

Backpack Garden

Grade Level

3 - 5

Purpose

Through project-based learning, students use school resources to construct and grow a school garden to supplement the school Backpack Program with fresh fruits and vegetables. [Grades 3-5](#)

Estimated Time

26 days

Materials Needed

Milestone 1: Entry Event

- Garden journal, 1 per student
- Katie's Cabbage by Katie Stagliano and/or [Katie Stagliano—The Girl With One Hundred Gardens](#)
- [What is the Backpack Program?](#) video or guest speaker
- [MyPlate Food Groups](#) video
- [MyPlate Image](#)
- *I Will Never Not Ever Eat a Tomato* by Lauren Child
- [What if You Never Ate Fruits and Vegetables?](#) video
- [Fruit and Vegetable Scattergories](#) instruction sheet, 1 per group
- Timers, 1 per group

Milestone 2: Research

- Garden journal
- Fruits and Vegetables Group List (from Day 2)
- Your state's [Agricultural Facts Sheet](#)
- [Cooperative Extension Services](#) website for your state
- [Google Forms](#) or similar survey maker
- [Decision Making Chart](#)

Milestone 3: Garden Planning and Construction

- Garden journal
- [School Garden Center](#)
- [Desktop Greenhouses](#) video

- 16-ounce clear plastic cups with lids,* 2 per group
- 18-ounce black plastic cups,* 2 per group
- Black electrical tape*
- Black card stock* disks, 2 per group
- mL measuring cup or ruler
- 1/8 teaspoon
- Jiffy 7 peat pellets,* 2 per group
- Seeds* (we tested alfalfa and lettuce seeds)
- Labels, 2 per group
- White 5 mm LED lights,* 1 per group
- 3-volt coin cell batteries,* 1 per group
- Craft knife
- [Desktop Greenhouse Observation Sheets](#), 1 packet per student
- *The Magic School Bus Gets Planted: A Book About Photosynthesis* by Lemore Notkin
- [Photosynthesis Interactive Science Notebook Packet](#)
- Glue sticks
- Scissors
- [Interactive Periodic Table](#)
- [Molecular Model Cards](#), 6 carbon dioxide cards, 6 water cards, 6 oxygen cards, and 1 glucose card per group
- [Atom Disks](#), 12 hydrogen atoms, 6 carbon atoms, and 18 oxygen atoms per group
- Flashlights
- [Planning Your Garden](#) video
- Clipboard
- Graph paper
- Tape measure or string and rulers
- [Gallery Walk Recording Sheet](#)
- Materials, tools, and equipment for constructing or improving the school garden

*These items are included in the [Desktop Greenhouses Kit](#), which is available for purchase from agclassroomstore.com.

Milestone 4: Seed Germination and Plant Growth

- Garden journal
- [Bean Seed Diagram](#)
- Lima beans soaked in water overnight, 1 per student
- Hand lenses
- 100 lima beans
- 10 paper towels (the non-quilted paper towels typically found in schools work best)
- 10 pieces of plastic wrap
- 20 rubber bands
- [Needs of a Plant PowerPoint](#)
- [What Do Plants Need to Grow? Grid](#), 1 per student
- [What Do Plants Need to Grow? Cards](#), 1 per student copied front to back
- Clear tape

- [Garden Planner](#) available for purchase from [agclassroomstore.com](#)
- [School Garden Center](#)
- Material for plant markers (paint, markers, stakes, rocks, clothespins, wooden spoons, fabric, pinwheels, etc.)

Milestone 5: Final Presentation

- [Presentation Rubric](#)
- Materials for making information cards, brochures, and garden signs (paper, poster board, markers, stakes, etc.)
- Peer Collaboration Evaluation (Use this template and instructions to create a [Peer Collaboration Evaluation Google Form](#) customized to your class.)

Vocabulary

by-product: an incidental or secondary product made in the manufacture or synthesis of something else

chlorophyll: the green substance in plants that allows them to use the energy from the sun

chloroplast: one of the parts in a plant cell that contain chlorophyll and in which photosynthesis takes place

dormant: not active but able to become active

embryo: a human, animal, or plant in the early stages of development before it is born, hatched, sprouted, etc.

energy: power derived from the utilization of physical or chemical resources

food insecurity: a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life

germinate: to begin to grow; sprout

hunger: an uncomfortable feeling in your stomach that is caused by the need for food; when a person cannot get enough of the right kinds of foods to be healthy

immune system: a complex network of cells, tissues, organs, and the substances they make that helps the body fight infections and other diseases

MyPlate: nutritional guide published by the United States Department of Agriculture (USDA); icon depicting a place setting with a plate and glass divided into five food groups

nutrient: a substance that provides nourishment essential for growth and the maintenance of life

nutrition: the process of nourishing or being nourished

photosynthesis: the process by which plants convert carbon dioxide, water, and light energy into sugars and oxygen in order to store energy; the opposite of cell respiration

respiration: the process through which a plant exchanges oxygen and carbon dioxide with its environment

seedling: a young plant that is grown from a seed

stomata: small openings in the leaves and stems of plants which can open and close to exchange oxygen and water vapor for carbon dioxide

Background Agricultural Connections

Backpack Garden is a Project-Based Learning (PBL) plan. PBL is a teaching method in which students work for an extended period of time to investigate and respond to an authentic, engaging, and complex problem.

Gold Standard PBL

Seven Essential Project Design Elements



seven essential elements.

A quality PBL experience requires

1. **Challenging Problem or Question:** The project is framed by a meaningful problem to be solved or a question to answer, at the appropriate level of challenge.
2. **Sustained Inquiry:** Students engage in a rigorous, extended process of posing questions, finding resources, and applying information.
3. **Authenticity:** The project involves real-world context, tasks and tools, quality standards, or impact, or the project speaks to personal concerns, interests, and issues in the students' lives.
4. **Voice and Choice:** Students make some decisions about the project, including how they work and what they create.
5. **Reflection:** Students and teachers reflect on the learning, the effectiveness of their inquiry and project activities, the quality of student work, and obstacles that arise and strategies for overcoming them.
6. **Critique and Revision:** Students give, receive, and apply feedback to improve their process and products.
7. **Public Product:** Students make their project work public by explaining, displaying, and/or presenting it to audiences beyond the classroom.²

Backpack Programs

The USDA estimates that nearly 18 million children in the United States live in **food-insecure** households. That means that 1 in 4 children may not have consistent access to enough food for an active, healthy lifestyle.³ These students rely on school cafeterias for the majority of their **nutrition** during the week. Backpack programs provide students in need with food to take home for the weekends. The first backpack program was founded by a school nurse in 1995. She noticed that students at her school in Little Rock Arkansas were coming to visit her on Mondays complaining about stomach aches and headaches. To address the issue, she partnered with the local food bank to send food home in the students' backpacks every Friday. Since then, backpack programs have spread across the nation and have had a positive effect on decreasing absenteeism, behavioral issues, and visits to the school nurse with **hunger**-related complaints.⁴

Fruits and Vegetables

MyPlate is a nutrition guide from the United States Department of Agriculture (USDA) that serves as a reminder to eat from all five food groups—fruits, vegetables, grains, proteins, and dairy. Each food group's size is slightly different because our bodies need different amounts from each food group to stay healthy. The fruits and vegetables sections take up half the plate, with the vegetable food group being slightly larger than the fruit group. It is recommended to make half your plate fruits and vegetables daily.

Fruits and vegetables are the only source of vitamin C in the diet. Vitamin C helps keep the body from bruising and builds the tissue that holds muscles and bones together. Vitamin C, also known as ascorbic acid, helps the body absorb the iron found in foods and strengthens the **immune system**. Leafy greens, carrots, sweet potatoes, squash, spinach, apricots, and green peppers are all excellent sources fo

vitamin A. Serving several functions in the body, vitamin A helps maintain good vision, fight infection, support cell growth, and keep skin healthy. Fruits and vegetables are a good source of complex carbohydrates, whose **energy** release is slow, gradual, and long-lasting. Fruits and vegetables contain fiber. Fiber helps move food through the body to prevent constipation and provide a sense of fullness.

Fruits and vegetables are quick, often ready to eat, easy to carry, and tasty foods to have as snacks. They provide the energy needed to function throughout the day. Eating a variety of fruits and vegetables provides health benefits and **nutrients** that help us grow and stay healthy. People who eat more fruits and vegetables as part of a healthy eating style are likely to have a reduced risk of some chronic diseases. Fruits and vegetables are naturally low in fat and calories. No fruits or vegetables contain cholesterol.

School Gardens

School gardens provide an opportunity to build understanding about the natural world through active investigation and inquiry. Gardens inspire students to use their senses, exercise their imagination, build communication skills, think critically, problem solve, and explore their questions, while providing a meaningful context for multidisciplinary exploration. Visit our [School Garden Center](#) for more information on school gardens. For information about fruits and vegetables that can be grown in your state, visit the [Land-Grant University Website Directory](#) to locate the Cooperative Extension Services website for your state.

The life cycle of a flowering plant begins with a seed. A seed contains an **embryo**—what will become a new plant—and food for the embryo. Seeds are **dormant**, or inactive, until they receive the correct amount of moisture and the proper temperature. With appropriate warmth and moisture, seeds will **germinate**, producing a tiny, immature plant called a **seedling**. The seedling will grow into a mature plant which, when fertilized, will produce seeds.

Plants need water, light, nutrients, and air to grow. Water requirements vary by plant species, but all plants need some amount of water. Most water enters the plant through the roots. Water is necessary for **photosynthesis**, the process through which light energy is converted into food for the plant. Too much or too little water can be harmful to a plant. It is important to know the water requirements of a particular plant to ensure you provide the proper amount for healthy growth.

Light requirements also vary by plant species. All green plants need light to perform photosynthesis, although the intensity, quality, and duration needs will differ. Understanding the light preferences of a plant is important when choosing an appropriate planting location.

Plants obtain nutrients from the atmosphere, soil, or fertilizers. Nutrients are important to the process of photosynthesis and for the metabolic functions of the plant. When soils are deficient, the missing nutrients should be added prior to planting.

The oxygen and carbon dioxide present in the air are important for photosynthesis and plant **respiration**—the process through which the plant exchanges oxygen and carbon dioxide with its environment. Plants appear to be constantly exposed to air, but it is important to understand that plant roots also need air. If too much water is present in the soil for an extended period of time, the roots cannot get enough air. Being aware of the type of soil and how quickly water moves through the soil is important for ensuring that the roots are getting the appropriate amount of air.

Photosynthesis is the process by which green plants and certain other organisms transform light energy into chemical energy. Plants use the energy of light to convert carbon dioxide and water into sugar (glucose) and oxygen. Carbon dioxide is absorbed by the leaves through the **stomata**—tiny holes in the leaves. Water enters the plant at its roots and travels through the stem to reach the leaves. The leaves are the primary site where the photosynthesis process takes place. Inside the leaf cells are structures called **chloroplasts**. Each chloroplast contains **chlorophyll**, a chemical that gives leaves their green color. When the leaves receive light, chlorophyll captures the light's energy and stores it to eventually be used to convert water into hydrogen and oxygen. The water's hydrogen and oxygen atoms are combined with the carbon dioxide's carbon and oxygen atoms to create glucose molecules which are used by the plant to produce its food. Oxygen, a **byproduct** of the photosynthesis process, is released into the atmosphere through the stomata. In plants, photosynthesis only occurs in the presence of light.

[See More...](#)

Engage

At the beginning of the project, students are introduced to key content using a compelling situation that provides context and serves as a catalyst for an authentic problem or challenge. In Project-Based Learning (PBL), this authentic problem/challenge is referred to as an "Entry Event." Students use the Entry Event to initiate inquiry by reflecting on their prior knowledge of the key content, generating questions that they need to know the answers to in order to successfully complete the project or process that will solve the problem, and identifying what their next steps might be to answer their questions. These questions are used in an ongoing way throughout the project to track learning and guide inquiry.⁵ While students may have several questions, one driving question needs to be agreed upon that, when answered, should address the initial situation. Refer to *Milestone 1* for Entry Event procedures.

Explore and Explain

In PBL, projects are organized into milestones. Each milestone represents a significant stage of the project. Click on each milestone below to access instructional procedures.

Milestone 1: Entry Event (approximately 2 days)

Milestone 2: Research (approximately 2 days)

Milestone 3: Garden Planning and Construction (approximately 14 days)

Milestone 4: Seed Germination and Plant Growth (approximately 4 days)

Milestone 5: Final Presentation (approximately 4 days)

Evaluate

As a final wrap-up, review and summarize the following key points:

- School Backpack Programs provide students in need with food to take home for the weekends.
- It is recommended to make half your plate fruits and vegetables daily.
- Plants need water, light, nutrients, and air to grow.
- Photosynthesis is the process through which light energy is converted into food for the plant.

Sources

1. <https://www.pblworks.org/what-is-pbl>
2. <https://www.pblworks.org/what-is-pbl/gold-standard-project-design>
3. <https://www.feedingamerica.org/hunger-in-america/child-hunger-facts>
4. <https://foodforfree.org/wp-content/uploads/2019/06/FoodForFreeWeekendBackpackProgramToolkit.pdf>
5. <https://my.pblworks.org/resource/ntks>

Recommended Companion Resources

- [A Moose Boosh: A Few Choice Words About Food](#)
- [A Seed is Sleepy](#)
- [Alice Waters and the Trip to Delicious](#)
- [And the Good Brown Earth](#)
- [Anywhere Farm](#)
- [Botany on Your Plate: Investigating the Plants We Eat](#)
- [Dig In! Posters](#)
- [Encyclopedia of Gardening Techniques](#)
- [Farmer Will Allen and the Growing Table](#)
- [Food for the Future: Sustainable Farms Around the World](#)
- [Fruit Bowl](#)
- [Garden Planner](#)
- [Grow it Again](#)
- [Gwendolyn's Pet Garden](#)
- [Harlem Grown: How One Big Idea Transformed a Neighborhood](#)

- [Health and Nutrition from the Garden](#)
- [How to Use a Ragdoll Test to Estimate Field Germination](#)
- [I Will Never Not Ever Eat a Tomato](#)
- [It's Our Garden: From Seeds to Harvest in a School Garden](#)
- [Jayden's Impossible Garden](#)
- [Junior Master Gardener Handbook](#)
- [Junior Master Gardener Literature in the Garden](#)
- [Junior Master Gardener Teacher & Leader Guide](#)
- [Katie's Cabbage](#)
- [Learn, Grow, Eat, and Go!](#)
- [Maddi's Fridge](#)
- [Math in the Garden](#)
- [Maxine and the Greatest Garden Ever](#)
- [My School Yard Garden](#)
- [Our School Garden!](#)
- [Poverty and Hunger](#)
- [Rooftop Garden](#)
- [Saturday at the Food Pantry](#)
- [Something, Someday](#)
- [The Growing Classroom](#)
- [The Soil in Jackie's Garden](#)
- [The Summer My Father Was Ten](#)
- [This Year's Garden](#)
- [True Food TV's Home Gardening Video Series](#)
- [Vegetables Flowchart](#)
- [We Are the Gardeners](#)
- [What is a Fruit? What is a Vegetable? Bulletin Boards](#)

Author

Lynn Wallin

Organization

National Center for Agricultural Literacy (NCAL)

We welcome your feedback! If you have a question about this lesson or would like to report a broken link, email at matrixelearning@gmail.com. If you have used this lesson and are willing to [share your experience](#), you with a coupon code for 10% off your next purchase at [AgClassroomStore](#).

Agricultural Literacy

Education Content Standards

Agricultural Literacy Outcomes

Agriculture and the Environment

- Explain how the interaction of the sun, soil, water, and weather in plant and animal growth impacts agricultural production (T1.3-5.b)

Food, Health, and Lifestyle

- Describe the necessary food components of a healthy diet using the current dietary guidelines (T3.3-5.a)