Welcome to My Garden

Integration of School Gardens and the Standard Course of Study

Materials Needed for Unit

Computer lab, research materials, internet connection, gardening supplies, basic art supplies, small plants, water, banner paper, index cards, magazines with pictures of plants, clothes hanger, string, assorted vegetables and fruits, small cups, food coloring, tissue paper, rubbing alcohol, paper towels, assorted seeds, collection of books relating to plants

General Activities

At the beginning of the garden project, make a KWL chart with the class. Find out what the students **know** about plants, what they **want** to know about plants, and finally, at the end, find out what they **learned** about plants. Discuss the completed chart.

Take the class on a walk around the school grounds. Stop to look at some plants and see if you can identify their parts. Which parts are visible and which ones aren't? Have the students record their observations in a plant journal and make suggestions about how plant life could be improved at their school. After they return to the classroom have the class design a plan to improve the landscape of the school campus.

Have plants in the classroom for students to observe. Discuss the special needs of plants for growth. As a class, design and conduct an experiment. Place one plant in the light without water, one in the dark without water, and one in the dark with water, record what happens to each plant.

Have a class discussion about the parts of a plant. Create a large chart on banner paper with six columns, one for each part of the plant. Have students bring pictures of edible plant parts to class. Have the students glue the pictures of plant parts we eat in the correct column. Using the finished chart, discuss which parts are eaten the most and least.

Bring a variety of small plants to class. Divide the class into groups of two or four Set some of the plants near each group. Ask students to brainstorm with their partner or small group what the plants have in common.

Have students tell about their favorite plants.

Have students keep a notebook of the plants discussed during the garden unit. Prepare drawings of the plants with colored pencils to include in the notebook. Students should write a simple sentence about each plant.

At the beginning of the class write on the board, "Where am I? I sit in my place and look at all the different types of individuals that live near me. It is easy to tell

when it is day and night, but the temperature hardly ever changes. I can look out and see the trees loose their leaves, grass turn yellow, and plants die, but I flourish despite the horrible weather. Sometimes it's so hot in here that there appears to be a mist in the air." Give students think time to solve this riddle. Ask students for answers; record all answers on the board/overhead. If no one has the correct answer give a few hints. You might then hold up a picture of a green house or take students to a greenhouse. Discuss what a greenhouse is. Have the class answer the question "What do plants need in order to survive?" Inform the students that they are going to make their own greenhouse and plant seeds to observe what really happens inside a greenhouse. Hand out the directions for creating the greenhouses. See "Build a Greenhouse." Read the directions aloud as they read silently. Check for understanding. Have the students from each group collect all the necessary supplies and give students approximately 15 minutes to complete the task.

If you are studying the Pilgrims: Inform the students that once they are finished with their greenhouses that they may use the time to write in their journals using the topic, "How might greenhouses have helped the Pilgrims?"

To prepare students for carving out a garden site in the schoolyard, have them reflect on and write about their favorite childhood places. Have students share their memories with a partner. As students share their images, with the class, take notes and discuss similarities and patterns that occur. Have the class suggest features they would like to see in their own garden-learning center. When it comes to making a garden, half the fun is in the designing.

One easy garden design is to divide one-foot-squares with paths, adding as many as you'd like in whatever pattern suits your spot. The paths can be made of stones, bark mulch, newspaper covered with straw, or even boards. Students plant something different in each square. The design is tidy and manageable.

Circular gardens are an option. Slice them, pie-fashion, with the paths. Once you have your basic shape, sketch it out on graph paper with one square equaling one foot. First add paths; choose the plants last.

Some things to consider before beginning your garden:

- As you choose your location, think inside out. Place the garden area where it can be seen and enjoyed by all
- Look up and down. Before you dig, be aware of any power lines, pipes, septic systems, or other existing limitations.
- Create your space. A fence or wall adds privacy and sets boundaries for students.

- Choose your materials wisely. They should resist rust, rot, and roughhousing. Surfaces should be comfortable and safe for bare feet but not too slippery when wet.

- Give yourself room. Make paths that are at least 2 feet wide.

Dirt Made My Lunch
The following are good follow up activities to the video “Dirt Made My Lunch.” Video available at www.bananaslugstringband.com

Explore how and why soils vary throughout the state. Have students brainstorm, then research to find out why soils differ from region to region and county to county throughout the state. (The important factors that affect soils include "parent" rocks, climate, time, types of plants and animals present, and slope.) Ask students, teachers, and parents to bring soil samples back from travels around the state. Then examine and compare the soils and learn about the areas from which they were taken. Find e-mail or pen pals willing to swap soils, information, and experiences. A way to do this is locate the names of one school from each county using the Educational Directory (available online at http://www.dpi.state.nc.us/nceddirectory/).

Write descriptive soil poems
Invite your county’s representative from the Soil and Water Conservation District to talk with your class about the work they do and basic information about soils.

Bring in or have the class bring in soil samples. Display next to large sheets of paper. Divide the class into teams. Have teams examine each sample, then have each student in the team write down adjectives to describe it. Next, have each team use its collective descriptions to write a poem about soil. Finally, mix up the poems and have the class to guess which sample each poem describes.

Have students design "advertisements" about soil. Make sure they include information that reflects what they know about soil.

Have the class become soil detectives. Give students an unfamiliar soil mixture, and have them use "tests" discover what ingredients the soil contains. Have them defend their answers. As an alternate activity bring in mystery soils and have students observe them and describe what they can infer about the location from which each soil was taken.

Art

Have students create a mobile featuring the parts of a plant. Make one of your own to use as an example. Give each student 7 index cards with prepunched holes. Have them draw a picture of a plant part on one side of the card and on the other side write the part's name and a description of that part's function. Students can even cut the cards in the shape of that part. When they are

finished with the cards, give the students strings/yarn and a hanger so they can attach the cards with string to a hanger. Have students create and add a title card to the center of the hanger. Display mobiles all over the classroom.

As an Art activity have the students to imagine themselves as special, unique seeds. Their job will be to design a personalized seed packet, describing this new and unique seed, beginning with a name for the seed such as (Lucy Lettuce or Suzy Sunflower.) The students need to be sure to include the three phrases they choose from the seed packet, and to add additional words to describe the seed. Have the students use descriptions, and illustrations showing how the seed looks. Suggest that they include requirements needed for the seed to thrive and grow (water, sunshine etc.). Use the seed packets on a bulletin board or in the hall as a display.

Make a flower out of tissue paper. Provide students with colored tissue paper, pipe cleaners, and rubber bands to make their own flowers. Help students fold the tissue paper (accordion style). Once paper is folded fold in half and tie with rubber band. Attach pipe cleaner to rubber band and tissue paper. Separate the folds of tissue paper until you have a flower.
Make a rainbow using colored flower petals. Put the petals in a bowl and mash them into a paste with a fork. Assist students in adding enough rubbing alcohol to make a runny mixture. Clip a strip of blotting paper over the bowl so that it just touches the mixture. Leave for one hour in a well-aired place, like on a window ledge. Then check to see what has happened. Have students write their observations in their notebook.
Discussion Questions

1. What flower would you like to learn more about?
2. Do you have any flowers at home? neighborhood? school grounds? If so can you name them?
3. Why do you think flowers have colors?

Designer Pots

If you're short on pots but strong in the arts, consider creating your own pots for homebound plants. Line 6-inch plastic pots with muslin, then line the cloth with 1-inch clay balls and mold the clay to the inside of the pots. Let each pot sit one day before removing the new clay pot. Use a straw to poke drainage holes in the bottom. Glaze the pots before students take them home filled with seedlings, herbs, and houseplant or whatever they have grown.

Language Arts

Planting a Rainbow by Lois Ehlert

Prereading Activity- Read the title and name of the author. From looking at the title and cover, have the students predict what the book will be about. After reading the book, have the students brainstorm why the author may have chosen the title *Planting a Rainbow*. Have students think of other titles that could

have been used and explain why that title would have worked.

Print the following phrases from the book on sentence strips.

ιbuy bulbs and plant them in the ground
ιorder seeds from catalogs
ιwait all winter long
ιspring comes to warm the soil and sprout the bulbs
ιgo to the garden center to select some seedlings
ιsow the seeds
ιset out the plants in soil
ιwatch the rainbow grow all summer,
ιpick them and bring them home

After a discussion about the steps taken in planting a garden, have the students take turns placing the sentences in sequential order in a pocket chart. When all sentences have been placed, review the book for the correct order.

Go through the book together and make a list of all the flowers that were planted. Make large petals and a circular center from construction paper. Distribute the parts to students. Have the students choose one flower and write its name in the center. On each petal, have the students write a characteristic of that flower or requirements needed to make it grow. Display the flowers.

Have the students make a list of the things they have learned so far that are necessary for the growth of plants. Since this book does not specifically tell about those things, have the students use their list to add to the book. Discussion Questions:

1. What are the differences between seeds and bulbs?
2. How might the seasons affect the growth of plants?
3. What are some things that you would like to plant in your own garden?
4. Where are some places that you have seen "a rainbow grow"?

Show/read the ***The Secret Garden*** and discuss with the class.

Jack and the Beanstalk**,** is a good project to tie language arts and science together after the class has studied different types of fiction and have studied green plants. Materials Needed: story or book of *Jack and the Beanstalk*, construction paper, rulers, butcher paper, markers/crayons, glue, cups, potting soil, bean seeds After reading and discussing *Jack and the Beanstalk*, with the class, have the students draw, write, and perform *Jack and the Beanstalk*. Divide the class into groups. Have each group pick out and list the fairy tale elements, for example: giant, magic, all good characters, all bad characters, problems to be solved. After each group has successfully completed this task, have the groups write a script for a puppet play of the story. They will need to design the puppets and the sets for the scenes. Have teams present their plays to the rest of the class.

Give students a variety of seeds and have them look closely at the seeds. Have students identify at least five things the seeds reminded them of or looked like, and write these analogies.

As an introduction to a garden project, collect a variety of colorful, descriptive seed packets. Ask each student to carefully choose a seed packet from the collection and on a slip of paper describe why they choose their particular seed packet. Next, ask students to choose three words or phrases from the seed packet that they feel describes themselves, for example tall and spiky, prefers hot weather, blooms year-round. Then, using "Inside Outside Circle" strategy, have students share.

Read ***Over and Under In The Garden*** by Pat Schories.
There is at least one plant for each letter of the alphabet. Assign one letter to each student or group of students. Have each student/group write their letter in large capital letters on blotting paper. Fit the paper into a food tray or dish. Soak the paper with water. Then shake cress seeds onto the letter, pushing them close together so that there are no gaps. Put the tray on a windowsill, and make sure the paper is always damp. It will take about one week to ten days for the letter to be fully grown. It is best when it is about two inches tall and even green in color. Have students record observations.

Science

Bring a plant to class and discuss with the students the parts of a living plant. This way they are able to identify the parts of an actual living plant as opposed to only a picture of a plant. In observing their plants, students are to identify the seed, stem, leaves, fruit, flower and roots. Give each student the materials necessary to plant beans. The students will need to keep daily records of the plants' progress - date planted, date sprouted, daily height of plant. Note: It is possible to maintain a bean plant until it blooms. For assessment use student plant journals and records of daily observations. A class awards presentation can be held with prizes given for tallest plant, most productive plant, etc.

Divide students into teams. Assign each team a plant part with the assignment to research and become an expert on that plant part. Explain that each team will then teach the rest of the class more about this important plant part. Discuss with the class the important questions that they should answer in their reports. For example:
Where is the part located on the plant? What is its job? Why is it so important to the plant? etc. Give the students choices as to how they will present the information to the class (i.e. a news report, skit, video). After the projects are complete, have each team teach the other teams what they have learned about the importance of its plant part.

If possible have students bring a small plant to class. Make sure they understand they will be dissecting the plant and it will not be returned. If this is not possible, provide them with plants of different varieties. Have them take the plant apart, piece by piece, examining each different part of the plant and discussing how it contributes to the growth of the plant as a whole. Help students uncover their root systems with systems attached. Have them measure the system length and width. Each student will draw their own root system. List the terms discussed and observations on the board.

Have students place a carrot in a small cup containing water and food coloring (dark blue.) Discuss how plants absorb water and minerals. Explain that the carrot is the root of the carrot plant. Have students leave carrot in water for several hours and then remove. Cut of small section near the tip of the carrot. The circle of blue dots indicate where water is being carried up into the plant. Continue cutting small sections to see how far the dye has been absorbed.
Discussion Questions
1. Are plants necessary for us to live in our environment? Why?
2. What do you think would happen if we didn't have plants?
3. What do plants require to live?
4. For what do we use plants?
5. What are the six major parts of plants?

Classification
For this activity you will need oranges, tomatoes, peaches, plums, pears, apples, sturdy plastic knives, pieces of plastic
Teacher Background:
Flowering plants produce seeds encased in fruit. Three kinds of fruits are berries, drupes, and pomes.
Oranges, grapes, and tomatoes are berries. Their seeds are embedded in the flesh of the fruit.
Peaches and plums are drupes. Drupes have one seed enclosed in a hard case surrounded by flesh.
Apples and pears are pomes. Pomes have several seeds enclosed in a core surrounded by flesh.

Explain to students that different kinds of plants form different amounts of seeds. Some plants form only a few seeds, while others form many seeds. The fruit is the part of a flowering plant that contains seeds. Show students a one-half piece of each of the following fruits: oranges, tomatoes, peaches, plums, pears, and apples. Help them observe and identify the placement of the seeds in each piece of fruit. Then have students group the fruits according to how the seeds are enclosed. You may wish to introduce the words berry, drupe, and pome to your students. If so, explain that many fruits commonly called berries are not berries according to the scientific definition. Give each group three pieces of fruit (one berry, one drupe, and one pome), a plastic knife, and a piece of plastic. It may be helpful to precut the fruit for your students. Have students cut their fruit apart on

the plastic, count the number of seeds in each piece, and record their observations on a worksheet.

Alternate Lesson – Discovery Method: Divide class into groups. Give each group several of one kind of one type fruits – berry, drope, pome. To one or two groups, give a mixture of the different types, but do not tell groups what they have. Assign students – without explaining berry, drope and pome - to determine which they have. Make sure dictionaries and other resource materials (encyclopedias, computer with internet access, textbooks) are available. After groups have reported their answers, reinforce their understanding of the three types of fruits.

Celebrating Seeds

"Seeds are the beginning and the end." Have your students explain how this statement can be true. Hold up an acorn. Explain that this seed contains all the information needed to produce a great oak. Seeds have sustained humans throughout history. Seeds can intrigue and inspire your classroom gardeners to become budding scientists

Weather and the Garden

Have students create a blueprint for their dream school garden. After the plans have been finalized, instruct the class to research the requirements for each plant they have included. Students will soon realize they will have to revise their plans when they look at amounts of sunlight and length of growing seasons that some plants require. Many seed catalogs, packets, and gardening resources depict charts or maps indicating conditions -- first and last frost dates, average minimum temperatures, or amount of sunshine or rainfall -- in different climatic zones throughout the country. A commonly used map type assigns zone numbers indicating which perennial plants can adapt to each area. If the winter temperature in your area dips below a certain temperature, for instance, certain tender perennials will simply not survive. Excessive summer heat can also spell the end of certain plants. Have students use gardening references or Internet resources to examine different climate zones.

Weather and the Garden

Background Information for the teacher

Computers play a major role in weather forecasting. Computers help to quickly collect weather data, calculating how the weather pattern might change and providing maps that show the type of weather a meteorologist might expect. The computer maps are helpful, but they are still imperfect. A meteorologist must study the maps and apply knowledge and experience about weather in his or her specific location before an accurate forecast can be made. Short term forecasts from the next day are usually quite accurate, but forecast accuracy significantly decreases beyond the next few days. Although the accuracy rate of long-range forecasts is slowly improving, they are still not as reliable as the 24-hour weather forecast. Although you may not have high-speed computers, massive satellites,

and expensive radar, students can use a few rules to make a short term forecast. As in the real world of professional forecasting, these are only guidelines. No rule guarantees 100% accuracy.

Begin class by asking the students if they ever watch the weather forecast. Ask why they are interested in the weather. Most will have answers that have to do with personal wants and needs (ballgames, out for snow days etc.) Next, have the class define “weather forecast.” Explain that a weather forecast is a prediction of weather conditions. Forecasts help to save lives, property and crops. Ask the question, “Why would a framer or gardener need to know about the weather?” Have the students brainstorm reasons. List responses on the board/overhead. Then discuss ways that weather affects plants and gardens. Remind students that most U.S. weather moves from west to east.

Have students survey family members, gardeners, and weather resources for examples of weather "folk lore." Some examples follow.

- If it thunders on All Fool's Day, it brings good crops of corn and hay.
- Red skies at night, sailor's delight. Red skies at morning, sailors take warning.
- If the woolly worm's head is more black than colored, the coldest part of the winter will come in the first months of winter.
- If oaks bud earlier than ash trees, it will be a wet summer; if ash buds first, it will be dry in July and August.
- When you see a mackerel sky, 'Twill not be many hours dry.
- When it rains before seven, 'Twill clear before eleven.

Ask students which sayings might have some scientific basis, and which are merely fanciful? Ask students how they might test the accuracy of these assertions. Take the class to the media center for research.

Review with students (1) how they used the internet to observe weather data; (2) how plotted weather map data and data charts or spread sheets can be used to study the temperature and sky data to note locations of high and low pressure centers, areas of warm and cold air, wind directions and the clouds on satellite images. Inform students they will use this type information to make a 24-hour forecast for the school area. The following are the major observations that should be plotted on the weather map and included in the 24-hour forecast: daily temperature and sky data, precipitation, locations of high and low pressure centers and associated fronts, areas of warm and cold air, wind speed and direction. Give students a copy of the major guidelines of forecasting. Discuss these guidelines with students. Remind students that this information should also be charted and recorded on a spread sheet. Students may construct graphs from the charts/spread sheets to compare the targeted stations. Inform students that they will be responsible for presenting the weather similar to the way it is done on TV. To prepare for the broadcast, students should pay close attention to a TV weather broadcast to find: What information is given to begin the weather broadcast? To end it? How many weather maps, satellite images and radar

pictures are shown? Are there specific regions of the country discussed? Why? Ask students to come to school tomorrow with observations and ideas on what they would include in their weather broadcasts.

Guidelines for predicating Weather

Pressure Trend:
The pressure reading itself is not as helpful as its trend or change. A rising barometric trend indicates high pressure and a greater chance for fair, dry weather. A falling trend indicates low pressure with a chance for clouds and precipitation. Record pressure readings often to detect trends.

Wind Direction:
We know that the wind direction has an effect on temperature, and we have studied how wind blows around highs and lows. Recalling that wind around a low pressure system blows counterclockwise, you would observe a warm southerly wind ahead of a low and colder northerly wind behind it. Lows on a weather map give you clues about what type of weather and temperature trend to expect in your area.

Cloud Cover:
Growing cumulus clouds can indicate conditions from thunderstorms, and high ice-crystal cirrus clouds can mean an approaching storm. The location and coverage of clouds on a satellite image can be extremely helpful in predicting sunny or cloudy skies.

Wind Speed:
An easy way to estimate relative wind speeds is to use the Beaufort Scale. This system was developed to estimate wind speeds on the ocean, and later adapted for land use. Consider having your young wind watchers use the following scale, or create a similar system themselves.

Observation----------Wind Description (speed)
smoke rises vertically----------calm
smoke drifts----------weather vane inactive;1-3 mph
leaves rustle, can feel wind on face--------light breeze (4-7 mph)
leaves and twigs move, light flags
extend; gentle breeze----------(8-12 mph)
moves small branches, raises dust
and paper; moderate breeze----------(13-28 mph)
whole branches swaying; strong breeze--(25-31 mph)

Math

Farmers use math to compute pesticide and fertilizer rates, decide on the amount of seed that needs to be purchased, price their products, buy and sell equipment, compute fuel needs, measure square footage, and graph rainfall. With a class

garden, student will use math principles for many of the same reasons. To focus on math in the garden, first identify which mathematical concepts you want to reinforce. Sunflowers, are an excellent plant for **real-life measurements** and graphing. Choose a variety of sunflowers, which grow quickly, but also come in many shapes and sizes. The students will observe how plant varieties differ and how those differences can help the farmer meet his or her production needs. For **weight measurements**, use plants such as bush beans, pumpkins, or tomatoes For practical computation, you might compare plants with low fertilizer needs (leaf lettuce, spinach, or radishes) to plants that need more fertilizer (broccoli, cabbage). Using a soil test recommendation, these can be obtained from local extension offices. Students can shadow a farmer observing his/her use of math to determine fertilizer needs and costs. Invite a local farmer to talk to the class about the ways he uses math daily.

Ways to use Math in the school Garden


Measure the garden area and lay out garden designs.


Calculate seed or transplant needs based on garden area.


Keep and balance garden accounts.


Measure and graph plant growth, rainfall, and insect population, over time.


Calculate the volume of mulch your garden needs.


Estimate harvest volume in pounds.


Compute out how many hours to leave classroom lights on when planting indoors.


Predict when vegetables would be mature.

Plant-Related Businesses

Earning money with plants has been a math motivator for students in gardening classrooms across the country. Students have sold everything from houseplants and seedlings, to sprouts, to harvested seeds. A range of math skills is required. Skills range from developing a plan, projecting costs and sales, to actually selling, making change, and reporting on profits or losses. Some class plant businesses have actually "incorporated," allowing students to purchase stock. Students can have their eyes opened to the harsh realities of business after dreaming about profits that do not materialize. Some students do realize that they would have expenses to deduct from their profits, but for many this will be a first time reality.

Salad Survey
Math can come alive if it relates to something in which students are interested. Have students conduct a "salad survey." Brainstorm with the class the most effective way to conduct the survey and come up with a questions to determine the salad ingredient likes and dislikes of their families and friends. Divide the class into groups and have each group conduct the survey and develop a graph to represent their survey findings. Have students graph the results with pencil and paper and then use the graphing program on the school computers. Students can calculate the percentage of respondents favoring each vegetable. Make a display of the graphs. Have teams explain the results to the class.

Solving Problems
Determine how many seeds per row or container will be needed if a packet says to plant X seeds every X centimeters.

If you have X plants, what are several ways you can group them when transplanting them outdoors (e.g., 4 rows of 4 each or 2 rows of 8 each)?

To determine if old seeds are still healthy, try germinating 10 on a moist paper towel placed in a plastic bag. Figure out the percentage germinated, and determine whether they're worth planting in the garden!

Estimate and verify the number of seeds in a fruit. Predict how many fruits you'd have if they all germinated and each plant produced X more fruits.
Discuss what prevents this from happening in nature.

Given the recommended dose of your fertilizer and your average rate of watering, calculate how much fertilizer you'd need for a week, a month, or a year of indoor gardening.

Figure out the fraction or percentage of seeds that actually sprout of those planted in a given container.

Try some root growth rate problems. For instance, roots of young seedlings can grow at .2 mm per hour. At that rate, how long would it take a carrot root to reach the bottom of a 10-cm pot? Discuss and investigate whether plant parts grow at the same rate throughout their lives.

Dig up a set volume of soil from outdoors. Count the number of earthworms, and estimate the total number of worms in an area. Discuss the earthworm’s role in soil enrichment.

Identify plant parts in different foods, using school lunches as a springboard (e.g., bread from seeds, pizza sauce from fruit, etc.). Calculate and graph the percentages of different plant parts represented in a typical school lunch.

Determine when to start seedlings indoors for spring plantings based on the days to maturity and recommended dates for transplanting out in your area.

Challenge teams of students to grow the biggest...longest...heaviest of a particular vegetable. Keep daily records, develop criteria for determining winners, graph results, and conclude with a feast!

Identifying Patterns
Investigate mathematical patterns in nature. For example, is there a relationship between number of flower petals to number of stamens and pistils?

Is there a relationship between the size of a fruit and the size or umber of seeds?

Make leaf rubbings with crayons. Identify and classify different leaf vein patterns.

Sorting/Classifying
Have students sort and classify leaves into different types, then calculate the percentage of the collection each category represents.

Predict, then count, compare, and graph the number of seeds inside different fruits.

Draw Venn diagrams, showing intersecting sets, to categorize fruits and vegetables. One set should show fruits; the other, vegetables. The intersection should show those fruits we commonly consider vegetables.

Sort a small amount of birdseed; glue seeds on paper to make a graph showing the numbers of different types of seeds in the mixture.

Measuring/Graphing/Mapping
Draw a map, to scale, of your indoor or outdoor garden.

Measure and compare areas, lengths, and circumferences of different plant parts under different growing conditions.

Compare and graph growth rates of a fast-growing plant (e.g., beans) with a slow-growing plant (e.g., carrot).

With a waterproof marker, draw rings on the stem of a bulb, bean, or other straight plant stem at 1-cm intervals. Measure and graph the distance between the rings daily for one to two weeks to see how stems grow. Consider exploring whether this growth changes as light and temperature change.

Determine the volume of soil mix necessary for X pots.

Grow sprouts for a salad. Measure a certain volume, estimate the number of seeds, measure the change in volume that the sprouts occupy daily. Note changes in weight over time.
Make a salad from the vegetables/fruits in the classroom salad garden. Estimate the weight of each ingredient in your salad, then weigh and graph the percentage of the total that each ingredient occupies.

Compare different plant roots by measuring and trying to estimate the total root length.

Use string to measure the lengths and circumferences of non-straight roots, fruits, leaves and other plant parts.

Calculate and compare the surface area of different leaves by drawing outlines on graph paper.

Social Studies

Start a "plant of the week" project in partnership with a local green house nursery or florist who agree to loan a different plant each week with the understanding that the plant would be returned in good condition. On each Monday morning, put the plant of the week on display (with a sign thanking the nursery) on a table in the main school hallway. Place a sign highlighting the plant name, country of origin, care requirements, and other interesting information next to each plant. Mini-oranges, pocketbook plants, and other unusual plants are sure to delight students and brightened the hall throughout the year. Have students design and sent a thank-you card to the company donating the plants.

Herbs in History
Teacher Background
Herbs, today the word conjures up visions of bottled spices and oils, soothing teas, or the green flecks in spaghetti sauce. But these aromatic plants played even more vital roles in earlier times. In many cultures, herbs and spices were considered more valuable than gold, and people took risky journeys to find and trade them. After all, it was the desire to find shorter routes for trading valuable spices that motivated New World explorers like Columbus to journey from home. Have your students transport themselves back in time for a moment and imagine how people coped hundreds or thousands of years ago without drugstores, grocery stores, sanitary facilities, cosmetic stores, or adequate clean bathing water. What did they do when they had a headache, for instance? Through trial and error, people discovered that certain plants could be used to treat illness and injury. As it turns out, these observant people of earlier times were onto something. It wasn't until the late 1800s, though, that chemists began actually isolating the chemicals in plants to promote healing. (The word drug comes from the old Germanic word drigan, which means "to dry," since drugs were originally dried herbs.) Although many of these active chemicals are now created

synthetically, new medically important substances are constantly being found in plants and herbal remedies still used in some cultures, and many of our drugs are still plant-based or synthesized from plants. Illness and injury weren't the only concerns in earlier times. Without refrigeration, food would have spoiled quickly. What better way to disguise the odors and tastes of spoiling food than with aromatic plants? The fragrances of many of these plants were also used to keep homes and bodies smelling fresh in the form of potpourri, perfumes, or lotions. During the medieval period, freshly cut herbs were actually strewn on floors to scent air and repel pests. Perhaps due to their strong aromas and flavors and importance to physical and mental health, herbs have historically played a key role in religious rituals, superstitions, and in inspiring fascinating folktales. (Did you know that it was once believed that parsley, which takes a long time to germinate, went "nine times to the Devil and back" before sprouting, and that it did best when planted by a pregnant woman? Or that one could cure baldness by sprinkling parsley seeds on the head three nights a year?) With such colorful histories, adaptations, and variety of uses, it's no wonder that herbs provide a compelling multisensory centerpiece for classroom garden investigations.

Aromatic History

Herbs in history can be the focus for a garden activity. Students can grow herbs such as catnip, basil, thyme and rosemary from seeds and cuttings. They can make herb window boxes. Herb vinegars, pot pourris, herbal recipes and herb folklore, and even catnip mice. Have students research herbal recipe cures for common problems and collect family cures using herbs!

Challenge students to experiment to test "the best" herb or combinations for particular purposes: for instance, the best spaghetti sauce herb, best salad dressing combo, or the best herb for fragrant bath oil. Require students to back up their choices with data rather than just stating their own opinions.

Using a school garden, botanic garden, or other herb garden, develop a scavenger hunt that focuses students' attention on qualities of herbs. Here are some sample clues: find an herb that smells like a mint, might taste good in spaghetti, or might repel fleas.

Herbs in Colonial Life

An exciting way to bring a study of colonial America to life is to have students actually experiencing those times. Have your students sign up for a variety of colonial era "apprenticeships," which can be facilitated by parent volunteers. After researching their respective professions, students who sign up for farming and apothecary apprenticeships can take charge of the school herb garden planting, harvesting and drying the herbs. As an extension, have students write an "herbal" (a description of herbs and their uses). Students need to do extensive research to learn as much as possible about individual garden herbs

and their uses in colonial times. The students will love discovering interesting historical uses of herbs, for instance, the herb mullein was used as bandages, rosemary was thought to "calm naughty children," and sage was used to color gray hair. Students can make safe herbal teas or experiment with home remedies such as using aloe for sunburn. Because there were no anesthetics or antibiotics during the Revolutionary War, people relied on certain herbs for medicinal purposes. The student herbal cures can be offered for sale to parents and the community in the apothecary shop of a simulated colonial town. In the spring, they could start more seedlings and tend the perennial herbs, so the cycle could continue the following fall.

The novel ***Where the Lilies Bloom,*** can be used to motivate students to try raising and investigating herbs. This is a story of some Appalachian children whose parents die and who must rely on their wits and understanding of how to use plants to survive. Have students list the herbs that are referenced in the story: catnip, blue cohosh, witch hazel, sage, yarrow, etc. Divide the class into teams and assign an herb(s) and plant in the school's literature garden. The garden can bring the story to life.

Have the students create a regional "wildcrafting" guide, complete with pressed herb specimens, and detail how each plant was used historically. Include recipes for herbal products such as sassafras tea. Through research, students will discover stories and folklore associated with the plants. Have the students write stories of their own.

Divide the class into teams and have each team research a period in history and the plants that were grown for food and for medicinal uses. Have the teams prepare a 5 minute presentation complete with visuals and taste testing if possible.

Ethnobotany
Teacher Background
From our morning breakfast cereal to our cotton sheets, we're utterly dependent on plants for much more than the life-sustaining oxygen they produce during photosynthesis. Plant products, interactions, and references are so much a part of the fabric of our lives that we rarely stop to even acknowledge their impact. Throughout history, plants have been the source of medicines, fibers, paper products, cosmetics, spices, building materials, and fuels, besides being our sustenance. They have affected (and been affected by) the course of human history. Perhaps the most significant shifts for both humans and plants resulted from our transition from a hunting and gathering people to farmers who to collected and replanted seeds of desirable plants. Since then, that continued human need to cultivate, acquire, and otherwise depend on plants has triggered wars, famine, and waves of migration. It has played a key role in social and technological shifts such as the Industrial Revolution, with both plants and humans continually adapting to the changing relationship. Our language is filled

with plant symbolism (i.e. putting down roots, cool as a cucumber). The Chinese, politely ask if your “rice bowl is filled” when they want to know how you're doing. The multiple roles and depictions of plants in religion, folklore, celebrations, music, art, and poetry gives us insight into the different meanings plants have had for humans. Different cultures have had very distinctive relationships with certain plants. Many Native American cultures, for instance, dependent on corn for survival, had corn gods, corn maidens, special corn-sowing dances, and harvest festivals of thanks. They developed many ways to preserve and use corn even devising some of the earliest calendars to keep track of harvest and planting schedules. Ethnobotany, broadly defined, is the study of the multiple roles of plants in a society, the dynamic interrelationships between humans and plants. In the classroom, you can use these relationships as a "hook" for exploring history and cultures. Ethnobotanists who study the relationship past cultures had with plants collaborate with anthropologists, archaeologists, and other scientists to look for a variety of clues. How do present cultures use certain plants? How are plants depicted in ancient art? What evidence can we find by examining soil samples of seeds, pollen, and other plant parts? Your students can become ethnobotanists and explore people/plant relationships through many different types of activities.

Ethnobotany People/Plant Relationships

Have students brainstorm all of the items they could that contained corn: corn chips, cornmeal, popcorn, and more. Bring a variety of labels from cereals, cosmetics, canned fruits (with corn syrup), etc. Then have students look for evidence of corn, then group the items according to the number of corn-related products each contained. Students will be amazed at just how prevalent corn products are. Have students read the labels and create a running log of information on all of the corn-related items they found. Have the students list their findings on mini-ears of corn on a bulletin board cornstalk.

Have your students become ethnobotanical interviewers by asking parents, grandparents, and friends about changes in foods eaten or plants grown over their lifetimes; culturally important recipes; special gardening techniques; plant or food folklore; memories of plants used for celebrations; and medicinal uses of specific plants. Consider partnering with a nursing home to grow "reminiscence gardens." Or experiment to "test" some of the folk/health wisdom about certain plants (that mint tea eases indigestion, for instance), **cautioning students not to try ingesting any plant preparation unless deemed safe by a reliable adult and reference materials!**

Compare cultural food preferences. Have students with different cultural backgrounds keep lists of all of the plants they eat in a week, then compare lists and discuss observations and questions that emerge.

Visit an ethnic market. Identify unusual plant foods and products and check labels to discover how different plants and plant parts are used. Talk to owners about preparing different foods, then try some.

Discover the origins of plants growing nearby. Examples might include those in your classroom, outdoor garden, or a nearby field. If they're not native to this country, explore how and why they traveled here and map their routes from their countries of origin. Explore their folklore and historical uses and their ecological roles (food and shelter for wildlife, soil stabilization, etc.)

Have students choose specific plants or plant groups (i.e. trees) that they value and write about why they value them. Or have them choose several of the roles plants serve (e.g., medicinal, recreational, aesthetic, religious, culinary) and write about a plant they value in each category.

Grow foods or use gardening techniques from another culture. Discover through their folklore how and why they value different types of plants and planting systems. For instance, research, plant, and raise a Native American "three sisters garden" (corn, bean, and squash); a Colonial garden; an English cottage garden; a Japanese garden; a Mexican garden; an African garden; or a Southern plantation kitchen garden.

Brainstorm and discuss with the class why they think certain foods or other plant products might have become important to certain cultures: potatoes to the Irish, corn to native North Americans, rice to the Chinese, for instance. Then research to find out, while also growing some of the crops.

Grow and save "heirloom" seeds of old plant varieties. Learn about their histories, and try to determine why different varieties were valued.

Explore different works of art, music, and writing to look for plant images and references. Discuss what you can infer from the pieces about each culture's relationship with the depicted plants.

Keep a running list of plant-related words and phrases that reflect plant-related images and metaphors (family roots, “she's blossoming,” “cool as a cucumber,” etc.). What information do these phrases give us about plants or how we value plants?

Create a list of ways in which plants affect our lives, and a parallel list of ways in which we affect plants. Compare lists and discuss reactions and questions that emerge.

Become ethnobotanists/archaeologists. Imagine you are searching through soil samples for evidence of plants from a past culture. Bring in a range of soil samples to dissect and observe (you may want to add some small seeds, plant

parts, and sand to make a diverse mixture of particles.) Analyze the mixtures and separate out particles by making a solution and repeatedly filtering it through cheesecloth or filter paper. What evidence can you find of plant materials?

Rather than begin a study of people/plant relationships with a particular culture, you might choose to focus your investigations on a particular plant (corn, potatoes, oak trees, peanuts) or group of plants used for a specific purpose (herbs, grains, medicinal plants, dye plants).Your students might want to explore such questions as: Where did these originate? What myths and folklore are associated with them? How do different cultures use and value the same plant or plant group? Can we grow this/these plants in an indoor or outdoor garden? Can we process or use them as other cultures do, or experiment to "test" folk wisdom? How has the plant "adapted" to technological and other human-influenced changes?

Survey family members, grocers, and friends, to find out how they use, grow, cook with, and value your selected plant(s). Explore why differences may exist between cultures' relationships with the same plant or group. Trace the origins and histories of your plant(s), including the roles they played for different cultures, how and when they traveled to new cultures, and how they may have influenced the course of history.

Explore how the evolution of technology (i.e. the transition from hand-held scythes to combines for harvesting wheat) affected plant evolution.

Exchange seeds of unusual, indigenous, or culturally significant plants with classrooms elsewhere, then try growing them. Share questions and information to discover how the plants are used and valued in different areas.

Research, then try to create some important plant products. Make and use dyes from homegrown and collected plants; make paper; make aromatic oils or potpourris with homegrown herbs and flowers; grow and grind wheat into flour.

Identify the origin and history of each ingredient of a common food, then try growing them -- a pizza garden or a tostada garden, for instance.

Conduct a botanical survey of a plot by observing, collecting, and mounting specimens. Describe, then identify the plants and discover which are native and which have been introduced, and how they've been used throughout history. Also discover what ecological roles they play.

Investigate ways in which humans use or grow plants to attract or protect wildlife. Try raising sunflowers for birdseed, gourds for birdhouses, nectar and host plants for butterfly gardens, or establishing wildlife habitat areas.

Investigate common foods that have been important staples in another culture and have become popular "novelty foods" here (tortillas, which are a staple in many Hispanic countries have become popular here in the form of chips, for example).

Collect matching items or photos, then mix them up and invite students to try to match each plant with its product. Have students work individually or in pairs to brainstorm some useful plants and products that are made from them (for instance, aloe plant and skin lotion). Encourage observations and questions that can lead to further investigations.

Garlic. Although it sends some of us rushing for the breath mints, this humble bulb has a rich history of folklore and use, from repelling vampires to building gladiators' strength to curing everything from the common cold to cancer. In the classroom, garlic grows rapidly from store bought cloves in water or soil mix. Have students explore garlic peeled, unpeeled, and crushed; describe its tastes experiment with different ways of cooking with and growing it; and test some of the folk wisdom regarding garlic's powers.

Grass seeds make up the basic foods of nearly all people in the world. Half of the world's population depends on the seeds of one grass alone: rice. The ground seeds of wheat are believed to have been grown for food for 10,000 years (ancient Rome's wealth was in large part based on the wheat trade.) Corn, also cultivated for thousands of years, is used for animal feed, cereals, and breads, not to mention its use in corn syrup, corn oil, paint, plastics, soaps, whiskey and many other products. Sugarcane, one of the largest grasses, is raised for the sugar we obtain from the crushed, boiled, and crystallized stems of this plant. When you factor in the indirect ways that we depend on grass for food via grass and grain-eating cows, chickens, pigs, and other animals - it becomes even more evident how important these plants are to our survival. (The root systems of grasses also play a key ecological role in preventing soil erosion.) Have your students grow and compare some of the cereal grasses such as wheat, rice, corn, rye, oats, and barley indoors or in your outdoor garden. You can purchase these grain seeds from garden centers or health food stores. Although they won't grow to maturity indoors under lights, they can provide a backdrop for exploring and experimenting with these essential plants. Ask your students, “Who eats grass for breakfast?” Have them explore cereal boxes to discover the answer.

Throughout history potatoes have been alternately maligned as food fit only for animals and revered as "apples of life." Though they've been often misunderstood, these unassuming tubers kept Incan civilizations thriving, helped fuel the Industrial Revolution, triggered mass population shifts, and are now one of the world's four most important food crops. They are also used to produce paper, adhesive, biodegradable plastics, and even cosmetics. In the classroom and outdoor garden, students might experiment with different ways of getting

potato pieces to grow, test how different preparation styles affect texture and taste, explore and raise some unusual "heirloom" varieties, search for potato products, and try some potato dishes of different cultures.

Have students research the rich histories of some of the following plants and plant groups: amaranth, chile peppers, chocolate, coffee, corn, cotton, dye plants, flax, ginger, gourds, grapes, herbs, horseradish, and trees (as a group or as individual species).

Have students research kudzu, an introduced plant that has become pest plant in the South. Students may be familiar with kudzu, but not realize that it was actually imported from Japan to feed cattle and prevent soil erosion. Have the class brainstorm reasons why Kudzu did so much better here that it became a pest weed. Have the students compared the latitude, climate, and other factors in both countries to make some inferences. They can explore ways in which it is used in Japan as a food source and thickener. Have students research ways it is used in the US.

To inspire creative problem-solving during an herb study, have students imagine they are shipwrecked salvaging only a wooden box of herbs and some seeds. Divide the class into teams and have the teams plan how they will survive suing the herbs and seeds they have. Have students keep a journal of their activities.