This will help students count and multiply inches in order to measure how much rain is in the rain gauge.

Materials

● Garden soil
● Two shallow buckets or containers
● Rain gauge or beakers
● Rulers
● Plant starts in containers with holes on the bottom and plates underneath them
● Watering cans
● Worksheet, What Can We Measure In The Garden?, pages 15-16 in student workbooks

Activity 1: Measuring In the Garden

Introduce the idea that gardeners measure things in the garden, such as their harvest, the
amount of rain, the temperature, etc.

Ask:
- What else do gardeners need to measure, and why?
- How do they measure it?
- What can we measure right now in the garden?
- Why do we measure these things?

NGSS Crosscutting Concept: Scale, Proportion, and Quantity
Standard units are used to measure length.

Reading the rain gauge helps us know how much water plants are getting. Using a ruler to measure our harvest helps us understand how well our plants grew this season. We measure how deep to plant the seeds and we measure the spacing between seeds.

**Activity 2: Using a Rain Gauge to Measure**

Show students to the rain gauge. Direct students to the worksheet, What can we measure in the garden?, on page 15 in their workbooks. Gardeners use a rain gauge to determine how much water they need to give their crops. A rain gauge is a cylinder that catches rain. If an inch collects in the cylinder, it means an inch of rain has fallen. Most standard rain gauges have a wide funnel leading into the cylinder and allow us to measure inches of rain over a period of time. Demonstrate how to read a rain gauge by multiplying by 10s (5, 10, 15 inches of rain!).

Distribute rain gauges to groups of students. Assist students in taking turns pouring water up to the one-inch lines, measuring the total inches of water, and pouring this water onto the potted plant starts. Students then use their fingers to test the dampness of the soil and report how many inches of water they needed to add in order for the soil to be damp at depths of one inch, two inch, three inches, and enough so that the water leaves through the bottom holes of the containers.

NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking
Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.
Ask:

- How many inches of water do our plant starts need to be fully damp through to the roots?
- If we only had two inches of rain, how much additional water would we need to add to fully soak the plant to the roots?

**Activity 3: Measuring our Harvest**

Distribute rulers. Demonstrate how to measure in inches using their ruler.

Ask:

- Where do you begin measuring something on a ruler? (0)
- How many small equal measures is one inch divided into? (8)
- What do you call one fraction part of the inch? (1/8)
- Find the halfway line for one inch. What is it called? (1/2)
- How many 1/8 equal 1/2? (4)

**Common Core State Standard 4.MD.A.1**

Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb., oz.; l, ml; hr., min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Show students how to harvest seasonal produce in the garden. Direct them to harvest and bring back only 1 item they picked. Direct them to use their rulers to measure what they harvested and record the object name and its length and width in the worksheet, What can we measure in the garden, on page 16 in their workbook.

Ask:

- What did you measure?
- How long is it in inches?
- How wide is it in inches?

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**

Record information (observations, thoughts, and ideas).
**Student Reflection**

What else can we measure in our garden? What measurement tool would we use?

**English Language Learning (ELL) Focus: Verbs to Nouns**

- We **measure** the amount of rain to find out how much it has rained.
- We are **measuring** the amount of rain using a rain gauge.
- The **measurement** is the amount shown on the rain gauge.

**Additional Information**

Rain gauges are thought to be the most ancient weather instruments. Rain gauges are believed to have been used in India more than 2,000 years ago. Rainfall as low as 0.01 inches can be measured with this instrument. Anything under 0.01 inches is considered a trace.

**Sources**

Growing Minds, ASAP (Appalachian Sustainable Agriculture Project)

Math in the Garden: Hands-On Activities That Bring Math to Life, Botanical Garden, UC Berkeley
Rain Gauge

*What can we measure in the garden?*

**What did you Measure?**

______________________________

**How long is it? (Measure in inches using your ruler)**

______________________________

**How wide is it? (Measure in inches using your ruler)**

______________________________
The Power of Mulch

Objectives/Assessment Targets

Students will:

● Measure the temperature of the soil using thermometers.
● Compare the temperature of mulched soil with un-mulched soil.
● Hypothesize and test mulching experiments.

Activity Preparation

This lesson reviews measurements in the garden. It introduces experimenting with temperatures in the garden using mulch. The acuities invite students to explore a problem, come up with a hypothesis, and then test it. This activity may be best taught during the winter months, when gardens need more mulch to keep warm and the soil is wet.

Prepare a garden bed to be covered with mulch with student help and one without for student testing. Write prompt questions (Experimenting with Temperature Using Mulch in the Garden) on the whiteboard to revisit after the activities.

Materials

● Mulch
● Thermometers
● Worksheet, Experiment with Temperature Using Mulch, page 17 in student workbooks

Activity 1: Taking the Soil Temperature

Review how to measure temperatures in the garden (rain gauge and thermometer). Reference the current season, focusing on the weather and climate characteristics.

Ask:

● Why do we measure things in the garden?
● How can we measure things in the garden (length of harvest, depth of seeds to be
planted, temperatures of the air and soil, etc.)?

- What have we measured in the garden before?

**NGSS Disciplinary Core Idea ESS1.B: Earth and the Solar System**
Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

Model how to use thermometers to take the temperature of the soil in various locations in the garden beds. Direct students to take soil temperatures and record this information in their worksheet, Experiment with Temperature Using Mulch, on page 17 in their workbook. Prompt them to note the location where they took the soil temperatures, whether there were a lot of plants, how much sunlight the area received, etc.

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Record information (observations, thoughts, and ideas).

**Ask**, How does temperature change the soil? (The temperature of the soil will help determine how many weeds are in the garden.)

**Activity 2: Experimenting with Mulch**
Take students on a tour of the garden, pointing out the beds that have mulch and those that do not. Students observe the garden bed that has mulch and the one that does not.

**Ask**, What do you think mulch does for the soil?

Review the importance of keeping the soil warm so that the plants don’t freeze and so that we can keep out weeds from competing for resources with the plants.

**Ask**, How can we change the temperature of the soil so that the heat of the soil would kill the weeds, but not enough to damage the soil?
Write some of the ideas on the whiteboard. Explain that they can test their ideas by using a step-by-step process to conduct an experiment and then compare results. Present the following questions to guide their hypotheses and tests. These questions can be answered in the worksheet, Experimenting with Temperature Using Mulch, on page 17 of their workbooks. Answer the questions as a group if students need more support.

1. Name the **problem**: How can we change the temperature of the soil?
2. Make a **hypothesis** (a smart guess) about how to solve the problem.
3. Test the hypothesis with an **experiment**. (Describe your experiment. What will you do?)
4. **Observe and document** the results. (What happened? Did you experiment solve the problem? If not, make another hypothesis about how to solve the problem and conduct another experiment.)

Help students use the worksheet, Experimenting with Temperatures using Mulch, to test and document their experiment. Remind students that they will check on the temperature of the soil in these exact same places next week to see if there was any change and discuss the possible reasons for these changes.

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**NGSS Crosscutting Concept: Cause and Effect**

Simple tests can be designed to gather evidence to support or refute student ideas about causes.

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**NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking**

Use quantitative data to compare two alternative solutions to a problem.

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**NGSS Science/Engineering Practice 6: Constructing Explanations and Designing Solutions**

Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.
Student Reflection

Why do we want to prevent weeds from growing around our flower and vegetable plants? Why are weeds harmful for the garden?

Additional Information

Some gardeners follow the ethos that there are no such things as “weeds” in the garden. For these gardeners, it may be helpful to reference that plants compete for resources in the garden and by narrowing this competition we allow some plants to flourish more than others. We do this by weeding around plants we want to grow bigger and stronger, like our veggie starts. When talking about weeds with students it may also be important to categorize all plants as helpful for humans, not useful to humans, and poisonous to humans.

English Language Learning (ELL) Focus: The Language of Science

- Hypothesis
- Educated guess
- Prediction
- Smart guess

Sources

Soil Sterilization Lesson Plan, Bay Farm Elementary
Experiment with Temperature Using Mulch

1. Where did you take the temperature?

   

2. Are there a lot of plants? How many?

   

3. How much sunlight is there?

   

4. How wet is the soil?

   


Objectives/Assessment Targets

Students will:

● Name six parts of a flower.
● Dissect flowers.
● Observe each part of the flower and label it with descriptive and technical names.

Activity Preparation

This lesson is designed to be a two part lesson that can be taught over several days. The first part familiarizes students with the flower parts by inviting them to observe, incite wonder, and label plant parts using descriptive words that describe their color, shape, reference to other objects, etc. The second part introduces flower biology and invites students to be scientific in their observations and use technical titles to name the parts.

Collect samples of flowers with pronounced parts. Draw the basic Flower Part diagram on the whiteboard.

Materials

● Microscopes
● Tweezers
● Tape or glue sticks
● Pieces of paper
● Flower samples
● Flower diagram
● Worksheets, Flower Parts, on page 20 and 21 in student workbooks

Activity 1: Dissecting Flowers Using Observation

Scientist use their senses to observe natural environments, especially when they are unfamiliar with them. Invite students to pretend like they have never seen a flower below. Direct them to use their eyes, ears, nose, and touch, to observe and identify each flower
part. Prompt them to come up with creative names for each part based on what they observe.

Demonstrate how they will dissect the flower, carefully retaining the structure of each part, tape it to their worksheet on page 20. Label each flower part using imaginative descriptions based on observation. Invite them to get creative, use correct spelling, and explore deeply. Use the flower diagrams for reference.

1. Locate the outermost layer of flower parts. These are the sepals. Carefully remove the sepals. Record the numbers of sepals, attach one to the paper, and describe the function in your data table in your journal.
2. Identify the petals. These form the next layer of flower parts. Carefully remove each petal.
3. Locate the stamen, the male flower parts that are now being exposed. Record the number of stamen, attach one, and describe the function.
4. Record the number of pistils and detach one to the Flower Part Diagram.

**NGSS Crosscutting Concept: Structure and Function**
The shape and stability of structures of natural and designed objects are related to their function(s).

**NGSS Crosscutting Concept: Systems and System Models**
Objects and organisms can be described in terms of their parts.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**
Use and share pictures, drawings, and/or writings of observations.
**NGSS Disciplinary Core Idea LS1.A: Structure & Function**

All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

**Activity 2: Dissecting Flowers Using Scientific Names**

Invite students to now be a scientist as they further explore flower parts. Distribute flowers and review the different parts and their functions (see below). Prompt students to name as many parts as they can remember. Students take the flowers apart and tape them to the Flower Part diagram worksheet according to these steps:

1. Locate the outermost layer of flower parts. These are the sepals. Carefully remove the sepals. Record the numbers of sepals, attach one to the paper, and describe the function in your data table in your workbook.
2. Identify the petals. These form the next layer of flower parts. Carefully remove each petal.
3. Locate the stamen, the male flower parts that are now being exposed. Record the number of stamen, attach one, and describe the function.
4. Record the number of pistils, attach one to the Flower Part worksheet on page 21.

**NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking**

Use counting and numbers to identify and describe patterns in the natural and designed world(s).
Ask:

- Is the scientific name for each part similar to the names you came up with?
- Why is it important for scientists to observe and use their imaginations when identifying plants?

Student Reflection

Reflect on each flower part. What are the petals used for? How about the leaves and stem? What do we know about the stamen and sepals that would help us identify their function?

English Language Learning (ELL) Focus: Language of Science

- Locate
- Observe
- Identify
- Record
- Document

Additional Information

The parts of the flower are usually found in whorls, or rings. Petals are one of the sets of whorls. Sepals lie outside the petals to protect the bud. The reproductive organs, the stamens and pistils, lie inside the petals. A stamen is a male reproductive part. It consists of an anther that is held up by a filament. The anther produces pollen grains. A pistil is a female reproductive part. Its top is called the stigma. It is sticky to ensure that when pollen grains land on it, they stick to it. The middle supporting structure is the style, and the large base is the ovary, where the eggs are produced.

Sources

Flower Power, Growing Classroom, Life Lab
Weighing Our Harvest

Objectives/Assessment Targets

Students will:

- Weigh harvest from the garden using a scale.
- Compare the weights of different fruits and vegetables.

Activity Preparation

This lesson builds on measurements in the garden, focusing on designing and measuring garden harvest. Collaborate with classroom teachers to align the timing of this lesson with other design and engineering lessons.

Make a weight out of a hanger for weighing harvest:

1. Drill a small hole in each corner of the plastic containers.
2. Take one 18-inch string and thread each end through two adjacent holes, securing each end with a knot.
3. Thread another string similarly on the opposite side so the strings are relatively even in length. Do the same for the second container.
4. Place a paper clip through each hook of the hanger to create a hook for the hanging containers.
5. Make a plumb line by tying a heavy washer to one end of the 12-inch string and tying the other end to the middle of the hanger at the hood.
6. Test to see if the containers are even and balanced.

Materials

- Two plastic containers with four holes drilled on the sides of each
- One hanger with hooks on the ends
- One weight/heavy washer
- A roll of string
- Worksheet, Weighing our Harvest, page 23 in student workbooks
**Activity 1: Harvesting Our Garden**

Assign student groups to harvest each of the following from the garden (only one or two per group) based on the suggested categories:

1. Brightly colored
2. Heavier than your shoe
3. Grows on a tree
4. Grows on a bush
5. Dug up from the soil

**Activity 2: Weighing Our Harvest**

Have students make a prediction about the items they collected. Students use their worksheet, Weighing Our Harvest, on page 23 to document their experiment.

**Ask:**

- Which item will weigh the most?
- The least?

Guide students in weighing the harvest on a balancing scale. Select other students to add items from the harvest to the other container until the plumb line is on the midpoint and the containers are balanced.

**Ask:**

- Which fruit or vegetable weighed the most?
- Which weighed the least?
- How did the balance scale results compare to your predictions?
- How could you check to see if a fruit and vegetable weighs the same as another?
- How do standard weights make it easier for gardeners to sell their harvest? (They know more accurately how much is being bought and sold.)

**NGSS Crosscutting Concept: Scale, Proportion, and Quantity**

Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).
**Activity 3: Measuring Length and Width**

**Extra Credit!** Demonstrate how to use their hands to measure by following these steps:

1. Spread your hand on the surface of the whiteboard and mark the outer tips of your thumb and pinkie finger.
2. Use a ruler to connect the two points with a straight line and label the length “My Hand Span.”
3. Count your hand span using one of the harvested items.

Students measure the length of items in the harvest and record the number of hand spans of each item in their workbook.

**NGSS Crosscutting Concept: Scale, Proportion, and Quantity**

Standard units are used to measure length.

**Ask,** Why is the *My Hand Span* method useful for gardeners?

**Students Reflection**

Show someone how to use the *My Hand Span* methods of measuring.

**English Language Learning (ELL) Focus: Adjectives of Size**

- Heaviest Heavier than
- Lightest Lighter than
- Smallest Smaller than
- Biggest Bigger than

**Sources**

Math in the Garden: Hands-On Activities that Bring Math to Life, Botanical Garden, University of California, Berkeley
Weighing Our Harvest

Instructions: List items harvested from the garden:

1. Brightly colored
   ______________________________________________________

2. Heavier than your shoe
   ______________________________________________________

3. Grows on a tree
   ______________________________________________________

4. Grows on a bush
   ______________________________________________________

5. Dug up from the soil
   ______________________________________________________

Make a hypothesis (a smart guess).

- Which fruit or vegetable weighed the most?

- Which weighed the least?

What happened at the end of your experiment?
Depending On Each Other

Objectives/Assessment Targets

Students will:

- Hypothesize how plants need animals.
- Hypothesize how animals need plants.
- Document what living things (using examples of plants and animals) need to survive.

Activity Preparation

This lesson is a great segue into the pollinator lesson. Both lessons challenge students to think about different habitats and the critical interdependence of living things.

Label areas in the garden that you want students to observe. Note places that have a lot of plants and animals. Pick places that also have very little growth for comparison. Varying environments will invite students to participate in a comparative discussion about what they observed.

Materials

- Worksheet, The Plants and Animals in Our Garden, page 26 in student workbooks

Activity 1: Observing Animal Habitats

Review the diversity found in the garden. Animals depend on plants for shelter and food.
All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

**Ask**, what are other ways they depend on plants?

Plants, in turn, depend on animals to disperse their seeds and add nutrients to the soil with their droppings.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**
Plants depend on animals for pollination or to move their seeds around.

**Ask**, what are other ways plants depend on animals?

Students pair up to observe the labeled spaces in the garden. Prompt them to use the worksheet, The Plants and Animals in Our Garden, to observe the animals that live there.

**NGSS Disciplinary Core Idea ESS3.A: Natural Resources**
Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.

**Student Reflection**

What are examples of plants that animals depend on? How do they depend on them? Are there different types of animals that depend on the same plants for similar reasons?
The Plants and Animals in Our Garden

**Instructions:** Explore the garden. Find animals and list them below. Describe what they need to live and how they get their needs met.

<table>
<thead>
<tr>
<th>Name of animal</th>
<th>Name of animal</th>
<th>Name of plant</th>
<th>Name of plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs</td>
<td>Needs</td>
<td>Needs</td>
<td>Needs</td>
</tr>
<tr>
<td>How do they meet their needs?</td>
<td>How do they meet their needs?</td>
<td>How do they meet their needs?</td>
<td>How do they meet their needs?</td>
</tr>
</tbody>
</table>

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Classifying Plants and Animals

Objectives/Assessment Targets

Students will:

- Collect samples of different plants in the garden.
- Classify plants and animals found in the garden.

Activity Preparation

This lesson introduces students to classification practices for identifying commonalities and differences in life sciences.

Place identifying markers in the garden that highlight where students can collect different plants to classify. You may want to reference the Friend or Foe worksheet (1st grade Investigating Insects) to have students identify the different animals (insects) in the garden and have them classify them according to observational commonalities. This may be a helpful rainy day classroom activity.

Materials

- Crayons or other coloring materials
- Tape
- Blank worksheet, Classifying Plants and Animals on page 27 in student workbooks.

Activity 1: Collecting Plants

Prompt students to think about their own families.

Ask:

- How are you alike and how are you different?
- How would I know that you were a member of that family?

Ask students to put on their scientific hats. Explain that scientists study living things by grouping, or classifying them so they can better understand them; how they interact with natural and each other and how we can support them in their natural habitat.
Ask, Why do scientists collect samples, or specimens of the things they plan on studying? (So they can study traits and behaviors more carefully.)

Students will practice collecting and studying specimens using their worksheets, Classifying Plants and Animals, on page 27 in their workbooks. Give examples of how scientists collect samples of plants; reference picking plants carefully and holding insects respectfully. Direct students to pick, or gather specimens and then tape them to their worksheet. Prompt students to collect specimens of plants in the garden based on characteristics, ex:
- Shape
- Number of flowers or leaves
- Texture

**NGSS Science/Engineering Practice 2: Developing and Using Models**
Compare models to identify common features and differences.

**Activity 2: Identify and Group Animals According to Their Needs**

Students display their specimens on the table.

Ask, How are your specimens alike, and how are they different?

Students work in pairs to categorize the plants based on their characteristics; for example, fuzzy leaves, long stems, and bright colors. Students work in their workbooks to:

1. Draw their specimens using as much detail as they can.
2. List all of the similar characteristics.
3. List all of the things they may need to survive and how they get them. For example, light from the sun, water from the holes, and nutrients from the compost.

Direct students to think about which specimens are alike and which are different. Direct them to group them according to alike and different.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**
Plants depend on water and light to grow.
**NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking**
Use counting and numbers to identify and describe patterns in the natural and designed world(s).

**NGSS Crosscutting Concept: Patterns**
Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

**NGSS Crosscutting Concept: Structure and Function**
The shape and stability of structures of natural and designed objects are related to their function(s).

**Student Reflection**
Where did you find your specimens? Have you seen them there before? What do they need to grow big and strong?

**Additional Information**
For additional lesson extension, read the book “Whose House Is This? A Look at Animal Homes—Webs, Nests, and Shells,” by Elizabeth Gregoire, with the class. Ask them to think about all the things animals and plants need to survive.

**Sources**
Needs of Animals and Plants, Let’s Do Science, Science Alberta Foundation
Plant and Animal Needs, Manitoba Government
Pollinators

Objectives/Assessment Targets

Students will:

- Hand-pollinate flowers using cotton swabs or paint brushes.
- Match flowers with different pollinators.
- List at least three reasons why we need pollinators.

Activity Preparation

This lesson is best delivered after the Flower Parts lessons, so students understand the basic parts and functions of flowers and how they may attract pollinators. Print out or write the Bee Sentence Stem poem on the whiteboard. Outline the Pollinator Preferences chart so all students can read it.

Materials

- Cotton swabs or paint brushes
- Flowers (one per student)
- Bee Sentence Stem poem
- Pollinator Reference Chart in student workbooks
- Chart of pollinator preferences below
- Worksheet, Pollinator Reference Chart on page 28 and Bee poem and Apple Flower Blossom diagram on page 29-30 in student workbooks

Activity 1: Matching Pollinators with their Preferences

Show the Flower Part diagram in the Flower Parts lesson and review the parts with students. Review the plant parts and their functions: roots, stem, leaf, flower, fruit, and seed. Review the six flower parts, identifying the stamen as the center of the flower that holds the pollen. Explain that without pollinators, fruit plants and trees would not be able to produce strawberries, plums, apples, apricots, etc.

Review that:
1. Pollinators are insects that transfer pollen so those plants can make seeds.
2. Plants have flowers to attract pollinators that take the pollen from one flower to another flower. This is called pollination, and we rely on pollinators to do this so that flowers can turn into fruits.
3. Pollinators are called “beneficial insects.”
4. Pollinators prefer some flowers to others. If we plant certain flowers, we can expect their pollinators will come to help spread the pollen.

NGSS Disciplinary Core Idea LS1.A: Structure & Function
All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.

Plants depend on animals for pollination or to move their seeds around.

Introduce the Bee Sentence Stem poem to reinforce this idea that pollinators (bees) need flowers, and visa versa. Share the Pollinator Preferences chart below.

Ask, What kind of flowers do _______ (a pollinator) prefer?

Activity 2: Pollinating by Hand
Ask, What do you know about pollinators?
Use the diagram for matching pollinators with their preferred plant and flower. Reference the importance of shape and color.

Ask, How does pollen get from one flower to another flower?

Figure 18 Bee sentence stem poem by Colette Rowe, Garden Instructor
Review that:

1. When a pollinator moves pollen from one flower to another, the pollen travels down the pistil.
2. At the bottom of the pistil, the pollen reaches an area called the ovary, where a fruit begins to form.

Sometimes gardeners need to pollinate flowers by hand when there aren’t enough bees to help out. Explain that we can pollinate flowers by hand using a cotton swab or paint brush. Invite students to role play each pollinator, making sure they only pollinate the flower or plant that they prefer. Distribute flowers and cotton swabs to each student and demonstrate how to pollinate the flowers following these steps:

1. Identify the petals.
2. Search for pollen inside the flower center, or stamen, by gently pinching the stamens.
3. Use the cotton swab or paintbrush to lightly dust the pollen from one flower’s stamen to the next.

Prompt students to watch what happens to the flowers that were hand pollinated and share their observations.

NGSS Crosscutting Concept: Cause and Effect
Events have causes that generate observable patterns.

Student Reflection
Flowers need pollinators. People need pollinators too. Can you explain why?

English Language Learning (ELL) Focus: Parts of Speech

- Pollination = abstract noun
- Pollinators = noun
- Pollinate, pollinating = verb

**Sources**

Kids Gardening: Helping Young Minds Grow
Science and Health Education Partnership, University of California, San Francisco

<table>
<thead>
<tr>
<th>Pollinator</th>
<th>Preferred flower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beetle</td>
<td>White or dull colored, fruity or spicy fragrance</td>
</tr>
<tr>
<td>Honeybee</td>
<td>Showy, bright petals, often blue or yellow</td>
</tr>
<tr>
<td>Mosquito</td>
<td>Small flower, often white or green</td>
</tr>
<tr>
<td>Butterfly</td>
<td>Red, orange, blue, or yellow flowers</td>
</tr>
<tr>
<td>Bat</td>
<td>Large flower with fruity fragrance</td>
</tr>
<tr>
<td>Hummingbird</td>
<td>Red flower, tubular shape</td>
</tr>
<tr>
<td>Moth</td>
<td>White or yellow flowers with heavy fragrance</td>
</tr>
<tr>
<td>Wind*</td>
<td>Small, odorless, colorless flowers</td>
</tr>
</tbody>
</table>

[*This is a pollinator that is not an insect.]*
Sometime vs. Anytime Foods

Objectives/Assessment Targets

Students will:

● Recall the difference between “sometimes” vs “anytime” foods.
● Categorize “sometimes” foods and “anytime” foods.
● List at least three foods in each category.

Activity Preparation

This lesson teaches health and nutrition standards and can be implemented in the classroom or outside. The activities reinforce food safety and health practices. You may want to implement this lesson at the beginning of the school year to set the stage for preparing healthy snacks and harvesting in the garden.

Gather food cards for both categories: sometimes and anytime foods.

Materials

● Laminated food cards
● Monthly Recipes book for recipe instructions and ingredients lists
● Containers or bags labeled “sometimes” and “anytime” for sorting relay race
● Sticky non-hazardous glitter
● A bucket, hand soap, and hose for outside hand
● Worksheet, Sometimes vs Anytimes Foods on page 31 in student workbooks

Activity 1: Staying Healthy

Greet students with a glitter handshake as they walk into the garden. Ask them to sit down in a circle and look at their hands. Tell them that all the germs you touched that day are now on their hands.

Ask:

● How much glitter is on your hands right now?
- Where did it come from?

Review classroom expectations when touching food and trying new things in the garden. Invite students to take turns sharing how they practice being healthy when sharing or eating food. Students wash hands and repeat as necessary. Reinforce the importance of food safety.

Ask:
- What do you know about germs?
- How could you protect yourself from germs?
- How can you protect your friends against germs?

**Activity 2: Define Sometime and Anytime Foods**

Review what “sometimes” and “anytime” foods are. An anytime food is a food in its most whole form, rather than processed foods that we find in packages at the store (Ex. fruits, vegetables we grow in our garden, and whole grains like brown rice and quinoa). A sometimes food is a food that has been processed or contains many ingredients. Sometimes foods are foods we may eat on a special occasion, because it has a lot of added sugars and little of the things that make us healthy, like vitamins and fibers (ex. cake, chips, candy).

| **CA Health Standard 1.6.N** |
| Differentiate between more nutritious and less nutritious beverages and snacks. |

| **CA Health Standard 8.1.N** |
| Support others in making positive food and physical activity choices. |

Group students and distribute food cards to each group (8-10 cards, mix of anytime and sometimes foods). They will have 5 minutes to categorize the cards by sometimes or anytime foods.

At the end of the 5 minutes, each group lines up to play the sometimes and anytime food relay race. Student groups line up with their pile of food model cards. Each group will get a chance to participate in the relay race. Student groups take turns placing a model card into the correctly labeled bag (sometime food and anytime food).
Ask:

- Why is this an everyday/sometimes food?
- Why is it important to eat this food every day?
- Why is it important to only eat this food sometimes?
- What would happen if you ate sometimes foods every day?

**NGSS Science/Engineering Practice 7: Engaging in Argument from Evidence**

Distinguish between opinions and evidence in one’s own explanations.

**Activity 3: One Bites**

Line students up for handwashing. Recall the glitter on their hands. Invite students to harvest straight from the garden. Model how to pick produce from the garden. Encourage them to be adventurous and try a food they might not sample otherwise. Examples of grazing one bite recipes:

- **Bubblegum Kale:** Sandwich a piece of spearmint inside kale. Chew it up and enjoy.
- **Lettuce Buffet:** Harvest several kinds of lettuce, wash it, and put a little bit of each layered onto another. Squeeze a bit of lemon and offer to students.
- **Six Plant Part Burrito:** As a group, harvest edible roots, stems, leaves (large ones for wrapping the ingredients like a burrito), fruits, and seeds. Cut plant parts up into bite size pieces, minus the large wrapping leaf. Have students fill their leaf up with samples of each part. Wrap it up and enjoy.
- **Taste of Nectar:** Use a variety of edible flowers from the garden. Discuss pollinators’ role in helping the flowers grow. Give each student a borage flower. Have them remove the pistil of the flower and lick the nectar from the receptacle. For plants like cilantro and radishes that have bolted, the flowers can also be dabbed on the tongue to taste the nectar. Plus, these flowers can be eaten after the nectar is licked off.

**Student Reflection**

Using dry-erase markers, have students check off the fruits and vegetables that they have eaten that day.

**English Language Learning (ELL) Focus: Developing their own taste preferences**

1. What tasting did you prefer and why?
2. What tasting would you like to create that we didn’t try?
3. What did you notice about the taste of a plant when combined with others?
4. What did you learn about your taste preference; do you prefer salty, herbaceous, sweet, etc.?)?

**Additional Information**

If the garden production is low, consider supplementing the garden harvest with other produce, and include other foods, like crackers, hummus, or cream cheese, that they may be more familiar with.

<table>
<thead>
<tr>
<th>CA Health Standard 7.2.N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices.</td>
</tr>
</tbody>
</table>

Make your own garden and tasting rules. Here are some suggestions for you to review about knife safety and sanitation:

- Hands should be washed for 20 seconds
- When you touch something other than cooking materials and food then you have to wash your hands again
- Knives should be kept flat by your side when walking or flat on your cutting board
- Use the claw or bridge cutting methods
- Always place the tip of the knife down when cutting
- Demonstrate how to cut each vegetable and hold a knife correctly

**Sources**

Western Growers Foundation, Collective School Garden Network
Plant It, Eat It, Grow It, Lessons, Garden-Enhanced nutrition Education from Life Lab
Garden Herbs

Objectives/Assessment Targets
Students will:

- Identify herbs in the garden.
- Create and taste herbal tea blends.
- Document healing properties of herbs.

Activity Preparation
This lesson introduces social science and history topics to the garden, referencing how herbs were used by many ancient cultures in the past and present. This lesson reinforces many nutrition lessons you may have taught over the year. These activities may be best suited for colder seasons, when students may enjoy warming themselves with some hot herbal tea.

Make labels for the herbs in the garden with their names and their health benefits. Stake them in the ground so kids can obviously see them.

Materials
- Herb collection bowls
- Laminated herb signs and garden stakes
- Pot with hot water, steeping herbs, honey or lemon for taste
- Small cups for tasting herb tea
- Worksheet, Garden Herbs, page 32 in student workbooks

Activity 1: Collecting Scientific Information about Medicinal Herbs
Pass around samples of herbs collected from the garden and invite students to use their senses to observe what they feel, see, and smell. Invite them to taste them and describe what they taste with descriptive vocabulary.

Herbs have a unique smell and taste, and are edible. For thousands of years, before modern
medicine, people used herbs and other plants to treat illnesses. Review the list of herbs in
the garden and their healing, or medicinal uses, many of which are considered common
weeds. Direct students to use their worksheet, Garden Hers T-Chart, on page 32 in their
workbooks to write the name of the herb and its medicinal use. Invite them to collect a
small sample of each herb to tape next to their description.

**NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data**

Record information (observations, thoughts, and ideas).

**NGSS Science/Engineering Practice 8: Obtain, Evaluate, and Communicate Information**

Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to
determine patterns in and/or evidence about the natural and designed world(s).

Prompt students to notice:

1. Smells
2. Texture
3. Size

**Activity 2: Using Herbs**

Students collect samples from the garden to make an herbal elixir (teas, ointments, salves,
smelling spritz). Make herbal tea with the class by adding the herbs to hot water, letting
it steep, and adding lemon and honey to taste. See examples of plants to include in the mix
below. Reflect on the healing properties described by ancient cultures, herbal
references in the Additional Information section.

![Figure 20 Student herb T-chart at John Muir Elementary School Garden]
Student Reflection

What can you use herbs for? What are examples of herbs you have in your kitchen or garden?

English Language Learning (ELL) Focus: Vocabulary

- Herb
- Herbs
- Herbal
- Herbicide

Additional Information

Ancient cultures and Native Americans used herbs to heal many ailments. Below is a short list of some herbs used by the Native Americans.

1. *Calendula* flowers help to heal your skin when you have small scrapes and cuts.
2. *Chickweed* helps with skin itchiness.
3. *Plantain* is good for drawing out stingers and splinters.
4. *Lavender* is an anti-inflammatory that helps bring down swelling.
5. *Mallow* is related to the marshmallow plant that marshmallows were once made of and is moisturizing and soothing to the skin.
6. *Mint* is cooling to your skin, so it can be nice to put on inflamed, itchy spots, and it is good for stomach aches.
7. *Ceanothus* is a California native plant that is good for helping decrease the itching of poison oak. It was also used by the Native Americans in California.
8. *Mugwort* is for treating poison oak.
9. *Lemon balm* is soothing and calming when drank in a tea.
10. *Borage* helps boost moods when eaten.
11. *Aloe* helps with burns and can be used after sunburn on the skin.

Sources

Alameda Unified School District
## Garden Herbs T-Chart

**Instructions:** Explore the garden. Find the signs that have the name of the herb and the medicinal use for that herb. Observe what you feel, smell, and see. Write down the name of the herb and the use in the T-chart below. Take a small sample of the herb and tape it next to the description.

<table>
<thead>
<tr>
<th>What is the name of the herb?</th>
<th>What is its medicinal use?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>
Healthy Attractions

Objectives/Assessment Targets

Students will:

- Read nutrition facts labels.
- Compare advertisements of common packaged processed foods.
- Compare ways flowers and plants attract pollinators with those of common packaged processed foods.

Activity Preparation

This lesson introduces nutrition facts label reading as a way to better understand what’s in a product and determine what is healthy. This activity sorts two common grains, corn and wheat, to demonstrate how a whole food, like a whole grain, is processed and sold in many packaged foods that we buy at the store.

If you plan in advance, let students know that they will be participating in nutrition lessons in the garden next time they are in the garden. Ask them to collect cereal boxes or other commonly purchased packaged foods from home ahead of time. If they are already familiar with nutrition fact labels, prompt them to bring packaged foods that have the first ingredient of corn or wheat. Collect nutrition facts labels for wheat or corn dominant products, as well, so you have enough examples for this lesson.

Materials

- Empty cereal boxes with corn and wheat as the main ingredient
- Flower samples with broad colors and shapes so they are easily explored
- Observation Worksheet on page 34 in student workbooks

Activity 1: Nutrition Facts

Prompt students to think about what they ate for dinner last night or breakfast this morning. Students share out their favorite foods and whether they are healthy. Direct them to think about how they know if the food is healthy.
Ask:

- Where can we find the nutrition facts label on packaged food?
- Who has read a nutrition label on the back of packaged foods at home or in the store?
- Why do we read these nutrition facts labels?

Show students the nutrition facts labels on the cereal boxes. Demonstrate how to read a nutrition fact label.

**NGSS Science/Engineering Practice 8: Obtain, Evaluate, and Communicate Information**
Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural and designed world(s).

Direct student groups to sort the boxes in different areas according to whether wheat or corn are the main ingredient. Show students the two piles of packaging and ask the different groups to read a nutrition facts label from one of the corn and one of the wheat boxes. (You know if they are the wheat or corn cereals by reading the nutrition facts labels).

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**
Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Students work in groups to compare the nutrition facts from their cereal boxes. Create a chart on the whiteboard separating the corn and the wheat cereals and record answers from the questions below.

Ask:

- Which cereal has the most sugar and the least added sugar?
- Which has the most ingredients?
- What was the most surprising about your cereals?
- Which one is the healthiest and why?
NGSS Science/Engineering Practice 5: Using Mathematics and Computational Thinking
Describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs.

NGSS Science/Engineering Practice 7: Engaging in Argument from Evidence
Construct an argument with evidence to support a claim.

Activity 2: Attracting Consumers
Hand out flowers with obvious anatomy to each group. Review flower parts and pollinators with students. Remind them that there’s a similar attraction between us and what we like and pollinators and the flowers they like.

Ask, How do flowers attract pollinators?

Explain that food advertisements try to attract us like flowers attract pollinators. Show students the cereal boxes and flower samples.

Plants depend on animals for pollination or to move their seeds around.

Ask:

- Are you attracted to a cereal box because of the way it looks or because a super star is selling it?
- Why else would you be attracted to buy this cereal?

Students use their worksheet, Healthy Attractions: Observation Worksheet, on page 34 in their workbooks to document their cereals/processed foods. Students compare the ways the boxes attract our attention with the way flowers attract the attention of pollinators.

NGSS Crosscutting Concept: Patterns
Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
**Student Reflection**

- Why are the cereal boxes attractive?
- What have you discovered about attraction?
- What could you eat for breakfast that doesn’t have packaging?

**English Language Learning (ELL) Focus: Attractive to, Attracted to**

- Cereal boxes are attractive to consumers.
- Flowers are attractive to pollinators.
- Consumers are attracted to brightly colored cereal boxes.
- Pollinators are attracted to brightly colored flowers.

**Additional Information**

You could pair this lesson with making a healthy snack with students that is attractive according to what they observed, color, shape, smell, etc. Some suggestions for fruits (flower parts) and cereals:

- Cereal with seasonal fruit
- Yogurt and granola
- Hummus or cheese on whole-grain bread

**Sources**

Harvest of the Month

Linking Science and Nutrition: Tips, Lessons, and Resources for Integrating Instruction, California Healthy Kids Resources Center
<table>
<thead>
<tr>
<th></th>
<th>Flower</th>
<th>Cereal</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the name of the flower?</td>
<td>What is the name of the cereal?</td>
<td></td>
</tr>
<tr>
<td>How many colors are on the flower?</td>
<td>How many colors are on the packaging?</td>
<td></td>
</tr>
<tr>
<td>What are the colors?</td>
<td>What are the colors?</td>
<td></td>
</tr>
<tr>
<td>What shape is it?</td>
<td>What shape is it?</td>
<td></td>
</tr>
<tr>
<td>Draw a picture of it here (optional)</td>
<td>Draw a picture of it here (optional)</td>
<td></td>
</tr>
<tr>
<td>Is the flower attractive?</td>
<td>Is the packaging attractive?</td>
<td></td>
</tr>
<tr>
<td>How is it attractive?</td>
<td>How is it attractive?</td>
<td></td>
</tr>
</tbody>
</table>
Establishing Expectations

Objectives/Assessment Targets

Students will:

- Personalize garden workbooks.
- Review the rules for being in the garden.
- Identify edible and nonedible plants.
- Practice respectful harvesting.
- Practice safe tool handling.

Activity Preparation

This lesson introduces students to the garden. The activities invite them to practice safety and being respectful in the school garden. Review your school’s 3 Be’s and write them on the whiteboard. Relate the garden rules with the school rules so students have an easy time relating what they practice daily in the classroom with what they are expected to practice in the garden.

Materials

- Drawing materials
- Student workbooks, worksheet, Establishing Expectations, page 2
- Sample tools student will use throughout the year

Activity 1: Behavior Expectations

Be clear on expectations for student participation in the garden. Create a vision statement with student participation for how students will behave in the garden.

The 3 Be’s for most schools are:

1. Be Respectful
2. Be Safe
3. Be Responsible
CA Health Standard 5.1.P
Use a decision-making process to determine personal choices that promote personal, environmental, and community health.

Students reflect on expectations for participating in garden activities in the worksheet, Establishing Expectations, on page 2 in student workbooks. Invite them to pair-share, or share as a group how they can be respectful, safe, and responsible in the garden this year. Write the vision statement on the whiteboard.

Ask:

- What are the 3 Be’s that you practice at school?
- How will you practice these in the classroom?
- How will you practice these in the garden?

CA Health Standard 8.1.M
Promote a positive and respectful school environment.

Activity 2: Review Tools and Safety
Lead students through a guided tour of the garden. Invite each one to practice one of the roleplaying examples, pointing out plants that are edible and nonedible. Invite students to taste new plants and describe their observations. Direct students to role-play using tools safely, harvesting veggies respectfully, and walking safely in the garden.

Ask, How will you practice each Be?

Be Respectful

- Listen attentively to each other and to the instructions
- Raise your hand
- Ask before you pick
- Stay on the paths
- Don’t yuck my yum when trying new foods
- Use quiet voices
- Don’t disturb animals and plants
Be Safe

- Handle tools with care
- Don’t raise tools above your waist
- Ask before you use tools
- Use tools as they are demonstrated by teachers

Be Responsible

- Clean up tools when you are done
- Keep a tidy garden and learning space
- Lead garden tasks, such as watering, distributing and collecting journals, or feeding the chickens
- Help your fellow students

**Activity 2: Making Your Garden Workbook Your Own**

Tell students that they will use their garden workbooks throughout the school year. It is a space for them to practice life science experiments, review what they learned, and explore their creativity. Instruct them to personalize the cover of their workbooks with drawings or writings that represent what they know about the garden, what they want to know about the garden, or how they would like to learn in the garden this year. Prompt them with how to personalize their workbooks:

1. Write your name and classroom teacher's name on the top.
2. Recall the last time you were in the garden or any garden if this is your first time here.

Students describe their ideal garden in their journals. Prompt students to think about whether their garden contains both edible and nonedible things and which plants specifically.

Figure 22 Students personalizing their workbooks at John Muir Elementary School Garden
Student Reflection

How will you practice safety in the garden this year? How will you be respectful in the garden?

English Language Learning (ELL) Focus: Vocabulary

- Respect
- Responsibility
- Safety

Additional Information

Students will use their workbooks throughout the year to take notes, draw pictures, and make scientific drawings. It’s also a good place for poetry in the garden, or other reflections outside of the curriculum workbooks. Keep these workbooks in an organized and safe place so students can easily access them, and you can demonstrate student work to students and principals.

Sources

Growing Minds, Farm to School
Objectives/Assessment Targets

Students will:

- Name the main nutrients of select fruits and vegetables.
- Identify that eating a variety of foods make up a healthy meal.

Activity Preparation

This lesson may be used throughout the year to test students on content retention. You can adapt these activities to be garden or nutrition heavy, based on what you are interested in testing. Checking in with students on content retention periodically may help you get a better understanding of what they learned and what they need to learn more about.

This is an activity that can be scaled up for 4th or 5th grade, as well as a rainy day activity inside the classroom.

Materials

- Fruit and Veggie Mania cards
- Variety of fruits and veggies for tastings
- Worksheet, Fruit and Veggie Mania: Veggie Quiz, page 3 in student workbooks

Activity 1: Fruit and Veggie Mania

Divide students into groups of two to four. Distribute a set of the Fruit and Veggie Mania cards and instructions to each group. These can be found in student workbooks, Veggie Quiz, on page 3. Direct students that they are going to play a game that will help them review:

1. The main nutrients of several fruits and vegetables.
2. How these fruits and vegetables grow strong in the garden.
3. Edible parts of the plant.

When the game is over, ask the players what they learned about fruits and vegetables they
would like to try, have tried, or are willing to try. Challenge them to try to eat at least one fruit and one vegetable from the card game that week.

**CA Health Standard 8.1.N**
Support others in making positive food and physical activity choices.

Students pair-share or group share:
1. Name a fruit or vegetable high in vitamin A? Vitamin C? Fiber?
2. Name two fruits that they eat most of and their plant parts.
3. Name two vegetables and their plant parts.

**Student Reflection**
What are your favorite vegetables to eat? What are your favorite plants that you planted this year? Which of these vegetables have you eaten before and which were new? Did you enjoy them?

**English Language Learning (ELL) Focus: Superlatives and Past Tense**
- My **favorite** veggie that I ate this year was __________.

**Additional Information**
You can make more fruit and veggie mania cards to cover as many fruits and veggies as you like by drawing or finding pictures and pasting a brief description of the plants’ nutritional value on the back. Flashcards are excellent to use as a base. Laminate these for years of use.
### Fruit and Veggie Mania: Veggie Quiz

#### Veggie Quiz Questions

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Questions</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Plate</td>
<td>Name the four food groups!</td>
<td>Vegetables and fruit, Grains, Dairy, and Protein.</td>
</tr>
<tr>
<td></td>
<td>What colors of the rainbow are represented in each food group?</td>
<td>Vegetables and fruits = green Grains = yellow Dairy = blue Protein = brown or red</td>
</tr>
<tr>
<td>Beans</td>
<td>Green beans are a source of fiber. Name the one way that fiber can help keep us healthy.</td>
<td>It can: make you feel full and add regularity to digestion.</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Broccoli is a great source of Vitamin C. Name one other vegetable that is an excellent source of Vitamin C.</td>
<td>Brussel sprouts, red peppers, cauliflower, etc.</td>
</tr>
</tbody>
</table>
Plant Traits

Objective/Assessment Targets
Students will:
- Categorize plants by their like features.
- Collect and sort plant samples into groups.

Activity Preparation
This is a great spring or fall lesson when there are more flowers growing. Use fruit and veggie cards to show examples of plants that have the same plant traits. Glue seeds to index cards and write the names of the seeds on the back. Prepare newspaper containers for students to make seed starts (newspaper containers could also be used for these).

Materials
- Samples of at least six different varieties of flowers
- Index cards
- Plant seeds
- Newspaper and mason jars for making seed start containers
- Fruit and Vegetable cards

Activity 1: Similarities and Differences
Prompt students to think about their own families and the similarities they share; the way we look, walk, talk, etc. Students group themselves according to similarities and differences (shoelaces, no shoelaces; shorts, pants).

Ask:
- How do you think plants are grouped together?
- Why did you group yourselves that way?
- Do you think this is how plants also group themselves? (Yes. The biological reasons are reflected in the “superficial” reasons. Students get more depth in fourth grade when they learn about the plant families.)
NGSS Crosscutting Concept: Patterns
Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and designed products.

Show students the different flower samples. Explain that the flowers that look similar are often part of the same family. Explain that botanists identify the flowers based on the number of parts they have, such as the number of petals, leaves, etc.

NGSS Disciplinary Core Idea LS3.A: Inheritance of Traits
Many characteristics of organisms are inherited from their parents.

Pass out flower samples and direct students to notice what is alike and what is different between the flowers.

Ask:

- How many petals leaves, etc., do they have?
- What are the similarities, and what are the differences between the different flowers?

Activity 2: Weeding the Garden
Similarities and differences are important to gardeners, because they help to identify helpful and non-helpful plants. Identify plants that are weeds and those that aren’t helpful for the garden. Describe that weeding is what gardeners do to sort the different plant families and allow plants room to grow.

Demonstrate how to identify weeds next to plants you want to flourish and how to safely remove them without disturbing the main plant. Students sort weeds into those that

Figure 23 Students examine flowers at Jefferson Elementary School Garden
support the garden and those that don’t and remove those that don’t.

Ask:
- What did you find?
- Was it a weed?
- How did you know it was a weed?

Students identify different plant families in the garden and make “weedos” made by gathering different edible plants and wrapping them in a larger leafy green to roll them up as burritos. Add slices of the garden tasting available that week (crunchy fruits or seeds). Common “weedos” include sour sorrel, milk thistle, mustard flowers, and dandelion wrapped in tree collards. Direct students to notice what they taste and prompt them to use descriptive words to describe their “weedos”.

Ask, Is it crunchy, sweet, salty, etc.?

Student Reflection
What did you learn about weeds? Why do we have some weeds and not others?

English Language Learning (ELL) Focus: Comparatives
- Similar to
- Different from

Additional Information
Edible weeds grow in fields, near streams, on rocky hillsides, along sidewalks, in empty lots, and in your own yard. Some plants are starchy, while others are rich in vitamins and minerals. Different parts of plants are edible; some only the blossoms are safe to eat, while
you can eat other plants’ roots, leaves, and stems. “Weedos” are an invention of Malcolm X students and garden educators that invite students to think about all plants and their uses, including weeds, and encourage students to taste those that are edible because many of them have a lot of nutrition.

Sources

Exploring Nature Educational Resources: A Natural Science Resource for Students and Educators

Western Sustainable Agriculture Research & Education (SARE) Farm Internship Curriculum and Handbook and All Classification of Living Things Flip Chart Set, found at https://attra.ncat.org/intern_handbook/crop_rotation.html
Dissecting Beans

Objectives/Assessment Targets

Students will:

- Identify the three parts of a bean.
- Dissect beans.
- Identify the function of each part.

Activity Preparation

This lesson invites students to be scientist and use scientific tools to dissect beans.

Draw the Bean Anatomy diagram onto the whiteboard. Soak beans (any large legume will work) in water for a few hours till they are swollen and malleable, so students can dissect the bean easily. Prepare paper towels and dissecting materials at each group station. If time allows, prepare beans for students to plant in the garden.

Materials

- Diagram of bean anatomy
- Soaked beans
- Paper towels
- Dissecting tools, like microscopes and tweezers (optional)
- Bean Anatomy Diagram Worksheet on page 6 in student workbooks

Activity 1: Dissecting Beans

Explain that beans, also called legumes (soybeans, lima beans, kidney beans, green beans, etc.), have the same anatomy. Review the Bean Anatomy diagram on the whiteboard. Direct
students to review this diagram in their workbooks, on page 6. Demonstrate how to dissect a soaked bean, pointing out each part of the bean anatomy you want them to look for. Use student ELL prompts to guide them.

1. Peel off the seed coat—it is a very thin, almost transparent, layer on the outer surface of the seed.
2. Gently split the seed in half, separating the bean’s leaves (cotyledons).

Direct students to identify the **four main parts** of a bean and their functions:

1. Leaves (**cotyledons**) that form a thick container that stores food (glucose) for the new plant as it grows.
2. Core center of the bean (**radical**) that sprouts out of the ground and grows into a plant.
3. The seedling (**epicotyl**) is the point along the embryonic shoot (the stem from which everything grows) just above the cotyledons (the seed leaves)
4. The part of a plant embryo that lies between the radicle and the cotyledons is the beginning of a plant stem (**hypocotyl**) that pushes the cotyledons above the ground to develop.
5. Seed coat (**hilum**), a thin, transparent layer on the outer surface that protects the seed (not shown here).
NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Student Reflection
Prompt students to use adjectives when describing the beans they are dissection. How are the seed’s coat (the hilum) like our skin?

English Language Learning (ELL) Focus: The Language of Science and Adjectives
- Inspect
- Remove
- Pry
- Examine

Additional Information
This lesson is best paired with a bean planting activity. Plant soaked beans in individual containers with students. Before the bean is planted, the cotyledons are usually not green. However, chlorophyll is activated and they appear green when the plant sprouts or germinates. In five to ten days, a plant will emerge out of each container. If more than one bean sprouts or germinates, have students carefully pull out all but the healthiest plant (thinning).

Sources
Bean Seed Cycle, National Agriculture in the Classroom
Gene Networks in Seed Development
Companion Planting

Objectives/Assessment Targets

Students will:

- Match several companion plants.
- Explain the purpose of companion plants.
- Design a garden bed for companion plants.

Activity Preparation

This lesson is best implemented in the spring or fall, when you plan on doing most of your garden planting. The activities invite students to think about methods for planning and how plants relate and support, or don’t support, each other.

Tape companion plant images on the back of the California Dept. of Education (CDE) Fruit and Vegetable Cards. Write the five types of companion plants on the whiteboard (attractors, confusers, enchanters, protectors, and symbiotic).

Materials

- Fruit and Vegetable Cards with labels of companion plants taped on the back
- Companion planting matrix in the Additional Information section
- Worksheet, Companion Planting, on page 8 and 9 in student workbooks

Activity 1: Identifying Companions

Gardeners plan out their garden each year. They make sure that the plants that support each other are next to each other.

Ask:

- How do you support your friends and classmates?
- How do plants support each other? (Reference the Three Sister’s Garden)

Plants prefer to be next to others, because of the nutrients they provide, the shade or sun
they offer, etc. Some plants are acidic and shouldn’t be planted to plants that don’t like acidic environments. Share the five types of companion plants; reference examples of companion plants growing in the garden currently.

Show the fruit and veggie cards and review each plant’s needs. Hand them out to student groups and direct them to group the cards according to the type of companion they would prefer.

- **Attractor** plants attract pollinators to help pollinate the garden fruits. Examples are fruits with coloring, petals, and nectar.
- **Confuser** plants confuse pests by distracting them from eating or disturbing plant parts. One example is wispy parsley tops that confuse white flies into thinking that it is a carrot plant.
- **Enchanter** plants have a chemical reaction with certain other plants that make both plants grow larger together. Examples are basil and tomatoes.
- **Protector** plants physically help our other plants. One example is squash, which grows around corn stalks to protect them against weeds.
- **Mutualism** is when two living organisms help one another out. Some plants demonstrate this by helping each other grow.

**Ask,** Why do these plants prefer to be next to each other?

Make a pile with all the cards. Students pick a card from the pile and stand by the person who has their companion plant card. Students guess what type of companions they are by using the information provided on the whiteboard and in their workbooks.

**Activity 2: Planning a Companion Garden**

Students use their Companion Planting Worksheets on page 9 in their workbooks to design their own garden bed based on what they learned about companion planting. Direct students to use the grid in the worksheet to locate the plants, label the plants, and place them next to their companion plants. Invite students to share their garden plans, explaining what they planted, where, and why they chose to plant them next to each other.

*NGSS Science/Engineering Practice 2: Developing and Using Models*

Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.
Students practice sowing the seeds of companions, transplanting a bed in companion configuration, or harvesting from two companions.

**Companion Planting**

*Follow this guide to plan your garden with companion planting.*

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Companion Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beans</td>
<td>Potatoes, carrots, cucumbers, cabbage</td>
</tr>
<tr>
<td>Beets</td>
<td>Onions</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Potatoes, celery, beets, onions</td>
</tr>
<tr>
<td>Carrots</td>
<td>Peas, lettuce, onions, tomatoes</td>
</tr>
<tr>
<td>Celery</td>
<td>Tomatoes, beans, cucumbers, squash</td>
</tr>
<tr>
<td>Corn</td>
<td>Potatoes, peas, beans, cucumbers, squash</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Beans, corn, peas, radishes</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Carrots, radishes</td>
</tr>
<tr>
<td>Onion</td>
<td>Beets, strawberries, lettuce</td>
</tr>
<tr>
<td>Peas</td>
<td>Carrots, radishes, cucumbers, beans</td>
</tr>
<tr>
<td>Potato</td>
<td>Beans, corn, cabbage</td>
</tr>
<tr>
<td>Radish</td>
<td>Peas, lettuce, cucumber</td>
</tr>
<tr>
<td>Squash</td>
<td>Corn</td>
</tr>
<tr>
<td>Strawberry</td>
<td>Beans, onion</td>
</tr>
<tr>
<td>Tomato</td>
<td>Onion, carrots, basil</td>
</tr>
</tbody>
</table>
Student Reflection

“Plants that like each other and help each other grow!”

English Language Learning (ELL) Focus: Prepositions of Location

- I would plant ______ next to __________.
- I would plant ______ near __________.
- I would plant ______ in front of ________.
- I would plant ______ in between ________.

Additional Information

CA Nutrition Network (CNN) Harvest of the Month Fruit and Vegetable Cards can be ordered at no cost for education programs here:

Sources

Companion Planting, Life Lab
Introducing Nitrogen

Objectives/Assessment Targets

Students will:

- Review the basic functions of soil.
- Plant favas, alfalfa, or peas to fix nitrogen.
- Add soil amendments to fix nitrogen.

Activity Preparation

This lesson introduces the topic that plants need nutrients, particularly nitrogen, in addition to light, air, water, and soil. The activities teach students that nitrogen comes from many different places, including the air, soil, other plants, and animals.

This activity is a good companion for a planting or garden heavy work day.

Materials

- Examples of nitrogen-fixing organic material, such as fava beans, dried blood soil amendments, or fish emulsion.
- Fava beans with nitrogen nodes.

Activity 1: Introducing Nitrogen

Review all the things that living things need to survive that students have learned in past lessons (light, air, water, sun, nutrients, and animal habitats).

Ask:

- How do we get our nutrients? (Healthy foods)
How do plants get their nutrients? (They make their own food through a process we will learn more about, called photosynthesis. They also get nutrients, like nitrogen, through other plants, the air, and animals.)

Soil performs four major functions:

1. Habitat for organisms
2. Recycles raw materials
3. Provides the foundation for engineering projects such as buildings, roads, and bridges
4. Supports plant growth

Show examples of nitrogen-fixing organic, such as manure and dried blood amendments. Show fava beans with nodes to describe how they fix nitrogen into the soil.

Fun facts:

1. Nitrogen is the most common gas found in the earth’s atmosphere
2. It is necessary for plant growth.
3. Gardens get nitrogen from the atmosphere, animal waste, and decaying and dead organisms.
4. Compost requires aerobic conditions for air or oxygen in order for decomposing bacteria to keep nitrogen in the soil.
5. This cycle reduces the amount of food waste in our landfill and produces rich soil.

Divide students into small groups to work in the garden on projects that provide nitrogen for plants:

1. Plant fava beans
2. Add nitrogen fixing amendments to the soil
3. Turn the soil to aerate it

Additional Information

While organic compost contains nitrogen, compost alone often does not provide an adequate supply for these plants. These plants collaborate with soil bacteria to absorb nitrogen from the air and deposit it in tiny root nodules—a process called nitrogen fixation. Some plants need more nitrogen than others, such as roses, corn, and lettuce.

Student Reflection

How can we fix nitrogen into our soil to help plants grow? What does fixing nitrogen mean?
English Language Learning (ELL)
Focus: Life Science Vocabulary

● **Nitrogen**: is a nutrient that is commonly in limited supply. Nitrogen deficiency in plants can occur when organic matter with high carbon content, such as sawdust, is added to soil.

● **Aerate**: to expose to the action or effect of air or to cause air to circulate through.

● **Aerobic Conditions**: Requiring air or oxygen for life or survival. Some bacteria are obligate aerobes that require oxygen for respiration.

● **Anaerobic Conditions**: Not requiring air or free oxygen.

**Sources**

Candela Open Course: Prokaryotes, Bacteria and Archaea, Candela Learning

“Grow Healthier Crops Using These Natural Nitrogen Sources,” by Beth Hanon, Rodale’s Organic Life, August 24, 2015
Decomposition Cycle

Objectives/Assessment Targets

Students will:

- Identify the functions of FBI in decomposition.
- Identify the components of the decomposition cycle.
- Document decomposition over time.

Activity Preparation

This lesson can be scaled up for 4th or 5th grades, and builds upon past lessons on decomposition. The activity allows students to model and track decomposition over time.

Prepare the decomposition bottle using a 2 liter soda bottle (make one per class) according to the steps below:

1. Fill a two-liter bottle with hot water and replace the cap. The heat will melt the glue and allow you to peel off the label and twist off the bottom easily.
2. Study Figures 2 through 5 to determine where to cut the bottles for a two or three bottle compost column.
3. Pour out the water and place the bottle on its side against a solid object. Mark a ring on the bottle (Figure 6) where you want to make the cut. Use a razor blade or knife to start a cut after marking the bottles, and then finish the cut with scissors (Figure 7). Note in Figure 5 that the shoulder of bottle #3 is cut at so that it fits into bottle #2.
4. Provide air and testing holes by poking holes in the sides of the bottle with a hot needle (heated in a candle flame, or a bunsen burner) or the soldering iron. Put a piece of netting or nylon stocking over the spout of bottle #2, securing it with a rubber band.
5. Put the pieces of column together, Figure 8.
Figure 28 Bottle Biology, an instructional materials development program, funded by a grant from the National Science Foundation, University of Wisconsin-Madison.

**Materials**

- Items that will decompose (wood chips, plant material, newspaper, food)
- Items that will not decompose (glass, plastic, metal, ceramic) small enough to fit into a larger plastic bottle
- Plastic bottles for decomposition experiment (one for each class)
- Worksheet, Decomposition Cycle, pages 11-13, in student workbooks
Activity 1: To Decompose or Not to Decompose

Draw a table on the whiteboard with two columns, one labeled “decompose” and the other “not decompose.” Show students examples of items that will decompose and those that won’t. Students share other examples of items according to each category, as you write them on the board. (Little microbes will only eat certain things you throw in the trash.)

Ask:

- What do we need for decomposition?
- How long does it take a banana peel, Kleenex, newspaper, plastic bottle, aluminum can, or glass bottle to decompose in a dump?

**NGSS Crosscutting Concept: Scale, Proportion, and Quantity**

Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**

Decomposition eventually restores (recycles) some materials back to the soil.

Review the Decomposition Cycle below, steps one through four. Direct students to use their worksheet, Decomposition Cycle, page 11 in their workbooks, to review the decomposition cycle. Students name the stage in each cycle in their worksheet, in order from least decomposed to most decomposed.

Activity 2: Making Decomposition Bottles

Show different stages of decomposed compost. Invite students to use their senses to explore each stage.

Ask, What do you see, smell, feel?

Introduce the project of making a decomposition bottle as a miniature compost pile or landfill or as leaf litter on a forest floor. Show students buckets or various items that will decompose and those that will not. Students sort objects according to whether they will decompose or not. Place an assortment of each category into the prepared plastic bottle.
Place masking tape on the bottle and write the class, their name, and the date. Students hang the bottles in a shaded place in the garden.

**NGSS Science/Engineering Practice 2: Developing and Using Models**

Use a model to test cause, and effect, relationships or interactions concerning the functioning of a natural or designed system.

Through the sides of the bottle you can observe different substances decompose and explore how moisture, air, temperature and light affect the process. Many landfills seal garbage in the earth, excluding air and moisture.

**Ask:**

- How might this affect decomposition?
- Will a foam cup ever rot?
- Which do you think decomposes faster, banana peels or leaves?
- If you add layers of soil to the column, how might they affect the decomposition process?

Students use their worksheets to write their hypotheses about what will happen over time and make a list of all of the items they placed in the bottle. Prompt them to make a timeline for checking the bottles throughout the year.

**NGSS Crosscutting Concept: Stability and Change**

Some systems appear stable, but over long periods of time will eventually change.

**Student Reflection**

What stage in the decomposition cycle will you expect the contents in the bottle to be at in a month, in 5 months, at the end of the year?

**English Language Learning (ELL) Focus: Definition of “Cycle”**

- A series of events that happen over and over in the same order
- A series of events that are repeated over and over in the same order
**Additional Information**

**Extra Credit!** Direct students to use their worksheets, Graphing Decomposition, to chart how much food they, or their school cafeteria, throw away at lunch in one week. Use the graph on the worksheet to record the amount of lunch leftovers.

**Sources**

Education Outside, Spring Valley Green Schoolyard, San Francisco Public School

A Teacher’s Guide to Composting, Marin County Office of Waste Management

Center for Online and Distance Learning, Los Angeles County Office of Education, “Bottle Composting.”
Plants to Compost

Objectives/Assessment Targets

Students will:

- Review the relationship between compost and healthy plants.
- Test different soil compositions.
- Document and hypothesize test results.

Activity Preparation

This lesson builds upon past lessons on decomposition and plant nutrients. The activities dive deeper into the importance of compost in providing nutrients for plants. It teaches students how to model and compare experiments with different types of compost and soil and their ability to support plants.

Set up workstations with materials for small student groups.

Materials

- Compost (add one part worm compost to three parts compost)
- Three containers, labeled: “1 Compost,” “2 Compost/Soil,” and “3 Soil”
- Seasonal seeds that sprout easily for planting in the containers (beans, sunflowers)
- A sample of soil and compost mixture
- Worksheet, Plants to Compost, page 14 in student workbooks

Activity 1: Review the Roles of Compost

Review that compost improves soil by helping it hold water and adding nutrients for plants.

Ask:

- What is compost made of?
- Why do we use compost in the garden?

Present different types of compost and soil mixtures and prompt students to use their
senses to observe the samples.

Ask:

- Why might certain soils be better than others?
- Why do we add compost to soil?

**Activity 2: Plants to Compost**

Show students the containers with the different labels, “1 Compost,” “2 Compost/Soil,” and “3 Soil”. Help students fill the plant containers with soil and compost according to the labels on the containers. Assign a student to place three seeds in each of the containers. Each student waters the containers until they are soaked.

Students use their Plants to Compost worksheet, page 14 in their workbooks, to document contents in each container, including the types of seeds planted, amount of compost, and type of soil.

Ask:

- What do you think will happen to the seeds in the different containers and why?
- Which seeds will grow the fastest and why?

**NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems**

Ask a question about what would happen if a variable is changed.

Students keep the worksheets so they can document the changes they observe in each container over time. Students fill in the section, Tracking Growth, in the Plants to Compost worksheet. Assign a student monitor for each container to report back to the class next time you meet.

**NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations**

Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.
Student Reflection
Check back in with students every week to see how they are doing tracking the growth of their plants in each container. Are there seeds sprouting? How many? Do they have leaves? How many? What’s the difference between plant growth, if any? Why do you think there’s a difference?

English Language Learning (ELL) Focus: Superlatives

- The _______ seeds will grow the fastest
- The _______ seeds will grow the slowest.
- The _______ container has the healthiest soil.

Sources
Plants to Compost, Do The Rot Thing
Plants to Compost Worksheet

Enter in the information for Container 1

Plant Name ___________________ Date Planted __________________

Compost type added: __________________________________________

Soil type added: _____________________________________________

Tracking Growth

<table>
<thead>
<tr>
<th>Date checked</th>
<th># of seeds sprouted</th>
<th># of leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Enter in the information Container 2

Plant Name ___________________ Date Planted __________________

Compost type added: __________________________________________

Soil type added: _____________________________________________

Tracking Growth

<table>
<thead>
<tr>
<th>Date checked</th>
<th># of seeds sprouted</th>
<th># of leaves</th>
</tr>
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<tbody>
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<td></td>
<td></td>
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</tbody>
</table>
Objectives/Assessment Targets

Students will:

- Demonstrate the significance of water in maintaining a healthy body.
- Make garden snacks that increase water consumption.
- Read and follow steps in a smoothie recipe.
- Model how dehydration affects heart rate during physical activity.

Activity Preparation

This lesson can be done inside or outside, as long as there are outlets for blenders to make the water-rich smoothie recipes. The activities teach students the importance of water in maintaining our mental and physical health, as well as the health of the garden. It also teaches them how to follow a recipe step by step and how to make a healthy snack.

Make sure each table has recipe cards, team job tasks, and produce for smoothies. Always review safety and rules when using knives or handling food others may eat.

Materials

- Blenders
- Pitchers of water
- Supplement garden produce with some seasonal fruits and veggies
- Tasting cups
- Cotton balls
- Rubbing alcohol
- Chart of produce high in water (as reference)
- Recipe for beet smoothies in the Monthly Recipes
- Worksheet, Water You Made Of, page 17 in student workbooks

Activity 1: Eating Water Heavy Fruits and Veggies

Prompt students to think about all the ways they need water, and all the ways they use water.
Ask:
- How do you get the water you need for you to be hydrated?
- What does dehydration feel like?

Two thirds of our body weight is water. If you weigh 90 pounds, 60 pounds of you is water. Water is in our cells, in our blood, and around our cells, so it is important for us to eat and drink foods that contain water. Water is found in all the food we eat, but some has much more water than others. Good sources of water are fruits and vegetables, milk, and - of course - water.

Plants acquire their material for growth chiefly from air and water.

**CA Health Standard 5.1.G**
Examine why a variety of behaviors promote healthy growth and development.

The recipes we will make in the garden have fruits and veggies that are rich in nutrients and water. Green leafy vegetables (GLV) are rich sources of calcium, iron, β-carotene, vitamin C, dietary fiber and many trace minerals. GLV are seasonal and also highly perishable due to their high water content. Direct students to harvest from the garden and wash them in preparation for the smoothies they will make. They will add other fruits or veggies supplementing their harvest.

Demonstrate how to read steps in a recipe and prepare the smoothies. Direct them to work in groups using the worksheet, Water You Made of, on page 16 to follow the Joyful 12 recipe for a beet smoothie.

Discuss the seasonality of the fruits and veggies they are using to make the smoothies.
**CA Health Standard 7.2.N**
Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices.

**Activity 2: Water in Our Bodies**

This activity may begin while students are enjoying their smoothies. It could also be a lesson implemented separately on a rainy day in the classroom.

Introduce water as a nutrient. Tell students they will learn about water’s functions keeping our bodies and garden healthy. Reference previous lessons on the water cycle and relate it to how water cycles in the human body, as well. Prompt them to recall their last sports game or PE activity and how they felt.

Ask:
- Were you hot, sweating, breathing heavy?
- What role do you think water played in making you feel that way?

Do one more demonstration with them on the cooling effect of water when it evaporates from our bodies by having students rub a little alcohol on their arms with a piece of cotton.

Ask, how does it feel? (Cooler than the rest of the arm, because alcohol evaporates more rapidly than water - the same effect as sweat).

**NGSS Crosscutting Concept: Patterns**
Patterns can be used as evidence to support an explanation.

Describe your bloodstream as if it were a river system.

Ask:
- What does it transport (oxygen in the red blood cells to working muscles and brain)?
- How does it get replenished? How does it cleanse itself? (Eliminate wastes)
- What does it transport? (Nutrients)
**Student Reflection**

Why is water so important to your body? What would happen if you did not sweat? How do animals that do not sweat cool themselves? (Dogs pant, which lets water evaporate off their tongues. Snakes and lizards seek shade in really hot weather. Birds spread their wings.) Are plant's water needs similar to our water needs?

**Additional Information**

Water is the basic ingredient of the body's transportation system, we call the bloodstream. It carries nutrients to the cells and carries waste away from the cells. Water also helps to regulate body temperature. When we exercise strenuously or if it's hot outside, the body temperature increases. When we sweat, the evaporating water cools our bodies and prevents overheating.

**Sources**

The Growing Classroom, Life Lab, Nutrients
Conserving Water

Objectives/Assessment Targets

Students will:

- Define drought.
- Practice activities that conserve water.

Activity Preparation

This lesson introduces the topic of drought and water conservation, particularly in California. The activities teach students how to conserve water and why.

Prepare materials for each student to plant a native plant seed.

Materials

- Native plant seeds or succulent clippings
- Small seedling containers, one for each student
- Soil for native drought tolerant plants

Activity 1: Conserving Water in the Garden

Review the basic needs of plants: sun, soil, nutrients, and water. Recall that water is a finite resource. The Earth does not get new or more water, rather, we can only recycle existing water.

Ask:

- Where do we get water from? (Oceans, rain, rivers)
- How do we use that water? (Cleaning, watering our garden)

When water is very scarce, because it hasn’t rained in a long time, it’s called a drought. Plants conserve the water they do have and struggle during a drought. Certain plants, such as the grass in your lawn, respond to a drought by slowing down so they don’t grow as fast.
**NGSS Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience**

When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

**NGSS Disciplinary Core Idea LS4.C: Adaptation**

For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Explain that students can conserve water in our garden by planting native plants instead of non-native plants. Native plants naturally occur in the local environment and have evolved under local conditions to adapt to the climate. They require less care (water and fertilizers) and are more likely to survive a drought.

Demonstrate how to make seed starts for planting native plants:

1. Fill a small compostable container with amended soil
2. Make a small indentation and place the seed inside.
3. Cover the seed with soil and water.
4. Place in a well light space

Encourage students to think of ways they can use recycled water to water the seedlings over time.

Ask, Why will native plants survive better than other plants in the garden?
Student Reflection

Students share ways they can conserve water in the garden and at home. These are two ways to save water:

1. Get a bucket to catch extra water when you run the water before a shower to water trees, shrubs, and non-edible plants.
2. Place a bucket under downspouts to catch runoff from any rain that falls.

English Language Learning (ELL) Focus: Prepositions

- During a drought we can ________.
- While we’re in a drought we can ________.
- Since we’re in a drought we can ________.

Sources

Plants to Compost, Do the Rot Thing
Hibernation and Migration

Objectives/Assessment Targets

Students will:

● Sort animals by those that hibernate and those that migrate.
● Follow steps to make an animal or plant habitat.

Activity Preparation

This lesson may be best done during the winter months, when animals either migrate or hibernate. The bird feeder activity can be done as a whole class or in student groups with adult supervision. Each student may also want to make their own to take home, which could be coordinated with a holiday home gift project for Earth Day. This will determine the amount of materials you will need.

Materials

● An empty plastic milk carton or water bottle
● Scissors
● String
● Bird seed
● Story books on migration and hibernation (found in your school library)
● Worksheet, Hibernate or Migrate and Making Bird Feeders, page 18 - 19 in student workbooks

Activity 1: Where Do Animals Go When They Hibernate?

Review seasonality and focus on the current season.

Ask:

● What season is it?
● What does this season feel like?
● What do you do in the winter?
● What do plants and animals do in the winter?
Define the word “hibernation.” Read from the recommended books in the Additional Information section on animal hibernation. Certain mammals are able to sleep through the winter to conserve energy, which we call hibernation. They bed down in the fall and don't wake up again until the spring. Raccoons and skunks do it. So do woodchucks and chipmunks, hamsters and hedgehogs, bats and bears.

Explain that many animals migrate in order to find food and escape colder weather. We call this “migration.” Some birds that migrate are hummingbirds, nightingales, and orioles. Insects migrate, too.

NGSS Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience
When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans
Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Direct students to think about animals in the garden that may migrate or hibernate (we may not have any hibernating animals in our Bay Area gardens, so ask them to be creative and think about other places they have visited that may have hibernating animals). Students use their worksheet, To Hibernate or Migrate, on page 18 in their workbooks to name and draw at least two animals that hibernate or migrate.

Activity 2: Making Bird Feeders for Winter
Tell students that they will make homes for the type of animals that migrate. Students use their worksheet, Making Bird Feeders for Migrators, on page 19 in their workbooks to follow instructions step by step. They can also work in groups make bird feeders following these steps:

1. Wash the bottle or carton and rinse it well.
2. Cut several small holes in the sides, about two inches from the bottom.
3. Cut or poke two small holes near the top and thread a long piece of string through them.
4. Fill the bird feeder with seeds and hang from a tree or shrub. Scattering some seeds on the ground can help the birds find the feeder.
5. Watch the birds. Be patient.
6. Try different types of seeds and different locations.

Student Reflection

Think of an animal that hibernates. Explain to the person next to you why. Think of an animal that migrates. Explain to the person next to you why.

English Language Learning (ELL) Focus: Nouns to Verbs

- Hibernation > Hibernate
- Migration > Migrate

Additional Information

Cold weather requires warm-blooded animals to use lots of energy to maintain their body temperatures. Hibernation allows animals to consume lots of food when the weather is warm and food is plentiful. This food is then stored as fat, which is used as energy during the winter. Animals can hibernate anywhere from days to months. The animal's low body temperature and metabolic rate of hibernation require less energy than the animal would normally use.

Supplementary reading:

- “More Bears!” by Kenn Nesbitt
- “Animals Hibernating: How Animals Survive Extreme Conditions,” by Pamela Hickman
- “Do Not Disturb: The Mysteries of Animal Hibernation and Sleep,” by Margery Facklam
- “Animals in Winter,” by Henrietta Bancroft and Richard G. Van Gelder
- “Bear Essentials of Hibernation,” by Peter Tyson

Sources

How Do Animals Spend the Winter, Science Made Simple
**Hibernate or Migrate**

**Instructions:** Name or draw an animal that hibernates and one that migrates.

<table>
<thead>
<tr>
<th>Hibernate</th>
<th>Migrate</th>
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Habitats

Objectives/Assessment Targets

Students will:

- Observe and document features and characteristics of different habitats in the garden.
- Document the type of animals and plants that live in each habitat.

Activity Preparation

This lesson builds on what students already learned about microhabitats and what plants and animals need. It invites students to search for and observe different animal and plant habitats in the garden.

Write the habitat hunt clues on the whiteboard. Include items available for students to find in the garden. For example: damp soil samples, edible plants and fruits, holes in the ground, rocks, etc.

Materials

- Investigative tools, like magnifying glasses and thermometers
- Worksheet, Habitat Hunt page 21 in student workbooks

Activity 1: Habitat Hunt

Prompt students to think about the garden as a large home, or habitat. Describe characteristics of a habitat as something that has all the necessary features for a creature or plant to grow and survive: food, water, and shelter.

Ask:

- What do living things need to survive?
- Who lives in our garden?
- Where do they live?
- What does their home provide them so they can live well?
Students pair up to observe and document their garden in search of different habitats using the Habitat Hunt worksheet on page 21 in their student workbooks. Direct them to follow the instructions on the worksheet to explore three different habitats in the garden. Fill in the information for location, temperature, light, moisture, and the type and name of the living things found in each habitat in the boxes on the worksheet.

Invite them to use the investigative tools to explore the habitats more, such as thermometers to take the temperature of the soil and magnifying glasses to look more closely. Invite them to consider evidence they can observe that would tell us how plants and animals get food, water, and shelter.

**Ask:**

- Who lives there?
- How do they get food, shelter?
- What else do they need?

Invite student pairs to present on their findings, explaining why they think certain plants or animals live there.

**NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans**

Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

**Student Reflection**

How are human habitats similar to habitats for plants and animals? What do we all need to survive? How can we care for our habitats and those of our plants and animals?

**English Language Learning (ELL) Focus: Conditional**

Unless a habitat has food, water, and shelter, living things won’t be able to survive.

**Sources**

Leave no Trace Schools

National Wildlife Federation
**Habitat Hunt Worksheet**

**Instructions:** You are a scientist. Explore at least *two* different habitats in your garden. Use the chart below to *investigate* and *document* characteristics of these habitats.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Location</th>
<th>Temperature</th>
<th>Light</th>
<th>Moisture</th>
<th>Plants</th>
<th>Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<td></td>
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<td>2</td>
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<td>3</td>
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</tbody>
</table>
Local vs. Non-Local Taste Test

Objectives/Assessment Targets

Students will:

● Compare a variety of seasonal, local and non-local fruits and vegetables.
● Define local and non-local fruits and vegetables.

Activity Preparation

This nutrition lesson introduces students to the topic of food systems, particularly food miles, seasonality, and retailing of food. It invites students to try new fruits and vegetables that are in season.

Prepare at different varieties of seasonal vegetables and fruits (one local and one grown in another state). If washing and slicing with students, reference food safety handling and tasting rules.

Materials:

● Apples
● Knives for slicing
● Worksheet, Local or Not? Tasting Worksheet, page 22 in student workbooks

Supplementary Reading Resources:

● “Apple Farmer Annie,” by Monica Wellington

Activity 1: Local vs. Non-Local

Present the different samples of fruits and vegetables. Make sure to keep the produce separate so you can tell which one came from a different state. Mark the local produce as 1 and the non-local produce as 2. Invite students to prep them for tastings; washing and
safely slicing them to share. Share the tastings with students as a blind taste test. Direct them to use the worksheet, Local or Not? Tasting Worksheet on page 22 in student workbooks, to compare tastes, color, shapes, etc. of the different fruits and vegetables. Prompt them to use their senses to describe the differences and similarities.

NGSS Disciplinary Core Idea LS3.B: Variation of Traits
Different organisms vary in how they look and function because they have different inherited information.

Ask:
- Does one taste sweeter?
- Is there a difference in shape or size?
Students hypothesize how the produce gets from the farm to the table. Record their hypotheses on the whiteboard. Reveal the identities of the produce.

Ask:
- Did you guess which one was the local produce?
- How could you tell?
- What were the main differences that told you that it was local or non-local?
Trace each of the produce from farm to fork. Compare the steps each takes.

NGSS Science/Engineering Practice 3: Planning and Carrying out Investigations
Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

If students want to dive deeper, guide them through a collage project that maps each of the main steps in the food system that the local and the non-local produce takes:

1. Farm
2. Distribution
3. warehouse-storage
4. Market transportation
5. Grocery market-retail
6. Purchases and taken home to eat
Figure 31 Student food system collage map at John Muir Elementary School

**Student Reflection**

What are the differences between the two apples? How did they taste? How far did they travel from the farm to our table?

**English Language Learning (ELL) Focus: Adjectives, Comparatives**

- **Sweet.** Sweeter than ________
- **Crunchy.** Crunchier than ________
- **Juicy.** Juicier than __________

**Additional Information**

**Add some math and agriculture history to the lesson:** There are 2,500 varieties of apples grown in the United States; 7,500 varieties grown throughout the world. 25% of an apple’s volume is air, which is why they float. Americans eat an average of 50.4 pounds of apples and apple products each year. California grows more varieties of apples than any other western US state, including: Fuji, Gala, and Gravenstein.

**Sources**

CA Farm-to-School, California

Choice, Control, & Change. LIFE, Linking Food and the Environment: An Inquiry-Based Science and Nutrition Program, Teachers College at Columbia University
Local or Not? Tasting Worksheet

**Instructions:** Taste the fresh fruits and/or vegetables. They come from two different places in the world. Record what you taste, smell, feel, etc. Can you tell the difference between the produce? Is there a difference?

<table>
<thead>
<tr>
<th></th>
<th>Produce 1</th>
<th>Produce 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What does it taste like?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What does it smell like?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Are there any bruises or other markings?</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What shape is it?</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What else do you notice?</strong></td>
<td></td>
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</tbody>
</table>
Mapping the Garden

Objectives/Assessment Targets

Students will:

- Use measurement, cardinal directions, directional keys, and scales to create a map of the garden.
- Document the plants and animals according to their location on the map.

Activity Preparation

This lesson builds upon past food systems lessons, focusing on the value of mapping resources and getting familiar with mapping tools. This lesson can be a two-part lesson if students make their own maps of the garden in Activity 1. Alternatively, you can map out the garden, print a copy for each student, and have them complete Activity 2. Print out a copy of the Environmental Factors worksheet or write it on the whiteboard for students to copy in their worksheets.

Figure 32 Whiteboards designed by Sarah Winer, Garden Instructor
Materials

- Clipboards and pencils/markers
- Worksheet, Mapping the Garden on page 23 in student workbooks
- Rulers

Activity 1: Mapping Our Garden

Invite students to put on their scientist hats and think about how scientist might better understand a resource like a garden. Scientist use mapping to identify environmental resources and help them plan for future gardening. Guide students in preparing their own garden maps or prepare them for them to fill in details of garden resources.

Prepare a rough draft map of the garden, including perimeters, garden beds or boxes, fences, shed, etc. Direct students on how to:

1. Locate the cardinal directions, north, south, west, and east.
2. Label their maps.
3. Note foliage.

Activity 2: Understanding Our Garden

Prompt students to observe and share what they notice about the many habitats found in the garden; noting location, temperature, air movement, animals, plants, sounds, and light. Students use their worksheet, Mapping the Garden, on page 23 in their workbooks attached to a clipboard with pencils. Direct students to observe and document every aspect of the garden on these maps, noting key environmental factors and qualities.

Figure 33 Garden map designed by Sarah Winer, Garden Instructor
Environmental Factors | Qualities
--- | ---
Sunlight | Sunny/shady
Moisture | Wet/dry
Cover | Foliaged/open space/clear
Air movement | Windy/calm
Sounds | Noisy/quiet

Ask, Why are some areas warmer and others colder, and how does this affect living things?

**NGSS Disciplinary Core Idea LS4.D: Biodiversity and Humans**
Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

**NGSS Disciplinary Core Idea LS4.C: Adaptation**
For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

**Student Reflection**
How will the time of day affect your focus area? Why would some animals and plants survive well in one location of the garden and not another?

**NGSS Science/Engineering Practice 1: Asking Questions and Defining Problems**
Ask a question about what would happen if a variable is changed.
English Language Learning (ELL) Focus: Adjectives

- Sunny/shady
- Wet/moist/dry
- Foliaged/clear
- Windy/calm
- Noisy/quiet

Additional Information

Students can continue mapping the garden on later visits by using cameras or drawing pictures to fill in their maps with more detail. They can also practice making detailed descriptions, using rulers to take measurements, or documenting the changes in the garden over time.

Sources

Schoolyard Ecology, Lawrence Hall of Science, Great Explorations in Math and Science, University of California at Berkeley

Figure 34 Students filling out garden maps at Oxford Elementary School Garden
# Mapping the Garden

**Instructions:** The garden is made up of many different habitats. Observe the different habitats you find in the garden. Fill in the information you notice, describe the location, the environment, and other qualities.

<table>
<thead>
<tr>
<th>Location</th>
<th>Environmental factors</th>
<th>Qualities</th>
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Worm Bins

Objectives/Assessment Targets

Students will:

- Identify worms as important agents for decomposition.
- Build a worm compost bin.

Activity Preparation

This lesson builds on past compost and decomposition lessons, focusing on the decomposers. The content could be scaled up for 4th and 5th grade lessons. The activities invite students to get hands-on experience handling worms, taking care of them, and tracking decomposition over time.

Pre-shred newspaper or have students shred the paper during the activity. Set up small activity stations so multiple student groups can be building worm bins with an adult supervising. The worm bins could be cared for in the classroom and managed by the students, pending teacher interest.

Materials

- Newspaper
- Scissors
- Rulers
- 3-5 buckets for groups to make worm bins
- Worms in compost
- Buckets of water
- Recycled containers to hold worms
- Worksheet, Worm Anatomy, page 24 in student workbooks

Activity 1: Worms are the “I” in FBI

Review the role of fungus, bacteria, and invertebrates (FBI) in decomposition; focusing on worms (invertebrates). Describe how decomposers break things down and turn organic
matter, like decaying plants and animals, into vitamin-rich compost.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**
Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants’ parts and animals) and therefore operate as ‘decomposers’.

**Ask,** What are the different ways decomposers break food down?

**Fun facts about decomposers:**
- Not only do sow bugs (scientifically called woodlice) eat decaying leaves, they also carry bacteria and fungi around the pile on their rounded backs.
- Snails and slugs chew rotting material into pieces that other decomposers like to eat.
- Millipedes and beetles feed directly on decaying plants and animals.

**NGSS Disciplinary Core Idea LS2.A: Interdependent Relationships in Ecosystems**
Decomposition eventually restores (recycles) some materials back to the soil.

Show students worms in the compost. Model handling worms with care. Students practice handling worms with care and confidence.

**Ask,** What do worms use for beds?

Review the worm anatomy diagram, directing students to name each part of the worm. Instruct students to review each anatomy part in the worksheet, Worm Anatomy on page 24 in student workbooks.

**Fun facts about worms:**

![Figure 35 Worm anatomy diagram by Colette Rowe, Garden Instructor](image-url)
● A worm can consume about half of its weight each day.
● A worm weighing 1 gram might eat ½ gram of food in a day.

Activity 2: Making a Worm Compost Bin

Instruct students to make worm bins that they can observe and care for. Review how to build a worm bins using the steps below. Divide students into small group. Ask an adult to supervise each group. Students could build one worm bin per class. Students follow these steps for making a worm bin:

1. **Shred** old newspaper. Model for students how large the pieces should be. They can use a ruler or scissors to help.
2. **Add** shredded pieces of paper to a small bucket of water, and carefully squeeze out the excess water. Have students open up the pieces of paper and spread them out on the bottom of the worm bin.
3. **Observe** the worms in small containers. Students can gently hold a worm. Model how to handle worms respectfully.
4. **Add** worms to the bins.
5. **Add** fruit (no citrus) and vegetable scraps to the worm bin.

**NGSS Disciplinary Core Idea LS4.C: Adaptation**
For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
Student Reflection

Prompt students to check in on the worms to notice and observe changes. Student volunteers bring scraps from home to feed the worms approximately once a week. When feeding the worms, put the food in one area of the bin so it is easier to find the worms. They usually can be found closest to the food source. How will we care for our worms going forward?

English Language Learning (ELL) Focus: Vocabulary and Verbs

- Sow bugs **eat** decaying leaves.
- Sow bugs **carry** bacteria and fungi around the pile on their rounded backs.
- Snails and slugs **chew** rotting material into pieces.
- Millipedes and beetles **feed** on decaying plants and animals.

Additional Information

Worms use brown materials, such as trees, that will decompose. All fruits, vegetables, small pieces of eggshells, teabags without staples, and coffee grounds are great food for decomposers. Do not add dairy, meat, citrus fruits, or lots of oily food, which will cause the pile to smell bad and can attract unwelcome animals. When adding your browns, avoid weeds. Their seeds usually don’t decompose and can cause a weed problem in your compost and garden beds.

Sources

University Extension: Garden and Yard, University of Maine

Worm Anatomy

Instructions: You handled worms carefully and observed their anatomy today. Write the name of each anatomy part in the right box.
Adaptations

Objectives/Assessment Targets

Students will:

- Investigate how plants and/or animals adapt to conditions in their environment.
- Identify different adaptations of plants and/or animals.
- Document and describe the types of plants and animals found in the garden.

Activity Preparation

This lesson introduces the concept that plants and animals adapt to their environment over time. The activities investigate how some animals and plants have adapted and why.

Make labels with the names and qualities for each plant that students will study for adaptation traits in the garden by affixing notecards to a stick or Popsicle stick. Place these next to each plant or location in the garden.

Materials

- Worksheet, Adaptations, page 26-27 in student workbooks
- Labels for plants growing in the garden

Activity 1: Adaptation in Plants and Animals

Review that adaptation is the process living things go through in order to be better suited to their environment.

Ask:

- How have you adapted to your environment?
- How long did it take you to adapt?

Certain plants have adapted to conditions in their environment, such as becoming more drought tolerant to survive the drought in California. Certain animals have adapted to conditions in their environment over time, like growing thicker fur in regions with very
cold climates and shorter fur in hot desert climates.

Ask:

- How have other animals and/or plants adapted over time and where do they live?

**NGSS Disciplinary Core Idea LS4.B: Natural Selection**

Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

**NGSS Disciplinary Core Idea LS4.C: Adaptation**

For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

**NGSS Disciplinary Core Idea LS2.C: Ecosystem Dynamics, Functioning, and Resilience**

When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

Ask:

- How have plants adapted to become better suited for their environment?
- How long does it take for a plant or animal to adapt to an environment?

Students use the worksheet, Adaptations, on page 26-27 in their workbooks to find out more information about how the plants and animals have adapted to their school garden over time. Students find the marked locations throughout the garden and answer the questions in the worksheet.

Students share and answer questions about why they think plants/animals have adapted to their environment through color, roots, leaf shape, and texture using these questions and answers as prompts:
Q: How does a plant stay cool in the bright sun?
A: With light colors, especially white flowers.

Q: How does a plant absorb as much water as possible?
A: With long roots that go deep into the ground.

Q: How does a plant retain as much water as possible (avoid evaporation)?
A: With needles, which are leaves that have very little surface area.

Q: How does a plant store as much water as possible?
A: Waxy, fat leaves hold the water.

**NGSS Disciplinary Core Idea LS1.A: Structure & Function**
Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

**Activity 2: Getting to Know Your Garden’s Drought-Tolerant Plants**
Discuss drought and plant adaptations in more detail. Plants that have adapted to very dry conditions are called drought-tolerant plants because they can survive months without little or no water. Drought-tolerant plants have certain features that help them absorb and retain as much water as possible. That way, even if it doesn’t rain for a long time, the plant can rely on its water storage. Drought-tolerant plants are perfect for...
the current conditions in California: very dry weather and very little rain.

Students pair up to explore the garden for drought-tolerant plants. Explain that they will find the plant labels in the garden and then identify each plant and its adaptive traits. Students describe each plant’s features and how those features help them stay cool, absorb water, retain water (prevent evaporation), and store water. Prompt students to think about:

- **Color**: If you were a drought-tolerant plant, what color clothes would you want to wear to stay cool and not evaporate as much water? (White)
- **Water Absorption**: How could you pull up the most water from the soil? (Long roots)
- **Water Retention**: What size and shape of leaves would you want to retain water? (Needles with less surface area mean less evaporation from leaves)
- **Water Storage**: How could you store water in your leaves? (Waxy and bulbous leaves, like those of succulents)

Plants acquire their material for growth chiefly from air and water.

**Student Reflection**
Brainstorm different adaptations that animals, plants, and humans have made over time. How can we practice water conservation like plants?

**English Language Learning (ELL) Focus: Verbs to Nouns**
- Absorb, absorption
- Retain, retention
- Store, storage

**Sources**
Kids in Gardens
Adaptations Worksheet

Designed by Colette Rowe, Garden Instructor

**Definition of Adaptation:**

1. How could a plant stay cool in the hot sun?

2. How could a plant absorb as much water as possible?

3. How could a plant avoid losing water through evaporation?

4. How could a plant stay safe from predators?

Search the garden for a few plants with features that could be adaptations:
Find and Draw a plant that is well-suited to grow in the desert, where saving water and staying cool is important for survival.

Find and Draw a flower shaped like a funnel – adapted to be pollinated by the beak of a hummingbird.

Find and Draw a plant that has natural defenses against predators. How is it effective?
Pollinators

Objectives/Assessment Targets

Students will:

- Review flower dissection to understand the structure and function of flower parts.
- Explain interdependent relationships.
- Roleplay different pollinators pollinating flowers.

Activity Preparation

This lesson builds on past pollinator lessons and follows up on the adaptations lesson. The activities are opportunities to check in with students about what they learned and to create a new pollinator based on what they learned about adaptations.

Materials

- Worksheet, Creature Feature, on page 28, folded into thirds, like an accordion.
- Coloring materials
- Flower samples for observation

Activity 1: Name that Pollinator

Review the role of pollinators and the flowers they are attracted to.

Ask:

- What does pollination mean: (The fertilization process of a plant that leads to production of fruit and seed)
- How do you think most plants are pollinated? (Most are pollinated by a variety of animal and visitors, some are pollinated by wind and water)
- Name all the pollinators you can think of!
NGSS Disciplinary Core Idea LS1.B: Growth and Development of Organisms
Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

Review the different pollinators on the whiteboard. Direct them to name pollinators and their favorite flower. Bonus points for describing how they pollinate. For example, when a honeybee flies to a flower looking for nectar, pollen from the blossom sticks to the fuzzy hairs on its body. When it visits the next flower, the pollen rubs off, pollinating the flower. If it were not for honeybees performing pollination, many fruit trees would not produce fruit.

NGSS Crosscutting Concept: Cause and Effect
Cause and effect relationships are routinely identified, tested, and used to explain change.

Show student a flower that a honey bee would like to pollinate. Review the anatomy of a flower and how it’s attractive to the bees.

Ask:
- How do flowers attract animal pollinators?
- What do the animals get out of the deal? (Nectar, pollen, honey)
- What do plants get? (Pollen from the other flowers)

Activity 2: Creature Feature

Review the lesson on adaptations, focusing on how pollinators also adapt to their environment so they can get the most pollen from the flowers near their homes.

Ask:
- What were the adaptations you observed in the garden?
- What did you learn about adaptations?
- How did those adaptations help plants and animals survive?

Divide students into groups of three. Explain that they are going to be creating a new kind of pollinator with adaptations that help it live in an imaginary environment. Invite them to imagine what their invented pollinator eats, how it protects itself, how it gets from one place to the other, how it gets pollen from one flower to the other, what kind of flower it prefers, etc.
NGSS Disciplinary Core Idea LS3.A: Inheritance of Traits

Other characteristics of organisms result from individuals’ interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.

Students use the blank worksheet, Pollinators, in their student workbooks to make their creature. Instruct them to fold the sheet into thirds from the bottom up. The worksheet has the lines dividing the 3rds for them to fold. Tell them that they will work together. Each student will start the drawing with a creature head then pass it to the next student to draw the body, and then again to draw the bottom third of the creature. When the bottom part of the creature has been drawn, that student then passes it back to the original student who drew the head. Instruct students on how to make their creature:

1. Draw the head(s) of the creature on the top ⅓ of the square. Make marks showing the neck to the 2nd fold. Fold the head drawing under and pass it to the next student. Include all the features a head might have.
2. Draw a body on the 2nd fold. Extend the body so the lines are seen on the 3rd fold. Pass it on to the next student. Include any features such as scales, fur, features, stingers, etc.
3. Draw the bottom half of the creature. Pass the completed drawing back to the first person who began it. Include any features such as legs, tail, fins, etc.

Ask:
- What environment is the creature best suited for?
- How will it survive?
- How has it adapted to this environment?
Student Reflection

How are flowers and honeybees interdependent?

Remind students that:

1. Plants and animals are interdependent.
2. All living things have basic needs and depend on other living things to meet those needs.
3. Most flowering plants depend on animals for effective pollination and sexual reproduction.
4. Animals are vital to the reproductive process of many plants, and many animals rely on plants for food and shelter.

English Language Learning (ELL) Focus: Nouns of Biology

- Dependence is when ________.
- Interdependence is when ________.
- Independence is when ________.

Additional Information


Sources

“Garden Pollinator: Third Grade Science Exploration,” Life Lab

Kids Gardening: Helping Young Minds Grow
Find the Sugar

Objectives/Assessment Targets

Students will:

- Read nutrition facts labels on food packages (particularly different wheat and corn cereals).
- Review digestion of sugars produces short term energy and how fiber supports long-term energy.
- Experiment with whole grains and processed grains and the different health benefits.

Activity Preparation

This nutrition lesson builds on past lessons students learned about reading nutrition facts on packaged foods. It focuses on sugar and how it affects our minds and bodies. The activities invite students to experiment with the difference between natural and added sugars. This lesson may be best paired with a quick whole grain healthy snack recipe in the Monthly Recipes.

There are many different types of sugar found in processed foods, especially packaged cereals. This lesson focuses on carbohydrates/sugars and fiber. The nutrition facts label lists calories and nutrients (fats, carbohydrates, protein, vitamins, and minerals). On the nutrition facts label, carbohydrates include the total amount of natural and added sugars, while sugars are the amount of added sugar. They can be used to compare between foods.

Materials

- Samples of packages from whole grains (brown rice, quinoa, wheat berries) and processed grains (white bread, white rice, corn)
- Felt whole grain example (The Health and Wellness Team has these) or Grain Diagram below and in student workbooks
- Cereal boxes for label reading or printouts of the cereal label (1-2 for each group) in student workbooks.
**Activity 1: Whole Grain vs. Processed Grain**

Prompt kids to share what they like to eat for breakfast.

**Ask,** What do you eat for breakfast when you’re at school?

Distribute empty packages of processed breads and cereals. Include samples of packaged foods that contain whole grains. Demonstrate how to read a nutrition label using the package samples (one of the whole grains and one of the processed grains) to determine the sugar content of a single serving. Identify the different ingredients that have sugar in the cereal: high fructose corn syrup, dextrose, sucrose, honey, beet sugars and molasses. These are all processed sugars.

**Ask,** How can nutrition facts labels help us choose healthy foods?

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**CA Health Standard 1.6.N**

Differentiate between more nutritious and less nutritious beverages and snacks.

**CA Health Standard 7.3.N**

Identify ways to establish and maintain healthy eating practices consistent with current research-based guidelines for a nutritionally balanced diet.

---

Students share out one kind of sugar they found in their label. Remind them that they get cereals in the morning for breakfast at school often.

**Ask:**

- Was there a cereal labeled healthy that had a lot of sugar in the nutrition facts?
- Is cereal a sometimes food?
- What other foods or drinks are labeled healthy, but have a lot of sugar in them (we often drink them and it’s not soda-energy drinks, fruit drinks, juice)?

Tell them that you need their help investigating cereals to find the one with the most grams of sugar. We’ll rank all of the cereals and see which has the most.
NGSS Science/Engineering Practice 4: Analyzing and Interpreting Data
Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.

Show a serving size amount of cereal in a measuring cup. Demonstrate what 19 grams of sugar looks like by spooning the amount of sugar into a plastic bag or cup and counting it out with the full group.

Whole wheat contains all three layers of the grain: bran, endosperm and germ. Show them the whole grain model below to review the different layers of a whole grain until there is nothing left but the processed germ. A stripped whole grain leaves only the carbohydrate “white” grain.

Student Reflection
What kind of cereals do you eat at school? On the cereal labels in front of you, Which one has low-sugar (5 grams or less for sugar), moderate sugar (6-10 grams of sugar), or high sugar (10 grams or more of sugar) cereals? Which words on the label actually mean sugar?

NGSS Science/Engineering Practice 7: Engaging in Argument from Evidence
Use data to evaluate claims about cause and effect.

English Language Learning (ELL) Focus: “More” (Countable) vs. “Less” (Uncountable)
- I will eat less processed grains.
- I will eat more whole grains.
Additional Information

An ingredient is something that goes into a mixture or, in this case, something that goes into a food. The list of ingredients on a food product names all of the things put into a mixture to make the final food. The first ingredient on the label is the ingredient of which there is the most by weight in the product. Fiber is a plant material that adds structure and form to the plant. In your intestines, fiber absorbs water, adds bulk, and speeds up digestion.

Sources

LEARN NC, Sugar Seekers Third-grade lesson plan, from the Food for Thought, 4.3

Figure 39 Students taste greens and grains recipes at Rosa Parks Elementary School Garden made by Chris Nakao, Garden Instructor
Garden Superheroes

Objectives/Assessment Targets

Students will:

● Name nutrients found in select fruits and vegetables.
● Create a nutrient dense snack based on the nutrient composition of each plant.
● Identify that eating a variety of foods make up a healthy meal.

Activity Preparation

This nutrition lesson reviews the importance of eating seasonally, focusing on specific nutrients found in power fruits and veggies. The activities can be taught inside or outside. They are matched with a recipe for healthy dips found in the Monthly Recipes book.

Prepare sliced veggies for students to make veggie designs or hero masks that represent the nutrition content of each fruit or veggie.

Materials

● Cutting boards and knives
● Variety of fruits and veggies
● Fruit and Veggie Cards
● Healthy dips recipe and ingredients list found in Monthly Recipes book
● Blank worksheet on page 30 in student workbooks

Activity 1: Veggie and Fruit Superheroes

Challenge students to try at least one fruit and one vegetable from the sliced veggies and fruit platters. Hold up each sliced veggie or fruit and ask students what they know about each. Hold up the whole fruit...
or veggie so they can see what it looks like before slicing.

**CA Health Standard 1.3.P**
Identify positive health practices that reduce illness and disease.

**CA Health Standard 5.1.G**
Examine why a variety of behaviors promote healthy growth and development.

**Ask:**
- What part of our body does this fruit/veggie help the most? Why/how?
- What vitamin or mineral is it high in?
- What part of the plant does it come from?

Place cut veggies and fruits on each table for students to use to make superhero designs or masks. Instruct students to use as many different types of veggies as they can to create their own heroes. Prompt them to give their hero a name and use the veggies or fruits strategically so that they represent a body part that they help the most.

**NGSS Crosscutting Concept: Energy and Matter**
Energy can be transferred in various ways and between objects.

Pass out mixed salad dressings or dips (hummus or yogurt based dips are a healthy option). Allow students to eat and enjoy their super heroes.
Student Reflection

Why did you choose the veggies/fruits that you did? Why is your design, mask, etc. a superhero?

English Language Learning (ELL) Focus: Superlatives and Present Tense

- The **healthiest** part of the plant is __________.
- My **favorite** veggie is __________.

Sources

Exploring Food Together, Share Our Strength’s Cooking Matters, July 2013
Knowing Your Nutrition

Objectives/Assessment Targets

Students will:

- Calculate the amount of sugar in foods, according to nutrition labels.
- Pledge to become more “sugar savvy.”
- Compare grams and teaspoons.
- Interpret an infographic for information about added sugar in common drinks.

Activity Preparation

This lesson is a version of the Count It Up nutrition lesson. The activities invite students to get more familiar with how much sugar (mainly added) are in sweetened beverages. It can be scaled up or down for all grades and is best paired with an agua fresca recipe activity, which teaches students how to prepare a healthy drink alternative to sodas or other sweetened drinks they like to drink. These are found in the Monthly Recipes book.

Collect food labels from a variety of processed foods. Write the different foods and their nutritional benefits on the whiteboard, per below.

Materials

- Rethink Your Drink worksheets on page 31 in student workbooks.
- Nutrition labels from multiple types of processed foods and drinks (found in student workbooks under Find the Sugar lesson)
- Teaspoons and a glass of water
- Bag of sugar
- Sample soda can(s)

Activity 1: Nutrition Information

Prompt students to think about foods that they ate the previous day. Students group their foods listed (meat, grains, fruits, vegetables, and milk). Students share the foods they listed. Find common foods and write them on the whiteboard.
Ask:

- What are the five main food groups? (meat, grains, fruits, vegetables, and milk)
- Why do we need to eat food from each group?

Review the main nutrients that we need to grow and suggest some sources of plant-based foods that provide those. Below are suggestions:

- Kale: Iron
- Banana: Potassium
- Spinach: Vitamin C
- Sweet potato: Beta Carotene
- Wheat: Protein
- Broccoli: Vitamin K
- Soybeans: Calcium
- Avocado: Vitamin B
- Artichoke: Magnesium
- Cantaloupe: Vitamin A
- Mushroom: Vitamin D
- Blueberries: Vitamin E
- Plum: Vitamin K

Students form small groups to discuss the different foods we eat from the garden and their health benefits.

- List the items they ate the other day.
- Identify and describe the main nutrients discussed that are found in the foods they ate.

Activity 2: Calculating the Sugar in Soda

Review the six main categories of nutrients found in food: protein, fat, carbohydrates (sugar and starch), vitamins, and minerals. Display the Rethink Your Drink poster, or worksheet on page 31 in student workbooks, to review and practice counting the teaspoons of sugar in sweetened beverages.
**Ask**, According to the poster, how much sugar is in a soda? (17 teaspoons)

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<th><strong>Common Core State Standard R1.3.1</strong></th>
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<td>Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.</td>
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Demonstrate the relationship between the amounts of sugar in a soda compared with a glass of water. Measure out 17 teaspoons of sugar, adding each to the glass of water. Prompt students to count along.

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<th><strong>Common Core State Standard M.P.4</strong></th>
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<td>Reason abstractly and quantitatively.</td>
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Distribute a handful of nutrition labels to student groups. Explain that the sugar content is displayed on the nutrition facts label in the form of grams (4.2 grams equals a teaspoon). The nutrition facts round it to four grams. Using this equation, you can look at the grams per serving for any food product containing sugars and convert this quantity into a familiar measurement of teaspoons by dividing by four.

<table>
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<tr>
<th><strong>NGSS Crosscutting Concept: Scale, Proportion, and Quantity</strong></th>
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<td>Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.</td>
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Students work in groups to calculate the number of teaspoons of sugar in each food serving according to the information on the nutrition labels.

<table>
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<tr>
<th><strong>CA Health Standard 5.1.P</strong></th>
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<tr>
<td>Use a decision-making process to determine personal choices that promote personal, environmental, and community health.</td>
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Student Reflection

Prompt students to make a pledge to either drink fewer sugary drinks or drink no sugary drinks at all. Once they choose, prompt them to complete one of the following pledges:

This summer, I _________________ will drink fewer sugary drinks and eat fewer foods with added sugars, like ___________ and ___________. I will choose more foods with natural sugars, like ___________ and ___________.

This summer, I _________________ will go “soda free” and not drink any sugary drinks. I will choose water. I will also choose fewer foods with added sugars, like ___________ and ___________, and choose more foods and drinks with natural sugars, like ___________ and ___________.

Students share their pledge with a partner and discuss how they can share with their families what they have learned about the amount of added sugar in food. Encourage them to talk to the people at home about going “soda free.”

English Language Learning (ELL) Focus: “Fewer” (Countable) vs. “Less” (Uncountable)

- I will eat less sugar.
- I will drink fewer sugary drinks.

Sources

Healthy Living for Life, Alameda County Public Health Department—Nutrition Services

Be Sugar Savvy!, Rethink Your Drink, Champions for Change, Network for a Healthy California
Figure 42 Rethink Your Drink poster by Champions for Change, Network for a Healthy California
Vocabulary

**Abiotic:** Nonliving, inanimate, characterized by the absence of life; of inorganic matter.

**Adaptation:** A change in an organism or its parts that make it more fit for the conditions of its environment.

**Agriculture:** The active production of useful plants or animals in ecosystems that have been created by people.

**Agroecology:** An ecological approach to agriculture that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices.

**Agroecosystem:** An ecosystem created when people actively plant flora in order to increase the diversity of available plant resources.

**Anatomy:** The parts that form a living thing (such as an animal or plant).

**Angiosperm:** A vascular seed plant in which the ovule (egg) is fertilized and develops into a seed in an enclosed hollow ovary.

**Annual:** Happening once a year; having a life cycle that is one year or one season long.

**Anther:** The part of a flower that contains pollen.

**Bacteria** (singular bacterium): Any of a group of microscopic single-celled organisms that live in enormous numbers in almost every environment on Earth, from deep-sea vents to deep below Earth’s surface to the digestive tracts of humans.

**Bean:** A seed or pod of certain leguminous plants of the family Fabaceae. Rich in protein and providing moderate amounts of iron, thiamin, and riboflavin, beans are used worldwide for cooking in either fresh or dried form.

**Biodiversity:** The diversity (number and variety of species) of plant and animal life within a region.

**Biology:** The study of living things and their vital processes. The field deals with all the physicochemical aspects of life.

**Biotic:** Of, pertaining to, or produced by life or living organisms.

**Carbon:** The chemical element that forms diamonds and coal and that is found in
petroleum and in all living plants and animals.

**Carbon Dioxide**: A gas that is produced when people and animals breathe out or when certain fuels are burned and that is used by plants for energy.

**Carpel**: One of the individual female reproductive organs in a flower. A carpel is composed of an ovary, a style, and a stigma, although some flowers have carpels without a distinct style.

**Cell**: The basic unit of a living organism.

**Chlorophyll**: The green coloring matter of plants that is found in chloroplasts and is necessary for photosynthesis.

**Chloroplast**: A cellular part that contains chlorophyll and is the location of photosynthesis.

**Climate**: The average course or condition of the weather at a place, usually over a period of years, as exhibited by temperature, wind velocity, and precipitation.

**Climate Change**: Changes in the Earth’s climate, especially those said to be produced by global warming.

**Climatology**: The science that deals with climates and investigates their phenomena and causes.

**Community**: A group of interdependent organisms inhabiting the same region and interacting with each other.

**Compost**: The decayed remains of organic matter that has rotted into a natural fertilizer.

**Conservation**: The discipline concerned with the protection of biodiversity, the environment, and natural resources.

**Consumer**: An organism that uses other organisms for food in order to gain energy.

**Cortex**: Tissue of unspecialized cells lying between the epidermis (surface cells) and the vascular, or conducting, tissues of stems and roots.

**Cotyledon**: The first leaf or one of the first pair of leaves developed by the embryo of a seed plant.

**Cultivate**: To prepare or use for the raising of crops; also: to loosen or break up the soil about (growing plants); to foster growth.
**Cycle:** A set of events or actions that happens again and again in the same order.

**Decompose:** To separate or break down something into its components; to disintegrate or fragment.

**Design:** To plan and make decisions about (something that is being built or created): to create the plans, drawings, etc., that show how (something) will be made.

**Dicot:** A plant whose seedlings have two cotyledons.

**Dicotyledon** (byname dicot): Any member of the flowering plants, or angiosperms that has a pair of leaves, or cotyledons, in the embryo of the seed. There are about 175,000 known species of dicots. Most common garden plants, shrubs, trees, and broad-leaved flowering plants, such as magnolias, roses, geraniums, and hollyhocks, are dicots.

**Dicotyledonous:** Having two cotyledons.

**Disperse:** To scatter in different directions.

**Disseminating:** Spreading widely.

**Diversity:** The quality or state of having many different forms, types, ideas, etc.

**Dormant:** Not active but able to become active.

**Drought:** A long period of time during which there is very little or no rain.

**Earth:** The planet on which we live; land as opposed to the sea, the air, etc.; the material in which plants grow.

**Ecology:** The science that deals with the relationships between groups of living things and their environments.

**Ecosystem:** Everything that exists in a particular environment.

**Embryo:** A rudimentary plant contained in the seed.

**Endosperm:** Tissue surrounding the embryo of flowering plant seeds which provides nutrition to the developing embryo.

**Energy:** The physical or mental strength that allows you to do things; natural enthusiasm and effort; usable power that comes from heat, electricity, metabolism, etc.

**Environment:** The conditions that surround someone or something; the conditions and
influences that affect the growth, health, progress, etc., of someone or something.

**Epidermis**: The outer, protective layer of a plant.

**Equinox**: A 24-hour period when day and night are the same length.

**Erosion**: The gradual destruction of something by natural forces (such as water, wind, or ice).

**Farmer**: A person who cultivates land or crops or raises animals (as livestock or fish).

**Fauna**: All the animals that live in a particular areas, time period, or environment.

**Fertile**: Producing many plants or crops.

**Fertilize**: To make (soil, land, etc.) richer and better able to support plant growth by adding chemicals or a natural substance (such as manure).

**Filament**: The stalk of a stamen in a flower, supporting the anther.

**Flora**: All the plants that live in a particular area, time period, or environment.

**Flower**: The reproductive portion of any plant in the division Magnoliophyta (Angiospermae), commonly called “flowering plants” or “angiosperms.” As popularly used, the term “flower” especially applies when part or all of the reproductive structure is distinctive in color and form.

**Food Chain**: A series of types of living things in which each one uses the next-lower member of the series as a source of food.

**Food System**: A network that integrates food production, processing, distribution, consumption, and waste management, affecting the environmental, economic, and social health of a particular place.

**Food Web**: The totality of interacting food chains in an ecological community.

**Fungus**: Any one of a group of related plants (such as molds, mushrooms, or yeasts) that have no flowers and that live on dead or decaying things.

**Gamete**: A mature sexual reproductive cell, as a sperm or egg, that unites with another cell to form a new organism.

**Genetic Diversity**: Refers to both the vast numbers of different species as well as the diversity within a species. The greater the genetic diversity within a species, the greater
that species’ chances of long-term survival. This is because negative traits (such as inherited diseases) become widespread within a population when that population is left to reproduce only with its own members.

**Germinate**: To develop into a plant or individual, as a seed, spore, or bulb.

**Heredity**: The sum of all biological processes by which particular characteristics are transmitted from parents to their offspring.

**Humus**: The dark organic material in soils that is produced by the decomposition of vegetable or animal matter and is essential to the fertility of the earth.

**Hypothesis**: A proposition, or set of propositions, set forth as an explanation for the occurrence of some specified group of phenomena, either asserted merely as a provisional conjecture to guide investigation (working hypothesis) or accepted as highly probable in the light of established facts.

**Inorganic**: Not having the structure or organization characteristic of living bodies.

**Interdependence**: The quality or condition of being mutually reliant on each other.

**Invertebrate**: Not vertebrate; without a backbone. More than 90% of all living animal species are invertebrates.

**Investigate**: To try to find out the facts about and learn more about an object, person, place, thing, situation, etc.

**Leaf**: One of the expanded, usually green organs borne by the stem of a plant.

**Legume**: Also called “pod,” a fruit of plants of the order Fabales (peas and beans). The dry fruit releases its seeds by splitting open along two seams.

**Life**: Living matter and, as such, matter that shows certain attributes, including responsiveness, growth, metabolism, energy transformation, and reproduction.

**Metabolism**: The chemical processes by which a plant or an animal uses food, water, etc., to grow, heal, and make energy.

**Monocot**: Any of a group of flowering plants (as palms and grasses) having an embryo with a single cotyledon and usually leaves with parallel veins and flower parts in groups of three.
**Monoculture:** The use of land for growing only one type of crop.

**Mulch:** A covering (as of straw or sawdust) spread over the ground to protect the roots of plants from heat, cold, or evaporation, prevent soil loss, control weeds, enrich the soil, or keep fruit (as strawberries) clean.

**Natural Resource:** Something (as a mineral, water power source, forest, or kind of animal) that is found in nature and is valuable to humans (as in providing a source of energy, recreation, or scenic beauty).

**Nitrogen:** A colorless, odorless, tasteless gas that is the most plentiful element in Earth’s atmosphere and is a constituent of all living matter.

**Nitrogen-Fixing Bacteria:** Microorganisms capable of transforming atmospheric nitrogen into fixed nitrogen (inorganic compounds usable by plants). More than 90% of all nitrogen fixation is affected by these organisms, which thus play an important role in the nitrogen cycle.

**Nutrient:** A substance that an organism must obtain from its surroundings for growth and the sustenance of life. In most living organisms, nutrients provide not only the energy necessary for certain vital processes but also the various materials from which all structural and functional components can be assembled.

**Nutrition:** The assimilation by living organisms of food materials that enable them to grow, maintain themselves, and reproduce.

**Observation:** The act of careful watching and listening; the activity of paying close attention to someone or something in order to get information.

**Opinion:** A personal view, attitude, or appraisal.

**Organic:** Of, relating to, or obtained from living things; of, relating to, or containing carbon compounds.

**Organism:** A form of life considered as an entity; an animal, plant, or fungus.

**Oxygen:** A reactive element that is found in water, rocks, and free as a colorless, tasteless, odorless gas that forms about 21% of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life.

**Petal:** One of the often brightly colored modified leaves that make up the corolla of a
flower.

**Perennial:** Living for several years, usually with new leafy growth produced from the base each year.

**Pest:** A plant or animal harmful to human beings or human concerns (as agriculture).

**Pesticide:** A substance used to destroy pests.

**Photosynthesis:** The process by which plants that contain chlorophyll make carbohydrates from water and from carbon dioxide in the air in the presence of light.

**Pistil:** The seed-producing part of a flower, consisting usually of stigma, style, and ovary.

**Pollen:** A mass of tiny particles in the anthers of a flower that fertilize the seeds and usually appear as fine yellow dust.

**Pollinator:** The biotic agent (vector) that moves pollen from the male anthers of a flower to the female stigma of a flower to accomplish fertilization of the female gametes in the ovule of the flower by the male gametes from the pollen grain. Examples include birds, bats, bees, butterflies, beetles, and other small mammals. Creatures that pollinate plants are responsible for bringing us one out of every three bites of food.

**Pollination:** Transfer of pollen grains from the stamens, the flower parts that produce them, to the ovule-bearing organs or to the ovules (seed precursors) themselves.

**Pollution:** The action or process of making land, water, air, etc., dirty and not safe or suitable to use; substances that make land, water, air, etc., dirty and not safe or suitable to use.

**Polyculture:** The raising at the same time and place of more than one species of plant or animal.

**Producer:** A living thing (as a green plant) that makes its food from simple inorganic substances (as carbon dioxide and nitrogen) and many of which are food sources for other organisms.

**Propagate:** To cause (an organism) to multiply by any process of natural reproduction from the parent stock.

**Propagation:** The controlled perpetuation of plants, the most basic of horticultural practices. Its two objectives are to achieve an increase in numbers and to preserve the
essential characteristics of the plant. Propagation can be achieved sexually by seed, asexually by utilizing specialized vegetative structures of the plant (tubers and corms), or by employing such techniques as cutting, layering, grafting, and tissue culture.

**Protein:** Any of numerous substances that consist of chains of amino acids, contain the elements carbon, hydrogen, nitrogen, oxygen, and often sulfur, include many compounds (as enzymes and hormones) essential for life, and are supplied by various foods (as meat, milk, eggs, nuts, and beans).

**Reflect:** To cast back (light, heat, sound, etc.) from a surface. Also, to think, ponder, or meditate; to reflect on a topic or one’s opinion.

**Renewable:** Capable of being replaced by natural ecological cycles or sound management procedures.

**Respect:** Esteem for or a sense of the worth or excellence of a person, a personal quality or ability, or something considered as a manifestation of a personal quality or ability.

**Responsible:** Having the job or duty of dealing with or taking care of something or someone; able to be trusted to do what is right or to do the things that are expected or required.

**Root:** The leafless, usually underground part of a plant that absorbs water and minerals, stores food, and holds the plant in place.

**Season:** One of the four periods of the year (spring, summer, autumn, and winter), beginning astronomically at an equinox or solstice but geographically at different dates in different climates.

**Seasonality:** A pattern, variation, or fluctuation that correlates with a season, day of the week, or other period of time.

**Seed:** A fertilized, ripened ovule of a flowering plant that contains an embryo and is capable of producing a new plant.

**Sepal:** One of the specialized leaves that form the calyx of a flower.

**Solstice:** The point in the apparent path of the sun at which the sun is farthest north or south of the equator.

**Stamen:** An organ of a flower that consists of an anther and a filament and produces the
pollen.

**Stele:** The central cylinder or cylinders of vascular and related tissue in the stem, root, petiole, leaf, etc., of the higher plants.

**Stem:** The stalk that supports a leaf, flower, or fruit.

**Sustainable:** Pertaining to a system that maintains its own viability by using techniques that allow for continual reuse.

**Symbiosis:** The living together in close association of two different kinds of organisms (as a fungus and an alga making up a lichen), especially when such an association is of benefit to both.

**System:** A group of related parts that move or work together; a body of a person or animal thought of as an entire group of parts that work together.

**Topsoil:** The fertile, upper part of the soil.

**Trait:** A quality that makes one person or thing different from another.

**Transplant:** To remove (a plant) from one place and plant it in another.

**Vascular System:** An assemblage of conducting tissues and associated supportive fibers.

**Vertebrate:** Having a backbone or spinal column.

**Weather:** State of the atmosphere at a particular place during a short period of time. It involves such atmospheric phenomena as temperature, humidity, precipitation (type and amount), air pressure, wind, and cloud cover.

**Weed:** A plant that is not valued where it is growing and is usually of vigorous growth; especially, one that tends to overgrow or choke out more desirable plants.

**Xylem:** A tissue of higher plants that carries water and dissolved materials upward, functions also in support and storage, lies deeper inside the plant than the phloem, and usually makes up the woody parts (as of a plant stem).

**Sources**

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