

Teachers use the garden as a meaningful tool for integrating science with core curriculum. The garden helps to make learning accessible to all students regardless of their background, talents, or language proficiency. When students plan, plant, care for, and analyze their gardens, science and learning take on meaning like never before.

Lance Omeje, Teacher  
Yokomi Elementary School  
Fresno, CA

# Linking Gardens to School Curriculum

The following pages provide ideas on how to integrate gardening with classroom curriculum. Although science is the most natural fit, with the school garden playing the role of science laboratory, the classroom garden can also act as a springboard for a wide range of lessons in mathematics, history-social science, English-language arts, visual and performing arts, and health. Begin by looking at the education standards and your own curriculum goals and making a list or map of areas you intend to cover. Make a second list of garden tasks, projects, and goals, and match them with the student outcomes detailed in the standards. Next, select or develop specific activities that can help students achieve the standards. The lists that follow represent just a sampling of garden-focused subject area activities to get you started.

Free garden curriculum resources for teachers are plentiful. Check out the "Curriculum" link on the California School Garden Network Web site at [www.csgn.org](http://www.csgn.org) for lesson and activity ideas. Additionally, the California Department of Education published the book *A Child's Garden of Standards: Linking School Gardens to California Education Standards, Grades Two Through Six*, which identifies specific activities found in a variety of commonly used curriculum books that meet California standards in science, history-social science, mathematics, and English-language arts.

## Science

The garden provides ample opportunity for making science inviting and relevant to students' lives by inspiring active exploration and problem solving. The garden encourages inquiry as students use their senses, reasoning, and communication skills to find answers to questions. These experiences can help improve students' attitude toward science. Key science concepts that can be explored in the garden include organisms, cycles, basic requirements for life, plant anatomy, adaptations, food webs, decomposition, interdependence, ecological principles, pollination, and diversity of life. Students practice and hone scientific process skills by observing, classifying, inferring, measuring, predicting, organizing and interpreting data, forming hypotheses, and identifying variables.



Judy Huffaker



California Department of Education

Below are a few ideas for life, physical, and earth science activities in the classroom garden.

### **Life Science**

- What are the differences between living and nonliving things? How are humans like plants? How are they different? Distinguish and describe differences and similarities.
- How does a plant grow? Observe the life cycles of plants using fast-growing plants in your classroom.
- What do plants need to grow? Do all plants need the same things? Study the various conditions that different plants need to grow. Compare the things people need to the things plants need. Create experiments investigating what happens when plants are exposed to different amounts of light, water, air, space, and nutrients.
- Investigate the functions of different plant structures (cotyledons, roots, stems, leaves, flowers, fruits, and seeds).
- How do plants reproduce? How do seeds work? Dissect flowers and seeds. What factors influence germination of seeds? Create experiments to investigate how light, heat, and moisture affect germination.
- Explain to students that some characteristics are inherited and others are caused by the environment. Locate examples of both in your garden.
- How do plants use energy from the sun to make food? Discuss photosynthesis. Do plants need light to photosynthesize?
- Discuss how plants adapt for survival. Research adaptations of seeds for dispersal and adaptations of flowers for attracting pollinators. Observe pollinators in the garden.

“Instead of learning the parts of a plant by lecture or reading, my students have learned them by growing their own plants, examining root systems, adding water, and graphing and charting the growth. My students will definitely remember these lessons.”

Sarah Smith

Merced County Educator

California Foundation for Agriculture  
in the Classroom Ambassador



Debbie Delatour

**“My students will never remember the chapter in the math textbook on double-digit division, but they will always remember the year they grew carrots and used their division skills to figure out how many carrots each student in fourth and fifth grade got to take home.”**

Jesse David Johnson

Tulare County Educator

California Foundation for Agriculture in  
the Classroom conference attendee

- Investigate the impact of environmental changes on plants.
- Study wildlife and insects along with their habitats.
- Investigate food chains and webs. Demonstrate how plants are the primary source of energy for all food chains.

### Earth Science

- Create a garden weather station. Record daily measurements and compare conditions with plant growth.
- How are some soils different from others? Compare and contrast the properties of different types of soils (density, air spaces, presence of living organisms, composition, texture, smell, appearance).
- Simulate soil erosion in your classroom garden. Observe the difference in soil loss when water is splashed on a tilted, planted pot, and on a tilted, unplanted (but soil-filled) pot.

### Physical Science

- What is pH? How does it affect plants? Use litmus paper or a test kit to test the pH of different soils. Investigate how plants respond to soils with different pH levels.
- Simulate the water cycle in the indoor garden by covering it with a “dome” of clear plastic. Study and observe the transpiration, evaporation, and condensation of water.
- What are the properties of different types of light? Cover pots with cellophane of different colors to screen out all but one wavelength of light from plants. Observe plant growth.
- How does energy change to matter during photosynthesis?

## Mathematics

The garden provides a plethora of opportunities to practice basic mathematical activities such as calculations, comparisons, measurements, and varied representations of data (charts, graphs, etc.). Math becomes practical and relevant when students implement concepts they have learned in the classroom in a real-life garden setting. Designing and planting a garden takes mathematical problem solving and practice. The hands-on applications presented by gardening activities can help to motivate students often confused by abstract textbook questions and examples. Here are a few math activity ideas:

- Measure the growth rates of plants and display results on different types of graphs. Make predictions regarding future growth. Use standard and nonstandard units of measurement.
- Host a bean race. Plant a number of beans at the base of a trellis and track their growth on a chart. Determine the rate of growth and award the fastest plant a blue ribbon.
- Using information from seed catalogs, predict dates of germination and maturity.
- Plan backward from a desired harvest date to determine when each crop should be planted.
- Measure your garden parameters and calculate the area. Use graph paper to make a map to scale of your garden.
- Calculate amounts of fertilizer to use per quart and per liter of water.

# PROGRAM SPOTLIGHT

## Summer School Academy

*Monterey Bay Science Project, Life Lab*

Each summer the Monterey Bay Science Project of Life Lab Science Program coordinates a special Summer School Academy program in the tri-county area of Santa Cruz, Monterey, and San Benito. Through this program, teachers use a combination of state-adopted curriculum and the Life Lab garden curriculum to teach English language development to students using hands-on, garden-based lessons.

The project began in 1995 with funding from the National Science Foundation and continues today with support from the California Science Project. The main

focus of the program is to teach academic literacy, but it is put into a science context and applied in the garden. Approximately 25 teachers and 600 students participate each year. Students are in class each weekday morning for four weeks; in the afternoon, teachers participate in professional development programs to increase their content knowledge and expand their use of inquiry-based teaching methods. Program staff coordinate maintenance of and activities at the garden throughout the summer. Through this program, both the students and the teachers receive invaluable training. One summer school

teacher commented, “I believe integrating science, language, and literacy is natural. Science is an easy and interesting way to teach language and literacy because students are engaged by the lessons, and the lessons lend themselves to linking language into science. The garden is a wonderful context in which this can happen.”

According to the Monterey Bay Science Project’s manager, Alicia Dickerson, a main benefit of this program is that it puts language into a “real context” for the students. “The students go from lacking academic self-confidence, to gaining a tremendous amount of confidence about themselves and their poten-

**The benefits of this program are both immediate and long term, as students use knowledge gained to help them succeed during the school year.**

tial. In the garden, they learn how to ask questions about the world and make meaning for themselves, coming away with new ways of thinking, new concepts and new words,” she says. The garden activities are engaging, and they inspire and motivate students to learn. A study conducted by researchers at University of California, Santa Cruz, found:

- When language growth was measured with a standardized assessment of academic language, students progressed faster in the Summer School Academy than would be expected for that time period, achieving as much as three months of growth in four weeks.
- Students showed dramatic increases in the scientific accuracy of their performance on a concept mapping activity. At the beginning of the summer academy, an average of 13.9 percent of their propositions showed accurate scientific knowledge. By the end, the number was 52.5 percent.
- Students increased their use of science vocabulary.
- Students demonstrated improved math skills.

The benefits of the program are both immediate and long term, as the students use their new knowledge to help them succeed during the school year. The Summer School Academy demonstrates the power of school gardens as interdisciplinary teaching tools for standards-based curriculum. On top of the learning experience, both teachers and students have fun while teaching and learning. That’s a combination that’s hard to beat.



Alicia Dickerson, Life Lab

“The garden is a tool to provide real-life experiences in reading and math, and an opportunity for teachers to extend learning beyond the classroom. In addition, Kennedy’s garden is a vehicle to help ‘harder-to-reach’ students form a positive connection with our school. Participating in our garden program has boosted their self-esteem and academic performance.”

Lawrence Quismondo  
Samuel Kennedy Elementary School  
Sacramento, CA

- Chart temperatures of the air and soil in your garden in Fahrenheit and centigrade.
- Determine the weight and volume of soil mix when wet and dry. Determine the volume of soil in a rectangular window box.
- Investigate vegetable prices in a supermarket. Track the amount of produce harvested in your garden and use the market prices to determine the value of your harvest.
- Count the number of seeds planted and the number of seeds that sprout and calculate the germination rate.
- Measure the height of a group of plants and determine the mean, median, and mode.
- Calculate serving sizes of different fruits and vegetables using common cooking supplies.
- Make a recipe that uses fruits and vegetables from the garden and requires various measuring techniques.

## History–Social Science

Plants are an important part of world history. They have influenced human civilizations and economies since the beginning, and as the base of all food chains and supplier of oxygen for our air, they will always be essential to our survival.

Gardening activities can be used to teach students about specific historical events and cultures, and also to introduce current events like the impact of biotechnology. Some gardening activity ideas:

- Research and report on cultural or ethnic differences in food consumption and gardening practices.
- Research agricultural history and create a timeline of important events.
- Visit some local farms and interview farmers about choice of crops, growing practices, marketing, and farm history.
- Study the contribution of Native American foods and other cultures’ foods to our history and diet. Grow samples in the school garden.
- Research the histories of classroom garden plants. Discover where they originated, the impact they’ve had on our diets, and how today’s varieties differ from the original plants. Locate their origin on a map and then trace their movement around the world.
- Use the Thanksgiving holiday to explore meals throughout history and the different crops grown and harvested at that time of the year.
- Complete a site analysis of the school garden and create a garden map noting important features, including a north arrow.
- Trace the path of a fruit or vegetable from the field to the table.
- Use the classroom garden to complement a study of the influence of climate on food production.
- As a class, develop garden rules and then vote on them.



Western Growers Charitable Foundation

## English-Language Arts

Reading and writing are two very important classroom basics, and mastery of these skills provides students with the power to succeed. Relating language arts exercises to the garden can add an element of fun, too.

Example activities:

- Keep daily garden journals documenting observations, weather conditions, and classroom activities.
- Research the growing habits of the school garden plants using the Internet and reference material. Create a planting schedule based on the information.
- Write letters to local merchants explaining the school gardening project and asking for donations.
- Write thank you notes to volunteers and garden sponsors.
- Write, illustrate, and publish a collection of garden stories and poems.
- Brainstorm different adjectives to describe each plant in your garden.
- Study new vocabulary that relates to plants and gardens.
- Publish a class newsletter with student articles about the garden and distribute it to other classrooms and parents.
- Write step-by-step instructions for common garden activities.
- Follow written instructions to perform a garden task like planting seeds.
- Read books and stories about plants and gardens.
- Write a research paper on a favorite plant, including source citation.
- Prepare and deliver a presentation about the garden for other students, teachers, and parents.
- Learn about the origins of scientific plant names.
- Read a garden magazine article highlighting a plant and distinguish between the facts and opinions presented by the writer.
- Research the nutritional value of your favorite garden vegetable and then write a script for a 60-second advertisement designed to get more people to grow and eat it.

## Visual and Performing Arts

Nature is the inspiration for many works of art, dance, music, and drama. Your school garden is a small piece of nature that can inspire budding artists.

Activity ideas:

- Create paintings and drawings of garden plants.
- Paint a class garden mural to hang in the hallway for parents' night.
- Make a seed mosaic.
- Create a color wheel collage using pictures from old seed catalogs.
- Make musical instruments from gourds and learn how to play them.
- Make prints using paint and stamps made from various plant parts.
- Create and perform a garden-inspired dance expressing the growth of a seed or the opening of a flower bud.



Alicia Dickerson/Life Lab

“A school garden presents an ideal context for teaching interpersonal and cross-cultural content, skills, and values. Aspects of social education and lessons in cultural diversity can be intended outcomes of classroom gardening, along with knowledge of plants and soil. When children examine gardening in a cross-cultural and global context, they develop an increased appreciation for human and plant diversity. They begin to grasp how geography, economics, and history play a role in gardening today and, in the process, learn how their decisions as cultivators, consumers, and citizens may have a local and global impact.”

Doni Kwolek Kobus, Ed.D.

Professor Emerita of Teacher Education

California State University

Stanislaus, CA



Jim Morris/California Farm Bureau Federation

Using agriculture as an integrating context for learning can be relatively simple, thanks to resources such as the California Foundation for Agriculture in the Classroom; Food, Land, and People; the State Department of Education; the Center for Ecoliteracy; the Hansen Agricultural Learning Center; the Life Lab Science Program; and the Center for Land-Based Learning. If you look at how teachers incorporate food and agriculture as an instructional strategy, the range of involvement stretches across the curriculum and into the community.

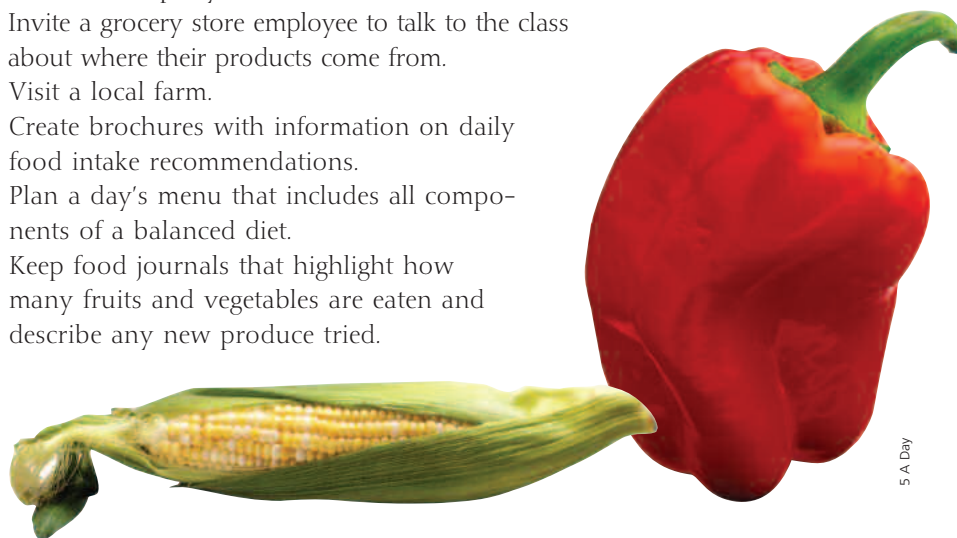
Dan Desmond, Retired Advisor  
University of California  
Cooperative Extension  
Placerville, CA

- Pantomime various gardening tasks (transplanting, fertilizing, sowing seeds, pollinating).
- Learn a collection of songs that relate to food, gardens, and the environment.
- Draw your dream garden.
- Listen to the music of composers inspired by nature.
- Build clay or tissue paper models of flowers.
- Use leaves to make crayon rubbings or fossils in clay.
- Using a movie camera with single-frame capability, make a time-lapse film of a plant growing.
- Create a skit about food safety.
- Paint a classroom mural using samples of different soils as the medium.

## Health and Nutrition

Research continues to document the significant health benefits of eating fruits and vegetables, and yet most children do not eat the recommended daily amount. Growing fruits and vegetables in the school garden improves students' attitudes toward these healthy foods and motivates reluctant eaters to try them. You can use the garden as a hands-on tool to teach nutrition lessons, including the importance of fruits and vegetables and proper food preparation techniques. Specific activity ideas:

- Compare the importance of nutrients in the health of humans and of plants.
- Study the nutritional value of the various crops in your garden.
- Identify the parts of the plant represented by common fruits and vegetables.
- Discuss the difference in nutritional value of various plant parts.
- Study adaptations of plant parts that make them good food sources.
- Sprout various seeds for eating.
- Conduct a blindfolded taste test using classroom-grown vegetables and supermarket vegetables.
- Experiment with food preservation techniques, such as drying, freezing, and canning.
- Grow a salad garden and give students a chance to sample the harvest with a salad party.
- Invite a grocery store employee to talk to the class about where their products come from.
- Visit a local farm.
- Create brochures with information on daily food intake recommendations.
- Plan a day's menu that includes all components of a balanced diet.
- Keep food journals that highlight how many fruits and vegetables are eaten and describe any new produce tried.



5 A Day

# PROGRAM SPOTLIGHT

## Learning about Ancient Civilizations through Gardening

Vista de Las Cruces School, Gaviota, CA

After attending the 2001 California Foundation for Agriculture in the Classroom conference, elementary teacher Tina McEnroe of Vista de Las Cruces School developed the Ancient Civilizations Farmers' Market curriculum to reinforce the garden experience and involve the community.

**“Next time you eat a bowlful of rice, think how easy it is for you to go and buy it at a store, because back in ancient times they had to cultivate, harvest, and maybe import the rice. It was a very, very hard job.”**

Tina notes that the curriculum allows students “the opportunity to stroll back in time to understand the effect of ancient civilizations on the world, as they research the history of indigenous foods in the civilizations of early Mesopotamia, Egypt, Persia, China, Rome, Greece, and Mayan Yucatan. Students choose a food to research and then they write

about it, make recipes, and create a realistic antique-looking label to summarize their food. The recipes have been included in a school cookbook now being sold in four bookstores in Santa Barbara County.” Students then plant some of the researched crops and use the harvest “to help supply school celebrations such as our Thanksgiving feast, community philanthropic luncheons, the Winter Program dinner and fundraiser meals,” Tina explains.

Vista de Las Cruces School formed a garden club that meets on a regular basis to ensure the success of the program. Tina shares quotes from some of her students:

“The reason I liked the Farmers' Market is because I got to eat food that I have never eaten such as date balls. And I got to use my own ideas.”

“I learned a lot about beans. I thought that they just came from



Paul McEnroe

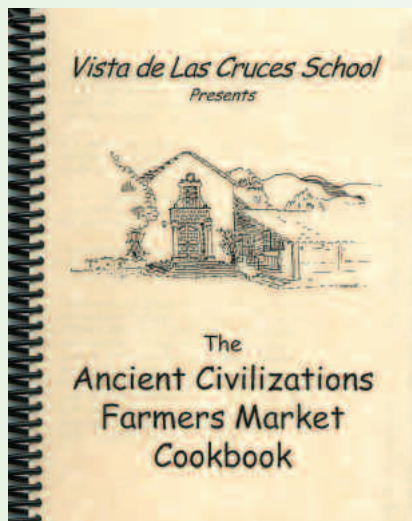
Mexico, but I was wrong. They came from Egypt and other places.”

“Next time you eat a bowlful of rice, think how easy it is for you to go and buy

it at a store, because back in ancient times they had to cultivate, harvest, and maybe import the rice. It was a very, very hard job.”

**“I learned a lot about beans. I thought that they just came from Mexico, but I was wrong. They came from Egypt and other places.”**

The Ancient Civilizations Farmers' Market curriculum goes beyond history class. It integrates language arts, social studies, math, and visual arts lessons and activities. It also provides students with an appreciation for agriculture and an understanding of the role of farmers in the past and present.





“I used to fear math, but working in the garden has changed that. I have a higher grade now. When we made salsa, we sold 150 pints at \$3 a pint and made \$450. The best part was when we got to collect and count the money.”

Student  
Turner Elementary  
Fresno, CA

- Invite chefs from the community to do cooking demonstrations for students and parents. Coordinate a cooking lesson in your school’s kitchen using the produce your class has grown.
- Ask cafeteria managers to share safe food handling information and provide tours of school kitchens.
- Invite a registered dietitian to visit classrooms and discuss healthy food choices and healthy preparation methods in connection with *MyPyramid.gov*.
- Present a skit or puppet show about food safety.
- Use *MyPyramid.gov* to help you choose a healthy diet. Come up with tasty recipes that use lots of fruits and vegetables and little fat or sugar.
- Create a classroom or school recipe book that features produce grown in school gardens.
- Compare the nutritional content of different colors of a specific variety of vegetables, e.g., salad greens. Graph the Vitamin A content in the lighter-colored greens and in darker greens. Contrast this with other vegetables.
- Research and compare fruits and vegetables with various origins. Identify cultural dishes and their preparation methods. Host an “international day” and provide healthful samplings of fruits and vegetables from those cultures.
- Incorporate literature using the book *Stone Soup* and involve students in making their own stone soup. Have students discuss the benefits of the ingredients and how they fit into *MyPyramid*.
  - Research cultural holidays and the symbolism of particular fruits and vegetables that are included during those holidays. For example, identify the symbolism of tangerines in the Chinese New Year celebration.
  - Create a public service announcement or school announcement promoting fruits and vegetables. The promotion could highlight something growing in the garden, a fruit or vegetable offered in the cafeteria, or both. This will encourage students to develop skills for marketing food choices.
  - Grow and use fresh herbs to flavor your dishes with natural ingredients and decrease the use of salt in recipes.
  - Visit a local farmers’ market or start a school farmers’ market.



Alicia Dickerson/Life Lab

These ideas are just a sampling of the classroom gardening activities available to you. Search books, magazines, and Web sites for additional ideas. Also, as you grow with your garden, you will create many activities of your own. Be sure to pass them along to other teachers and parents.