3rd Grade Garden Lessons
(From the Center for Ecoliteracy Curriculum Binder)

1. Endangered Species Salad Garden (by Marika Bergsund, c. Growing Great: Inspiring Healthy Eating)

2. Seed Scavenger Hunt (by Maria Sayles, c. The Lesson Pathway Project developed by Education Outside)

3. Making Newspaper Pots (by Maria Sayles, c. The Lesson Pathway Project developed by Education Outside)

4. Map the Garden (San Francisco Green Schoolyard Alliance, c. The Lesson Pathway Project developed by Education Outside)

5. A Human Paper Factory (c. Roberta Jaffe, Gary Appel, *The Growing Classroom*)

6. Three Sisters Garden (c. Growing Great: Inspiring Healthy Eating)

7. Me and the Seasons (c. Roberta Jaffe, Gary Appel, *The Growing Classroom*)

8. I Eat the Sun (c. Roberta Jaffe, Gary Appel, *The Growing Classroom*)

9. 3rd Grade Learning Garden Lessons (c. Captain Planet's Learning Gardens)

These lessons are for your use only. Please do not copy or distribute.

Third Grade Fall Garden—Endangered Species Salad Garden

Objective: This lesson teaches students many of the traditional varieties of vegetables planted by our ancestors, using seeds saved and passed on each year, are in danger of becoming extinct because modern farmers plant primarily hybridized seed only serves one season and that is selected for plants that are shelf stable and more disease resistant. Students learn about the traditions of saving seed, the importance of biodiversity in our food chain, and plant and taste heirloom varieties of common salad vegetables.

Seeds:

Carrots—Nante, plus one of the new purple varieties of carrot if you can find the seeds! Carrots were originally all purple so this is the renaissance of a long lost variety
Radishes—French Breakfast
Lettuce—Two to four different heirloom varieties, such as Black Seeded Simpson, Lolla Rossa, Quatre Saisons, Oak Leaf, Speckles
Broccoli--DiCiccio

Transplants (optional):

Edible Flowers—King James violas are an heirloom variety still commercially available

Lesson:

Today we are planting a special salad garden that we call our Endangered Species Salad Garden. This garden will teach you why certain varieties of vegetables are in danger of becoming extinct and what we can do to save

©Used with permission of Marika Bergsund, Growing Great 2005

them. Everyone will get to plant one type of seed or plant today. Then, you will get to watch your garden grow for the next few months. In January or February after the Winter Holiday break, you will have a special party where you get to harvest all the vegetables from the garden and eat a delicious salad that you grew!

Who knows what an "Endangered Species" is? (take answers). An endangered species is a species of plant or (take answers). An endangered species is a species of animal or plant that is "in danger" of dying out and no longer living on this earth. We think of this usually in terms of animals such as the Panda or Tiger—if the last tiger dies without reproducing a baby tiger, there will never be another tiger on this earth. This is something you will study much more about later in the year.

Plants can be endangered as well. We know that plants reproduce from seeds.

- If a plant grows in only one place and we pave that field and turn it into a shopping mall, could that plant become extinct? Yes!
- What if the seeds of a certain plant never get planted, could that plant become extinct? Yes! Seeds do not last forever—most seeds will not grow into a plant after several years. If a person collects all the seeds for a plant and never plants them, after several years those seeds will die and that plant will become extinct. This is exactly how certain varieties of vegetables, such as types of lettuce or carrots that were planted long ago, are in danger of becoming extinct—farmers are no longer planting some types of vegetable seeds.

We call this our Endangered Species Salad Garden because we are going to plant several of these traditional varieties of vegetables that are no longer being planted by farmers today.

- Not so long ago (100 years only!), there was no Ralphs or Vons—most people grew most of their own food. There were also no plant nurseries or Home Depot to buy seeds. Families grew vegetables for themselves and to share with neighbors. They grew the varieties of vegetables that grew best on their land and that they thought tasted the best.
- So that they could keep growing their favorite vegetables, farmers <u>saved</u> seeds each year to replant the following year. They did this by

©Used with permission of Marika Bergsund, Growing Great 2005

not harvesting the vegetables from some of their plants so that those plants could produce seeds. Then they collected the seeds from those plants and saved them in a cool, dark place until the next growing season.

- If they moved, they would bring the seeds with them and they would share their favorite seeds with friends and family. Many of the vegetables we eat today first were brought to America by immigrants who brought their favorite seeds with them from home—broccoli, carrots, radishes all came to America from Europe.
- Some varieties of these vegetables have been being planted for hundreds of years!
- We call these older varieties of plants "Heirloom Vegetables," an heirloom is something valuable passed down through families.

Modern farmers don't plant these old-fashioned varieties of plants because they are no longer just growing food for their families.

- The food we get from the market comes from giant farms very far away. The vegetables have to be able to travel great distance with out rotting, be strong enough to be handled by machines harvesting in the field or boxing it up for the market, and be resistant to pests and diseases that are more difficult to control on a giant farm.
- Most old fashioned varieties taste best fresh picked so they do not work well for large farms and supermarket sales.
- Because modern farmers no longer plant these heirloom varieties, they are in danger of becoming extinct.

But, just like with animals, people are worried about losing traditional varieties so are working hard to save and keep planting these seeds. Also, many people are rediscovering that these heirloom vegetables taste better. Small farmers grow them and sell them at Farmers Markets directly to customers. We are going to plant some of these heirloom varieties ourselves to see if we think they are any better. I am going to tell you how long the varieties of vegetables were are going to plant have been being grown. Remember this does not mean that the seeds we are planting are 100 years old!!! It means that people have been saving seeds and replanting the seeds each year for 100 years.

- Radish—French Breakfast—came from France in 1880—125 years

©Used with permission of Marika Bergsund, Growing Great 2005

- Carrot—Nantes—came from Europe in late 1800s—over 100 years (purple carrots—carrots originally came from Persia, which is now Iraq and they were purple—today they are reintroducing purple carrot seeds)
- Broccoli—DiCiccio—came from Italy 1890
- Lettuce—Oakleaf—Maryland and Pennsylvania 1880s; Speckles/Freckles—Pennsylvania in 1799; Black-Seeded Simpson—1850; Quatre Saison (French for Four Seasons)—from France in 1885
- Edible flowers—Violas and Pansies became very popular in early 1900s

Garden Rules:

1) IMPORTANT REMINDER: Plants and flowers in the school garden are safe for eating because we plant them specially for food and do not use any chemicals or pesticides that would be harmful if eaten. Children must NEVER eat a plant or flower they find growing anywhere at school, home or in their neighborhood unless their parent or another responsible adult says it is ok!!! Many plants are VERY POISONOUS. Plants are tricky because many look alike. You may think it is a plant that is safe to eat, but it may not be. Also many people put chemical pesticides on their plants to kill bugs or give plants special food called fertilizer that is safe for the plants, but not safe for people. These chemicals are NOT SAFE for people to eat!!!

2) Planting Directions for the Class:

- Students will each get to plant one type of seed to plant
- We will assign each student the type of seed or plant they get to plant
- It doesn't matter what they plant today—the entire class will share the whole salad. They will get to taste everything planted today, and they will not have to eat anything they do not want to eat at the harvest party.
- Students must follow planting directions very carefully. If you plant too many seeds or don't put the seeds in correctly, your seeds will not grow.
- Please be good listeners and learners in the garden. The garden is a classroom just like all the other classrooms at school. Rules like no

©Used with permission of Marika Bergsund, Growing Great 2005

running, yelling, etc apply in the garden as well. Also, there are classrooms nearby so do not disturb.

Planting Directions:

For all seeds: Make rows a 6 inches apart and $\frac{1}{4}$ inch deep. Have students place seeds 1 inch apart in row. Easiest if you hold seeds and students pinch them from your hand/cup one at a time. Do not let students dig holes for seeds—seeds will be planted too deep and will not grow. Have student pinch dirt closed and gently pat down to cover rows after they place their seeds.

For transplants: Assign 2-3 students to each transplant. Plant transplants one foot apart. Students to take turns digging hole (remind them only as deep as potted transplant), removing transplant from pot (turn upside down and tap, catching plant as it falls out v. pulling out of pot by neck of plant), and placing in hole, adding and patting down dirt around it.

©Used with permission of Marika Bergsund, Growing Great 2005

Third Grade Fall Garden Planting

This week your 3rd graders will participate in the GrowingGreat Garden program. The students will work with our garden coordinator and parent volunteers to learn about our fall plantings and sow seeds in a garden box. *All activities through the GrowingGreat Garden program support California State Standards in science, language arts, or social studies.*
Here are the details for your fall planting:

Heirloom Vegetable (Endangered Species) Garden

This special garden features "endangered," or "heirloom," species of salad vegetables including radishes, carrots, broccoli and four different varieties of lettuce. This garden project teaches students that few people today grow their own vegetables. We rely on produce that is grown by large-scale farms, which primarily grow modern, hybridized varieties of vegetables designed to be resistant to insects/disease, withstand travel and extensive handling and packaging, and have a long shelf life. Traditional heirloom varieties of vegetables do not meet these requirements. As a result, many varieties of vegetables that our ancestors planted are sadly at risk of being lost forever. These heirloom vegetables are valuable because of the historical tradition of passing down seeds through the generations, and also because they are often the tastiest and most nutritionally potent of all vegetable varieties. Without people like us to plant these seeds, we would lose them forever!

This garden supports the California State Science Standards:

2D: Understand when the environment changes, some plants and animals survive and reproduce, and others die or move to a new location.

2E: Understand some kinds of organisms that once lived on Earth have completely disappeared; some of these resemble others that are alive today.

2F: Understand the intra-reliance of living things upon each other.

Please visit the garden throughout the fall and winter to see how your plants are doing. We will plan a harvest party in late winter.

©Used with permission of Marika Bergsund, Growing Great 2005

Seed Scavenger Hunt

Created by Marie Sayles, Garden Educator
Sunset Elementary, San Francisco Unified School District

Lesson Summary

In this lesson, students take a seed scavenger hunt to find seeds in the garden.

Lesson Objectives

Students will be able to:

- Collect and identify seeds in the garden.
- Understand why seeds need to travel.
- Enjoy the school garden as a classroom.

Assessments

Students will:

- Collect and/or illustrate five seeds from school garden.
- Describe the seed by physical characteristics: shape and color.
- Describe how the seed travels from its' parent plant.

Materials

- Clipboards and pencils
- Clear tape
- Activity Worksheets per student (or per group)
- Trays or containers for seed collection
- Magnifying glasses

Before You Begin

Familiarize yourself with what seeds are around the garden. Look for seeds in as many different plants as possible. Most plants go to seed in the fall, look for common plants as California poppy, Douglas Iris, nasturtiums, Evening Primrose, Pink Currant. Weeds are also a great source, especially air traveling seeds, such as Dandelion. You can also get fruit from that day's school lunch, if available.

PROCEDURES

1. Introduce students to the basics of seeds. Read a book such as: **From Seed to Plant** by Gail Gibbons, **A Seed is Sleepy** by Dianna Hutts Aston or **A Fruit Is a Suitcase for Seeds** by Jean Richards.
2. Ask for a few volunteers and choose four students to stand in front of the class. They will be "seeds" and start by "planting" them (have them squat on the ground) close together. Ask the other students to be "rain" and "sun" (using their hands) to help the seeds to grow into plants. When the students start to stand up and put their hands out, them should be crowded together, competing for sunlight and rain. Pick one or two students "plants" that will not survive. Now choose another four students and plant them a few feet apart. Repeat the rain and sun actions. All the students (plants) should have enough space to grow.
3. Now ask the students to think about why they think seeds need to protect themselves and how and why they travel away from the parent plant. Write down their answers and come up with a list of all the ways that seeds can travel, including: wind, pods bursting, water, animal fur, eaten in a fruit.
4. Tell the students that they are going on a seed scavenger hunt. They will be looking for seeds in the garden, trying to find seeds that travel in different ways. Review the activity worksheet with the students, and send them off in pairs or teams to go seed hunting!
5. Have extra seeds or fruit on display for the students.
6. Gather the students at the end of class to review the seeds they collected and discuss how they think the seeds travel.

RESOURCES

All About Seeds
http://urbanext.illinois.edu/gpe/case3/c3facts1.html

Hidden Villa Classroom: Seed Sensations
www.hiddenvillaclassroom.org/curriculum/curriculum-for-your-school-garden/first-grade/seed-sensations

Seeds

Name ______________________________ Room ______________

Write down plant name, then DRAW or tape your seed.	What COLOR is it? Brown - Green Black - White	What SHAPE is it? round - square - oval - line	How does it TRAVEL? Wind/Air - Animals eat - Falls to Ground - - Pops out of pod -
Name: ________			
Name: ________			
Name: ________			
Name: ________			
Name: ________			

Making Newspaper Pots

Created by Marie Sayles, Garden Educator
Sunset Elementary, San Francisco Unified School District

Lesson Summary

In this lesson, students will learn how to make a newspaper pot and plant seeds.

Lesson Objectives

Students will be able to:

- Follow instruction to make a newspaper pot.
- Participate in class activity.

Assessments

Students will be able to:

- Make a newspaper pot independently
- Properly plant and label one or two seeds.

Materials

- Seeds
- Newspaper sheets (1-2 per student)
- Watering cans/spray bottles
- Potting soil
- Masking tape
- Labels and permanent markers

Before You Begin

Have all materials easily accessible for students.

- SOIL: Fill a wheelbarrow with potting soil and with 3-4 trowels ready.
- SEEDS: Have seeds out in labeled containers or use paper lunch trays and put seed name on the side.
- WATER: Set up watering station with full bucket or tub and small watering cans or cups. Or, make "seed sprinklers" by putting holes (with a push pin) into the top of plastic bottle. Fill with water and simply squeeze to water plants.
- LABELS: Get creative with labels by using popsicle sticks, cut up plastic jugs in strips, clothes pins or make "plant flags" by folding masking tape in half over a stick. Have lots of colors of sharpies on hand!
- CONTAINERS: Have all supplies ready to make the newspaper pots. Have one or two pots made as samples and for demonstration.

PROCEDURES

Remind the students what seeds need to grow. Discuss how seeds need to stay warm and moist/wet to start to grow (germinate). Tell the students that we will be making pots out of newspaper today and ask for reasons why this is a good idea, such as: it is recycling material, not using plastic pots, don't have to buy something new, can plant directly into the ground. Gather students together and demonstrate how to make a newspaper pot.

Instructions for making a paper pot

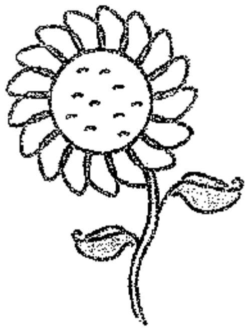
1. Place the 1/2 sheet of newspaper flat on to a table, with the longest edge of the paper at the top of the table.
2. Fold the paper in half lengthways with the folded edge nearest to you (I call this a "hot dog" fold).
3. Turn the paper so that the folded edge is to the left – this will be the top of your finished pot.
4. Place the yogurt pot/soup can/glass jar on the newspaper with the opening of the pot to the left, leaving a 1-2 inch gap between the bottom of the pot and right-hand edge of the newspaper. Tightly roll away from you. Tape side of pot.
5. Place the pot upright with the opening of the pot placed downwards on to the table. Fold the remaining paper in neatly and firmly to make the base of the pot in four neat folds (like wraping a present!). Tape bottom. Have student write name of seed and their name on pots.
6. Turn the pot over and clasp carefully and extract the can/jar.

Once the pots are made have directions for planting written clearly, with illustrations, on a whiteboard for them to follow along. Repeat instructions slowly for younger students.

1. Make your pot.
2. Fill to the top with soil.
3. Get 3 seeds. (or a pinch with smaller seeds)
4. Put seeds on top of soil.
5. Gently press the seeds into soil.
   (remind them that larger seeds need to be planted deeper)
6. Water slowly. (until it begins to drip from bottom)
7. Make a label for your plant.

Put the pots on trays to bring back to the classroom. Make sure the teacher has watering device (spray bottle works well) and have the students set up a schedule to water regularly. The soil should not dry out, so don't leave them in direct sun. Once the seedlings have appeared, move them to a sunny spot to grown into strong and healthy plants!

Sample Note to send home to families. If you are sending pots home, don't have the students water them at school. Put newspaper pots in paper lunch bags or plastic bags to keep soil from spilling out.



Newspaper Flower Pots

Dear Families,

Your child has made a "recycled" flower pot out of newspaper, containing two sunflower seeds. You can set the pot in a sunny spot inside, on a plate or plastic lids to prevent leaking.

Water every few days. When the plant is a 5-6 inches high can be put into the ground or in a bigger pot. The paper will gradually break down in the soil. The sunflowers can grow 3-4 feet high over the next 4 months.

Map the Garden

From the San Francisco Green Schoolyard Alliance

OBJECTIVES

Maps can be used to see the relationships between elements in a specific area, such as where a school is located within a city. Students will map their school garden in relation to their school and schoolyard, labeling the directions and appropriate features.

Grade Level	3rd-12th
Time	30-45 minutes
Materials	• Journals • Clipboards • Pencils and markers or colored pencils • Examples of maps: simple and to-scale • Compass
Standards Met:	*Science* • Earth Sciences • Investigation and Experimentation

Vocabulary:

Cartography
Geography
Key
Scale
Orientation

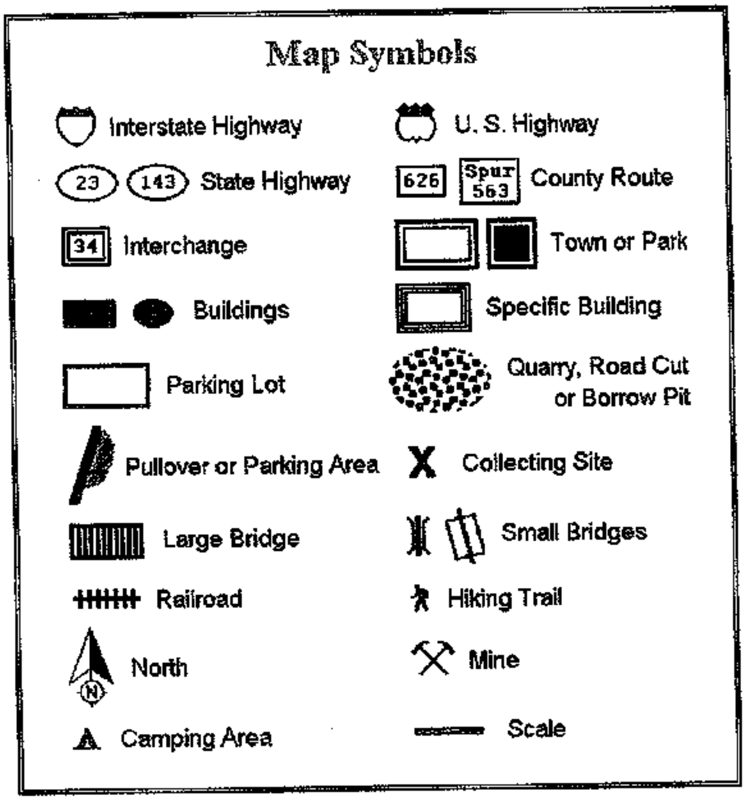
Key Concepts:

- Maps are useful in understanding spacial relationships between geographic features in an area
- Maps help show you where you are in the world
- Maps can guide you where you want to go
- Maps can help you analyse a place
- Maps can inspire you to think of new projects and where you could locate them on the schoolyard or at home

BACKGROUND

A map is visual representation of an area. They are often used to depict **geography** and help us see relationships between natural elements in that area, such as mountains, lakes, streams, oceans, bays, and built elements such as houses, streets, or schools. Understanding your local geography is important for getting a sense of your place on planet Earth.

Most maps have a **key** that defines what objects and features are illustrated, such as roads, trails, buildings, or bodies of water. The key also has a **scale**, which tells the reader of the map how to relate the distances on the page to actual distances on the ground. For instance, and scale of 1:100 ("one to



An example of a map "key."

one hundred") could mean that one inch of distance on the map equals 100 feet of distance on the ground. Lastly, a map has a direction symbol or compass that gives the map its correct **orientation.**

Cartography is the art of creating maps. Today, each student will become a cartographer by making a map of the garden in relation to their schoolyard.

PROCEDURE

Begin by asking your students what a map is and what it can be used for. Discuss what a bird might see flying over the garden (a bird's-eye view). Draw it on the board. This is a *rough* map, not exact, but it illustrates the general relationships between features around you. What direction is north? South? East? West? What streets border our school and garden? Lable these elements on the map. Discuss what a map "key" is and show them an example, such as the one above. Show the students the examples of maps that you have, from simple maps to more complex, to-scale maps.

Give each student their garden journal, along with a clipboard to write on. Tell them that they are now cartographers and will be making a map of the school garden. They will also need to show where the garden is in relation to the rest of the school. Ask them to include a key on their own maps, along with a compass indicating the correct orientation. Students may use colored pencils or markers to enhance their map details: beds, cistern, fences, hoses, seating, entry way, shed, etc.

When they have finished a rough map of their school garden and schoolyard, have each student pair up with another student to share and discuss their map and its details.

DISCUSSION

- What streets boarder our garden or school?
- What direction is north? South? East? West?
- What features does our garden contain?
- Where do we enter and exit the garden?

EXTENSIONS

1. What if you had to use your map to find your way around the schoolyard or in the garden? With your partner, ask him or her to find a certain feature that is represented on your map, using your map as a guide.
2. If you could add a new feature to your garden or schoolyard, where would it be located? Ask students to think about what they would add and where it could go (i.e. new beds, a cistern, compost, etc.), placing it on the map.

See the following lesson for more work with maps and using maps to identify features and location.

Sources:

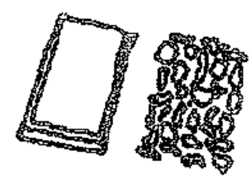
The San Francisco Green Schoolyard Alliance, Rachel Pringle, 2009. www.sfgreenschools.org
Map symbols courtesy of New Jersey Department of Environmental Protection
http://www.state.nj.us/dep/seeds/sect6.htm

INDOORS ❀ GRADES 3-6 ❀ FALL, WINTER, SPRING ❀ PROJECT

A Human Paper Factory

DESCRIPTION

Students make their own recycled paper.



OBJECTIVE

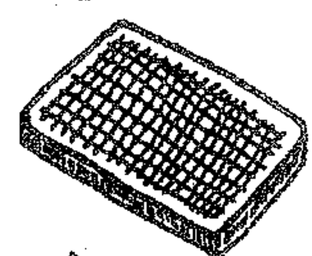
To demonstrate recycling.

TEACHER BACKGROUND

This simple art project is well worth the gathering of materials. In making their own paper, students get a full understanding of what happens to paper that is recycled. Add a few colored sheets to the blender mix and see what happens! You'll soon develop your own designer paper.

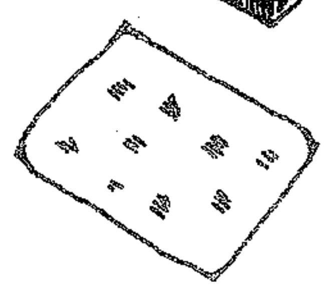
MATERIALS

- ❀ Bucket or plastic tub
- ❀ Blender
- ❀ Sheets of used white writing paper
- ❀ Large pan at least 2 inches (5 cm) deep
- ❀ Fine mesh screen cut to fit inside the pan
- ❀ Piece of cloth or old bed sheet
- ❀ Sponge
- ❀ Sunshine



CLASS DISCUSSION

Paper that has been used once can be recycled and made into new paper. How is this done at a factory? Guess the steps involved in remaking paper. *(Write students' ideas on the board for later comparison.)*



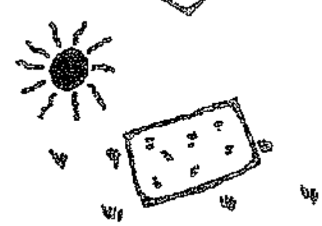
ACTION

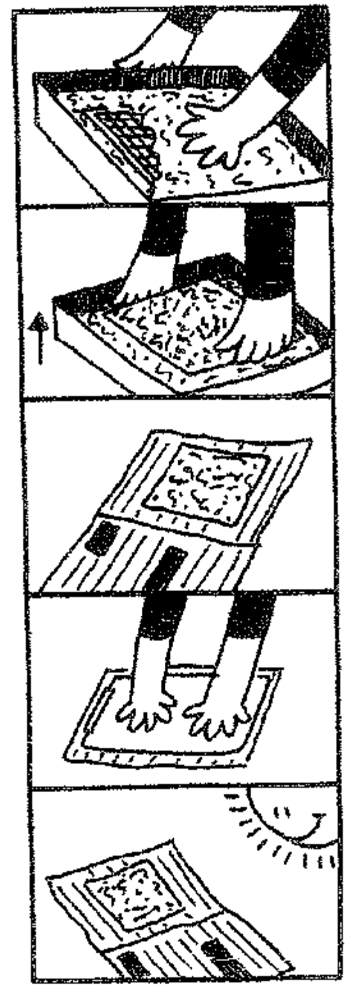
Have students make paper according to the following directions.

1. Tear paper into small pieces.

2. Fill a bucket or tub with warm water and add paper to it. The ratio should be one part paper to one and one half parts water.

3. Soak the paper until the pieces are soft.





4. Fill blender 2/3 full of the water and paper mixture.
5. Blend until the paper dissolves into a thin pulpy texture.
6. Fill the pan with 1 inch (2.5 cm) of water and set screen inside it.
7. Pour the watery pulp onto the screen.
8. Swish and shake the screen under the water to spread the pulp evenly. This is the most important step. If the layer of pulp on the screen is too thick you will end up with cardboard instead of paper.
9. Carefully, slowly lift the screen out of the water. Let water drip through.
10. Set the screen on a flat surface and place a cloth over the paper pulp on the screen. Press a damp sponge on top of the cloth to remove as much excess water as possible.
11. Flip the whole thing over and remove screen.
12. Place the paper on the cloth in the sun to dry out.
13. When dry, peel the paper off the cloth. It is ready to use!

WRAP UP

How do you think recycled paper is used? *(paper towels, cardboard, newspaper, toilet paper, notebook paper, office paper)* Why is it important to recycle paper? *(saves trees and reduces the amount of trash that goes to the landfill)*

Third Grade Spring Lesson

Three Sisters Garden

Objective:

Students will learn (1) folklore and practical use of traditional Native American Three Sisters plantings of corn, bean and squash, (2) different plant species have different growing habits and needs, and (3) Native Americans used complementary plantings of multiple plant species and symbiotic relationships between plant species to help their food grow more successfully than if they had grown the plants separately.

California State Content Standards:

1) Science Standards

3. Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

- a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
- b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
- c. Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.

2) Social Science

3.2: Students describe the American Indian nations in their local region long ago and in the recent past.

1. Describe national identities, religious beliefs, customs, and various folklore traditions.
2. Discuss the ways in which physical geography, including climate, influenced how the local Indian nations adapted to their natural environment (e.g., how they obtained food, clothing, tools).

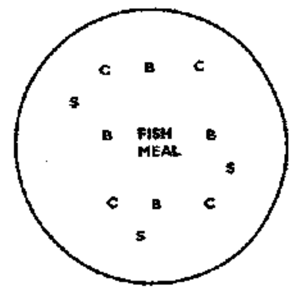
Lesson Outline:

A. Lesson
- a. History of Three Sisters
- b. Draw Three Sisters Planting diagram
- c. Discuss complementary growing habits of Three Sisters

B. Garden Rules

C. Planting Plans

D. Plant



Three Sisters Planting diagram

©Copyright Growing Great 2008

Seeds/Supplies:

Corn—preferably colored Indian corn
Pole Beans—Romano or Kentucky Wonder
Squash—zucchini or summer squash
Fish meal fertilizer

Lesson:

Corn, beans and squash were the primary agricultural foods planted by many Native American peoples. Traditional Native American planting of these three food crops together helps all crops grow better than they would if planted apart. For great stories and enrichment activities, use **In the Three Sisters Garden** *by Joanne Dennee.*

Here is how the sisters help each other grow:

1) Corn helps her sister Bean by providing support for beans to climb. Beans are a climbing vine; corn is a tall skinny plant.

2) Bean helps her sisters Corn and Squash by providing natural fertilizer, which means plant food, in the soil. Nitrogen is necessary for all plant growth—most fertilizers sold in the store are mainly nitrogen. Beans are special plants that can put nitrogen in the soil. They are "leguminous" plants—this means they absorb nitrogen from the air and release it back into the ground through their roots. Corn and squash grow better because they can absorb the nitrogen that beans release into the soil.

3) Squash helps her sisters Corn and Bean by using her large round leaves to shade the ground. This keeps the soil around the roots cool and protected so less water evaporates from the soil. This was especially important in the Southwest, which is a very dry, desert environment.

4) Finally, Native Americans would use fish heads and bones leftover from their meals to fertilize the soil. They would put them in the bottom of the mound and plant the three sisters on top. As fish parts decomposed, they would fertilize the crops.

Planting Directions:

Ten Students for Each Three Sisters Mound Planting

1) Make a circle two feet in diameter, approximately three feet from the next closest circle. If this is being planted in a container, the container serves as the circle and the mound (described in #3 below).

©Copyright Growing Great 2008

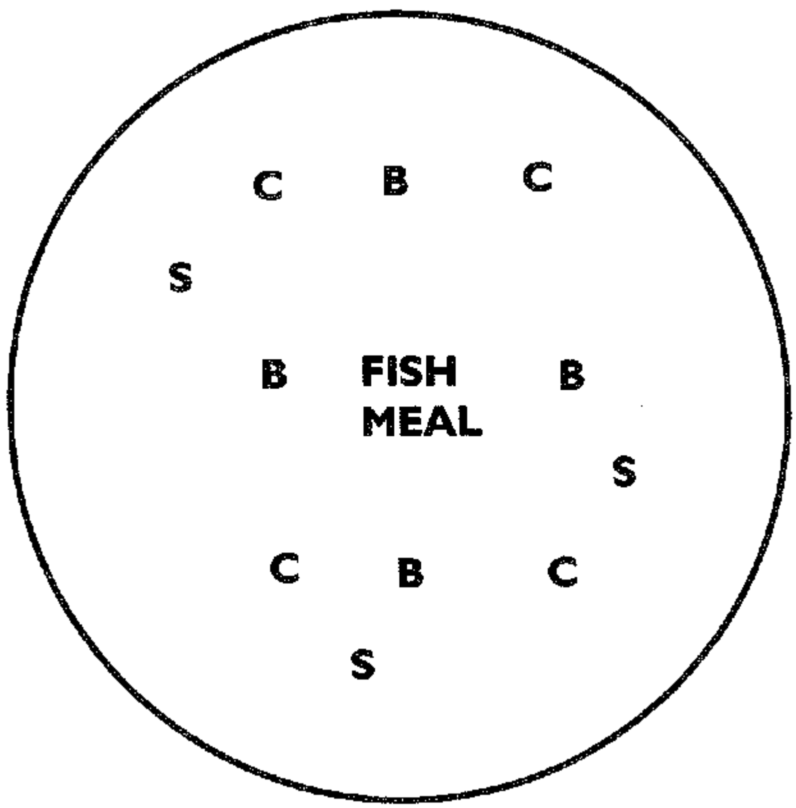
2) Sprinkle fish meal in circle—1 student.

3) Build 2 inch tall mound, looking like a "mesa" or flat-topped mountain typically found in Southwest, in circle—2 students. If planting in containers, have 2 students turn potting soil to aerate it and mix in the fish meal, and then spread it flat.

4) All seeds get planted 1 inch deep, having students insert their finger up to first knuckle to dig hole. Space seeds approximately two inches apart. Students should not cover their seeds until all have been planted so everyone can see where the others' seeds are.

a. Plant four corn (C) seeds in a square—2 students
b. Plant four bean (B) seeds, one on each leg of square—2 students
c. Plant three squash (S) seeds all around outside of square—3 students
d. Squash planters cover all seeds by pinching holes closed.

5) Cover with seed starter cloth and water.



©Copyright Growing Great 2008

Third Grade Spring Lesson

Three Sisters Garden

Today your class will be planting a Three Sisters Garden, which is a traditional Native American planting method for growing corn, beans and squash. The students will learn that the Native Americans used a complementary planting design growing these crops together that encouraged the plants to grow more successfully than they would have grown if planted separately.

1) Corn provides support for the bean vine to grow up.
2) Beans absorb nitrogen from the air and release it into the soil as fertilizer for corn and squash.
3) Squash leaves shades the soil and plant roots to keep them cool and retain needed moisture in the soil.
4) Native Americans added leftover fish parts to soils as additional natural fertilizer.

This lesson teaches both third grade Science (Life Science) and Social Science (Native American) Content Standards.

California State Content Standards:

1) Science Standards

3. Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.
b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
c. Students know living things cause changes in the environment in which they live: some of these changes are detrimental to the organism or other organisms, and some are beneficial.

2) Social Science

3.2: Students describe the American Indian nations in their local region long ago and in the recent past.

1. Describe national identities, religious beliefs, customs, and various folklore traditions.
2. Discuss the ways in which physical geography, including climate, influenced how the local Indian nations adapted to their natural environment (e.g., how they obtained food, clothing, tools).

Please visit the garden regularly to watch your garden grow! Hold an Open House in June to talk to your students about their garden.

©Copyright Growing Great 2008

INDOORS ❀ GRADES 2-3 ❀ FALL, WINTER, SPRING ❀ ACTIVITY

Me and the Seasons

DESCRIPTION

Students construct a pictorial wheel depicting seasonal differences in their activities, clothing, and environment.

OBJECTIVE

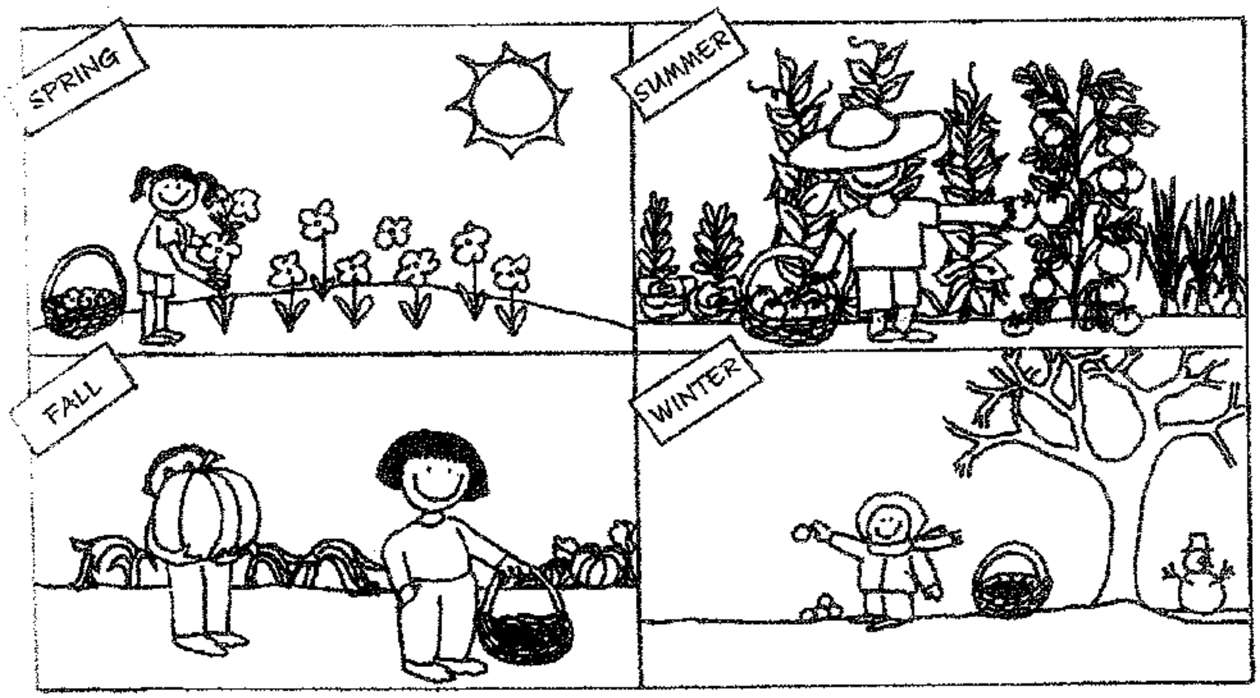
To reinforce the cycle of seasons and identify different clothing and activities that correspond to the different seasons.

MATERIALS

- Two sheets of construction paper per student
- One set of blackline masters for Wheel Part 1 and Wheel Part 2 per student, pp. 393-394
- One pair of scissors per student
- Paste
- One brad per student
- Crayons or colored pens

PREPARATION

Make copies of the two blackline masters so that each student has both.



CLASS DISCUSSION

Ask students to name the four seasons *(write them on the board)*. What kinds of weather are characteristic of our region during each season? Name some activities you do during each season. Discuss with the class how weather for different seasons varies around the world.

ACTION

1. Give each student two sheets of construction paper and a copy of each blackline master. Have them cut out the circles and paste them onto the sheets of construction paper.

2. Have students trim off excess construction paper, leaving a 1/2-inch (1.3-cm) border around the edge.

3. Have students cut out the window in circle 1.

4. Have students color in the pictures illustrating each season on circle 2. These pictures represent activities children in different parts of the world do during each season.

5. In the blank area beside each picture, have students draw an activity they do during that particular season.

6. Have students place circle 1 over circle 2 and insert the brad through the center.

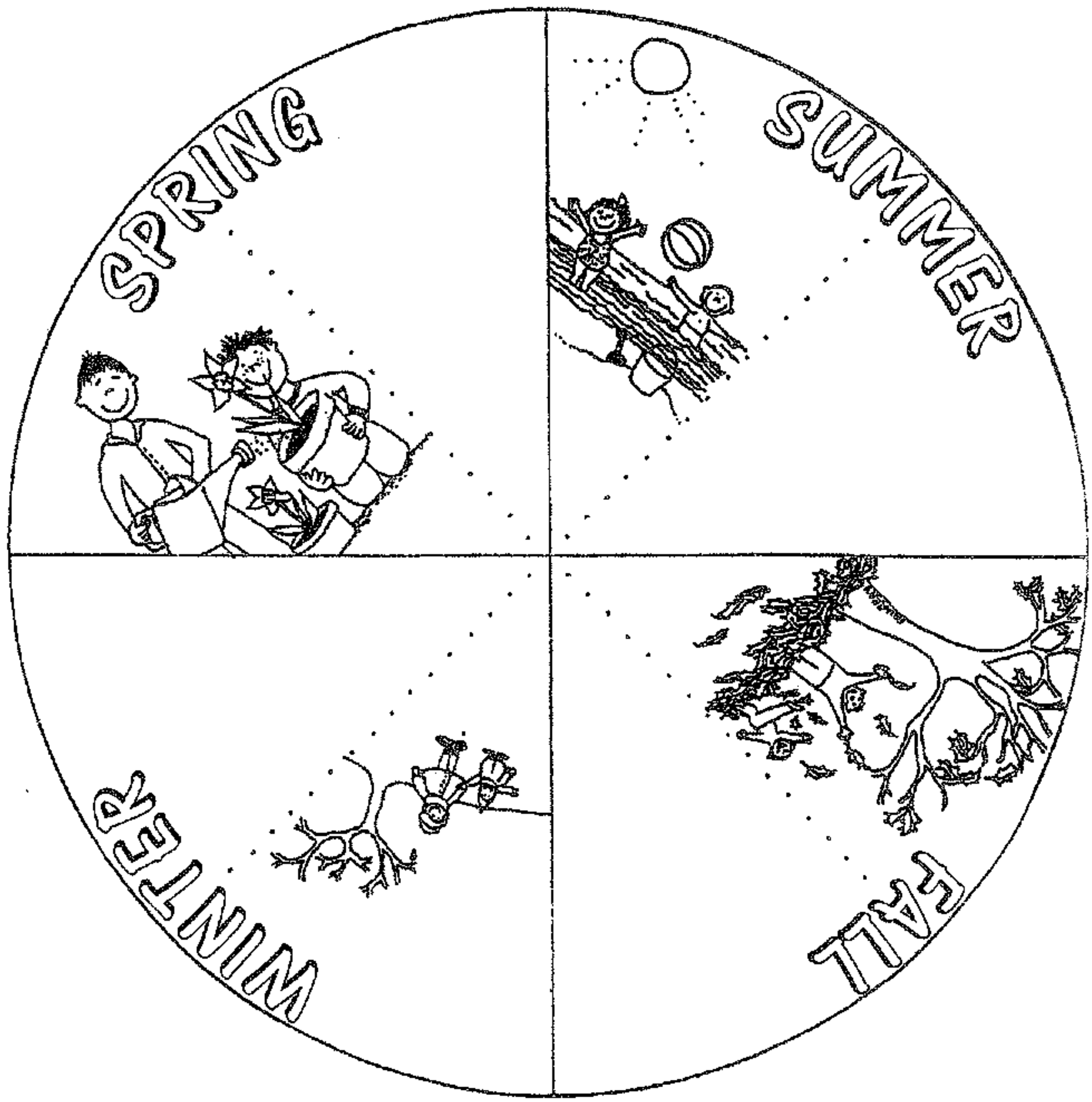
7. Give students time to explore and play with their wheel.

WRAP UP

Ask students how the weather seems to be different in each picture on the wheel. How is the clothing different? What different activities are shown? Why are the seasons in a circle?

☼ Wheel, Part 2

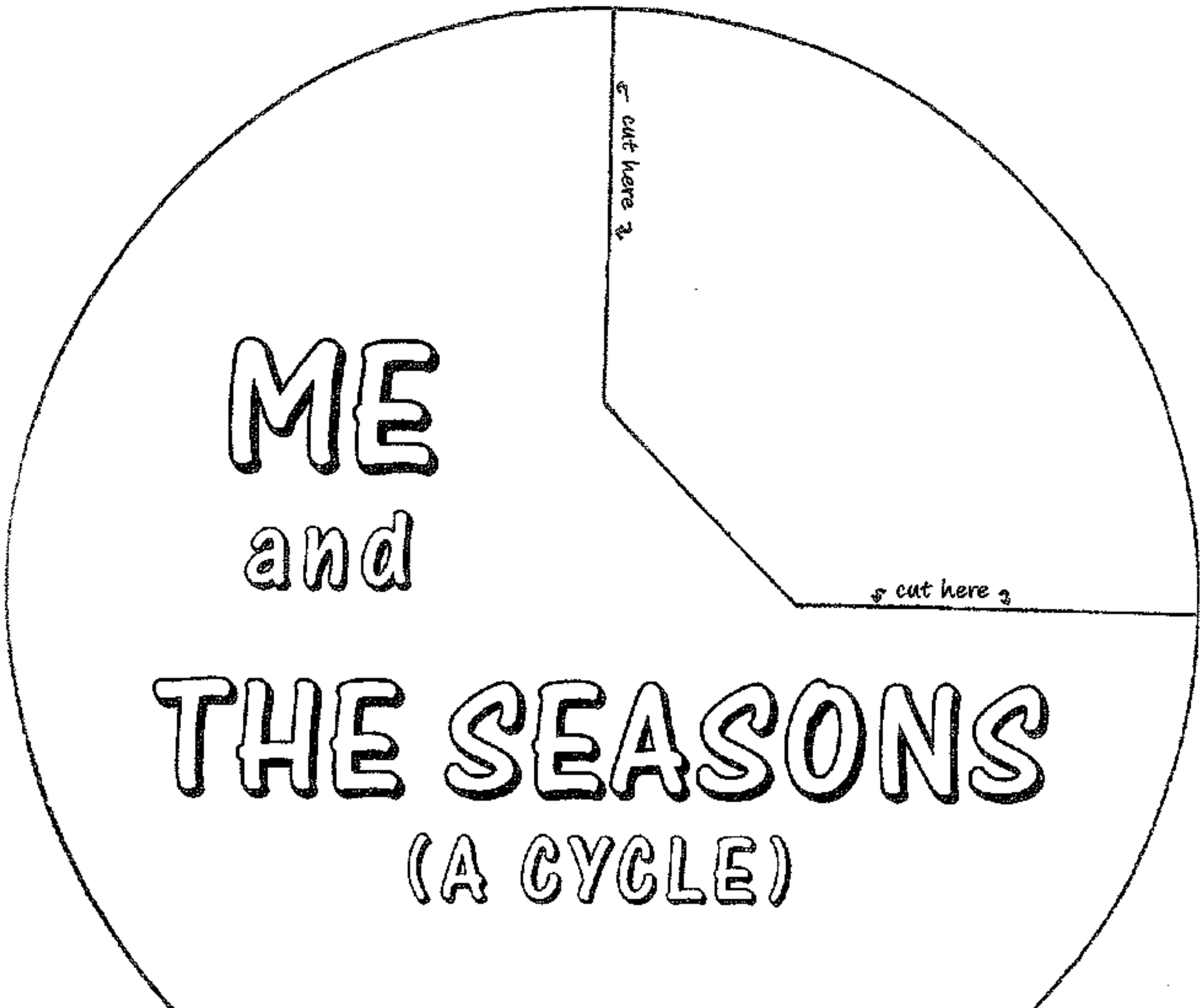
(From: Me and the Seasons, p. 187)



 ©Copyright Life Lab Science Program, Inc. (Published by the National Gardening Association)

☼ Wheel, Part 1

(From: Me and the Seasons, p. 187)



 © Copyright Life Lab Science Program, Inc. (Published by the National Gardening Association)

INDOORS ❀ GRADES 3-6 ❀ FALL, WINTER, SPRING ❀ ACTIVITY

I Eat the Sun

DESCRIPTION

Students are given labels so that they can group themselves into a food chain.

OBJECTIVE

To illustrate the concept of a food chain.

MATERIALS

Scraps of paper with the following labels (adjust the total number to your class size):

- 1 – sun
- 14 – plant
- 18 – microorganism decomposer
- 4 – snail
- 2 – chicken
- 1 – coyote

TEACHER BACKGROUND

All living organisms depend on energy from food. A chain is created as one organism consumes another to get its food. Every organism is part of a chain. Every chain begins with the energy from the sun, which is needed by plants to make their own food. The first two links in a food chain will always be the sun and a plant. The food chain is also a cycle. Consumers at the top of the chain, such as coyotes, will provide energy for decomposers who break down organic matter, putting nutrients back into the soil to nourish plants.

CLASS DISCUSSION

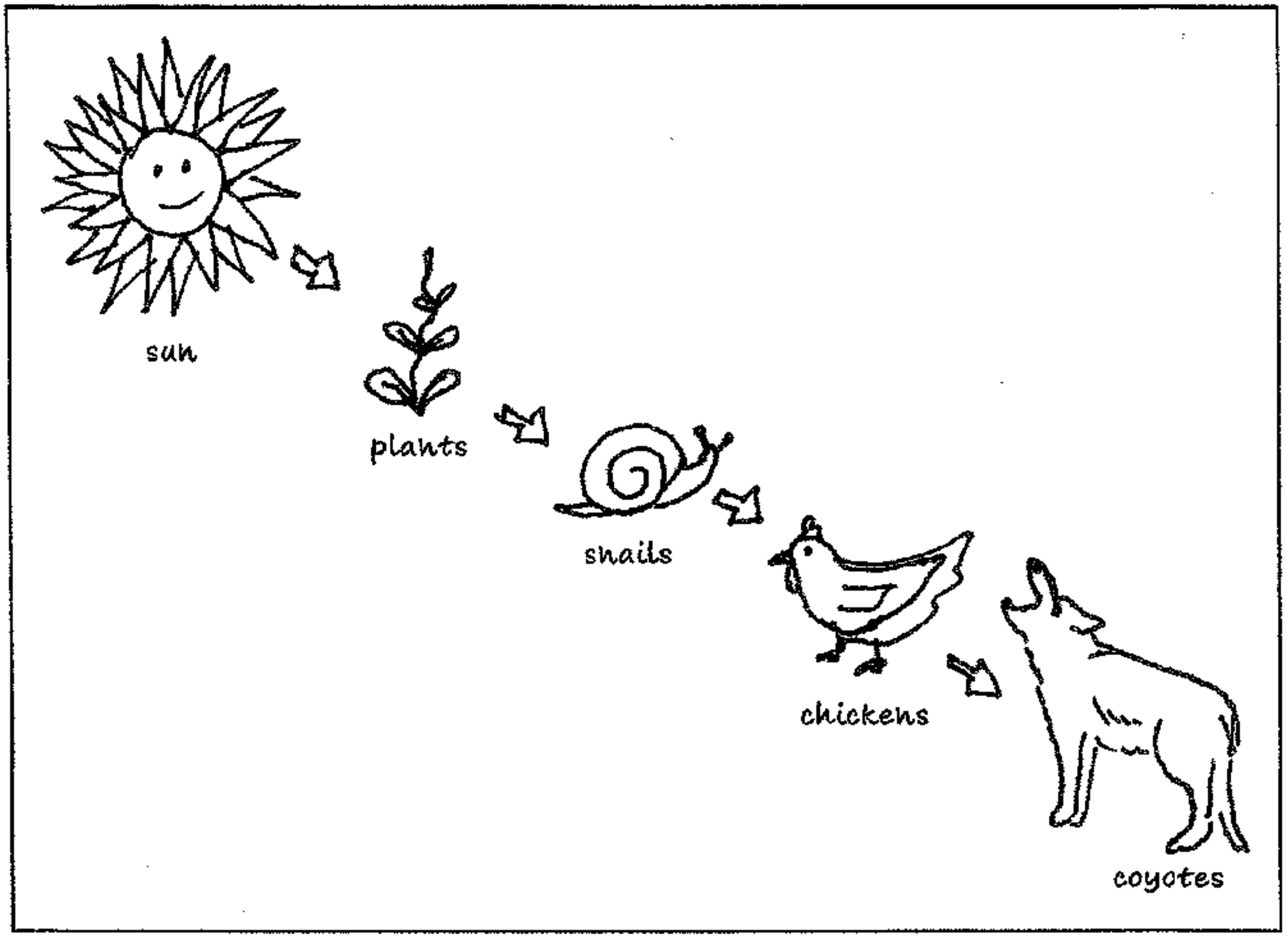
Name one of your favorite foods. *(Write a healthy response on the board.)* Why is this food important to your body? What was this before you ate it? *(plant or animal)* Did it need energy to grow? Where did it come from? *(Trace examples of the food chain back to a plant and the sun, and draw the chain on the board.)* Everything is linked together in a food chain. *(Try other examples if desired.)*

ACTION

1. Pass out one labeled paper to each student. Tell them to group themselves with the other students who have the same label.

2. Ask the groups to put themselves in order according to who feeds whom.

3. After students are in order, have each group, beginning with the sun, say who they are and whom they feed. For example, "*I am the sun, and I feed the plants.*" Who does the coyote feed?



WRAP UP

What do all food chains start with? Why? Why are there more snails than chickens? How can the chain be broken? How is the chain a cycle? Can you name a food chain that we are part of?

3d Grade Learning Garden Lessons: Student Pre- and Post-Test

Date: ______________ Name: ____________________ School: ________________

Circle one: PRE or POST

Worm Your Way Out of This

Draw a worm and label its parts:

What is compost? ____________________

What is soil made of? ____________________

Why would you want worms in the garden? ____________________

Shape Shifters in the Math Garden

What is perimeter of an object? ____________________

Draw an object with a perimeter of 8 units.

Draw a different-shaped object with a perimeter of 8 units.

What is the area of an object? ____________________

Draw a shape that has an area of 4 square units.

Draw a different-shaped object with an area of 4 square units.

Solar Cooking Race

What is 'temperature'? ____________________

What is 'insulation'? ____________________

Give an example of heat moving by radiation ____________________

Give an example of heat moving by convection ____________________

Give an example of heat moving by conduction ____________________

Healthy Eating

Do you 'eat healthy'? __________ What is a healthy food you like to eat? ____________________

Going Outside

Do you like being outside at school? yes no Why? ____________________

Learning

Do you like learning outside? yes no Why? ____________________

When you are at school, is it easier to learn things inside the classroom or outside? ____________

What do you like to learn about? ____________________

Do you learn more easily when you make and do things? or when you read? ____________

NOTE TO TEACHERS: Please mail this pre- or post-test to Captain Planet Foundation at 133 Lucky Street, Atlanta, GA 30303. Cobb Co. teachers may send tests to Sally Creel via CCSD mail. Include teacher name to be included in a drawing for prizes and resources. Also, we'd appreciate your tips and suggestions on Learning Garden lessons you teach: http://captainplanetfoundation.org/learninggarden-resources/

Lesson 1: Shape Shifters in the Math Garden

LEARNING

Grade
3

Standards
MCC3 MD2, MD3,
MD4, MD8

Time
90 minutes over 1 or 2 days

Supplies
(per student)

For Worm Safari

• metric measuring tape • bug catchers • magnifiers • forceps
• journal • Earthworm Anatomy
• Earthworm Groups Earthworm I.D.
• 4 liter (1 gal) jugs • ground yellow mustard • computer and Internet

For Food Critic

• Food Critic Review Sheet
• tasting plate

For RainGauge

• rain gauge • beaker /measuring cup

For Measurements

• scissors to cut string
• tiles (2-d squares) • scale

For Shape Shifting

• 254+ cm (100+") string, with extra length to tie
• bamboo skewers

(per class)

• rain gauge
• 5 types of vegetables or fruits, harvested for taste-testing
• 4 spray bottles to keep worms wet

Overview
Third grade students will explore measurement in the garden.

What they will learn

• Measure lengths to fractional mark
• Estimate and measure mass
• Estimate and measure volume
• Represent data in graphs
• Relationship of perimeter to area
• Ways to care for the Earth

How they will learn it

• Worm Safari to hunt longest worm
• Guess and weigh garden veggies
• Guess and measure rain gauge
• Taste-test food and graph ratings
• Design gardens same perimeter different area; design gardens of Care same area different perimeter.
• Build garden in best shape for space

Essential / Guiding Question
How can we create a garden that provides the largest and most useful shape for the space?

Engaging Students
Worm Safari: MCC3MD4

Take students to the garden for a Worm Safari. Declare a contest to find the longest worm. Worms will be measured or to the nearest 1/4" (or 1 cm).

Exploration
Food Critic: MCC3 MD3

Students will taste-test five edible items from the school garden, describe and rate the taste of each, prepare a picture graph of their own ratings, and create a bar graph that collects the entire class' data regarding one food, using an online web site.

Rain Gauge: MCC3MD2

Students will note the inches of rain in the rain gauge, and then predict the volume of water collected in milliliters, pour it into a beaker (or measuring cup), and record.

Massive Measurements: MCC3MD2
Students will estimate the mass of garden veggies and fruit before weighing them. Students will hold objects of various masses to practice guessing.

Engineering Challenge: Students will predict the relationship between perimeter and area. Given a specific amount of lumber for the sides of a raised bed, students will design two garden designs with the same perimeter: one with the largest possible area for planting, and one with the most convenient shape for student gardeners to reach. They will draw or create scale models of their designs using string to represent the sides and bamboo skewers as the corners, and then calculate the area of each design with square tiles and compare.

Explanation
Students will show their measurements and charts, explain the data, and articulate concepts.

Debriefing
Sub-unit marks on a ruler allow measurement with greater precision.
- Masses of solids and volumes of liquids can be estimated in g, kg and l units.
- Data is more easily interpreted when graphically presented in picture graphs, bar charts.
- Shapes that have the same perimeter do not necessarily have the same area. A square is the largest area/perimeter.

Environmental Stewardship
Students will apply knowledge learned in this lesson to care for the Earth by designing a garden of a given area, to maximize planting space AND be accessible to student gardeners.

Evaluation
Students will demonstrate ability to measure length to the nearest cm or 1/4 inch; estimate mass in g, kg, and l; measure liquid volume; display data in a bar graph; and explain the relationship of perimeter to area.

CONTEXT FOR LESSON ACTIVITIES
Standards
Math Common Core
MCC3MD2 Measure and estimate liquid volumes and masses of objects using standard units of g, kg, and l.
MCC3MD3 Draw scaled picture graph and scaled bar graph to represent a data set
MCC3MD4 Measure lengths using rulers marked with 1/2 and 1/4 in and show data by making a line plot
MCC3MD8 Exhibit rectangles with same perimeter and different areas or v.v.

Background Information
Earthworm sampling methods: http://www.nrri.umn.edu/worms/research/methods_worms.html
Calculating different areas with same perimeter, and vice versa:
http://investigations.terc.edu/library/common_core/3U4_Session.pdf

Teacher Preparation
1. Assemble supplies and materials needed for lesson; ask students to bring in empty gallon jugs, cleaned and rinsed.
2. Divide class into pairs of students.
3. Make copies of the following hand-outs for students (or provide online access during measurement activities)
    a. Earthworm Anatomy http://www.nrri.umn.edu/worms/identification/anatomy.html
    b. Earthworm Species http://www.nrri.umn.edu/worms/identification/ecology_groups.html
    c. Earthworm I.D. http://www.nrri.umn.edu/worms/downloads/identification/ecological_groups.pdf
    a. Food Critic Review Sheet
    b. Rain Gauge and Massive Measurement Data Charts

4. Provide access to Internet for students, if bar graphs are to be made online.

PROCEDURES FOR LESSON ACTIVITIES

'for each pair of students)

Worm Safari

- Divide students into pairs and assign each pair to a part of the garden for the Worm Safari.
- Provide hand-outs (Earthworm Anatomy, Earthworm Species, Earthworm I.D.).
- Direct students to Earthworm Sampling Methods web page or explain the protocol for bringing worms to the surface without harming them:
  - Mark a one square foot section of the garden .
  - Estimate the number of liters that will fit in a half gallon jug, and pour water in the jug to measure.
    - Mix 40 g (1/3 cup) of dry ground yellow mustard in 4 liters (1 gal) of water.
    - Pour the solution, 1/3 gallon (or 1 liter) at a time, over a 1 square foot area of the garden.
    - Use forceps to gently remove only those worms that fully surface between pourings.
    - Collect worms in bug catcher and spritz with water to keep skin moist, to allow them to breathe.
    - Distinguish among worm species, identify adult specimens only, and measure specimens to find longest for each species represented.
    - Encourage students to show and compare their worms, identifying the longest adult for each species.
  - Return earthworms to soil after measuring (unless they are a non-native, invasive species).

Food Critic

- Allow students to harvest and taste-test f5 foods from the garden (or prepare a food different ways and taste-test).
- Students will rate the food on the Critic worksheet and transfer data to bar charts.

Rain Gauge: MCC3MD2

- Students will note the inches of rain in the rain gauge, and predict the volume of water collected in milliliters.
- Pour the water into a beaker (or measuring cup), and record the amount.

Massive Measurements: MCC3MD2

- Students will estimate the mass of garden veggies and fruit before weighing them.
- Students will hold objects of various masses and volumes and estimate before weighing / measuring.

Name of Critic: ____________________

Date: ____________________

Directions:

- Taste-test foods from the garden
- Describe the flavors (sweet, sour, bitter, spicy, bland, etc.)
- Rate the food on a scale from 1to 5 by coloring in stars
- Tell what the stars mean: ★= __________ ★★= __________
  ★★★= __________ ★★★★= __________ ★★★★★= __________
- Create a bar chart, listing foods along the x axis, and stacking stars

1. ______________________________(name of food) ☆☆☆☆☆

   Describe flavors: ____________________________________

2. ______________________________(name of food) ☆☆☆☆☆

   Describe flavors: ____________________________________

3. ______________________________(name of food) ☆☆☆☆☆

   Describe flavors: ____________________________________

4. ______________________________(name of food) ☆☆☆☆☆

   Describe flavors: ____________________________________

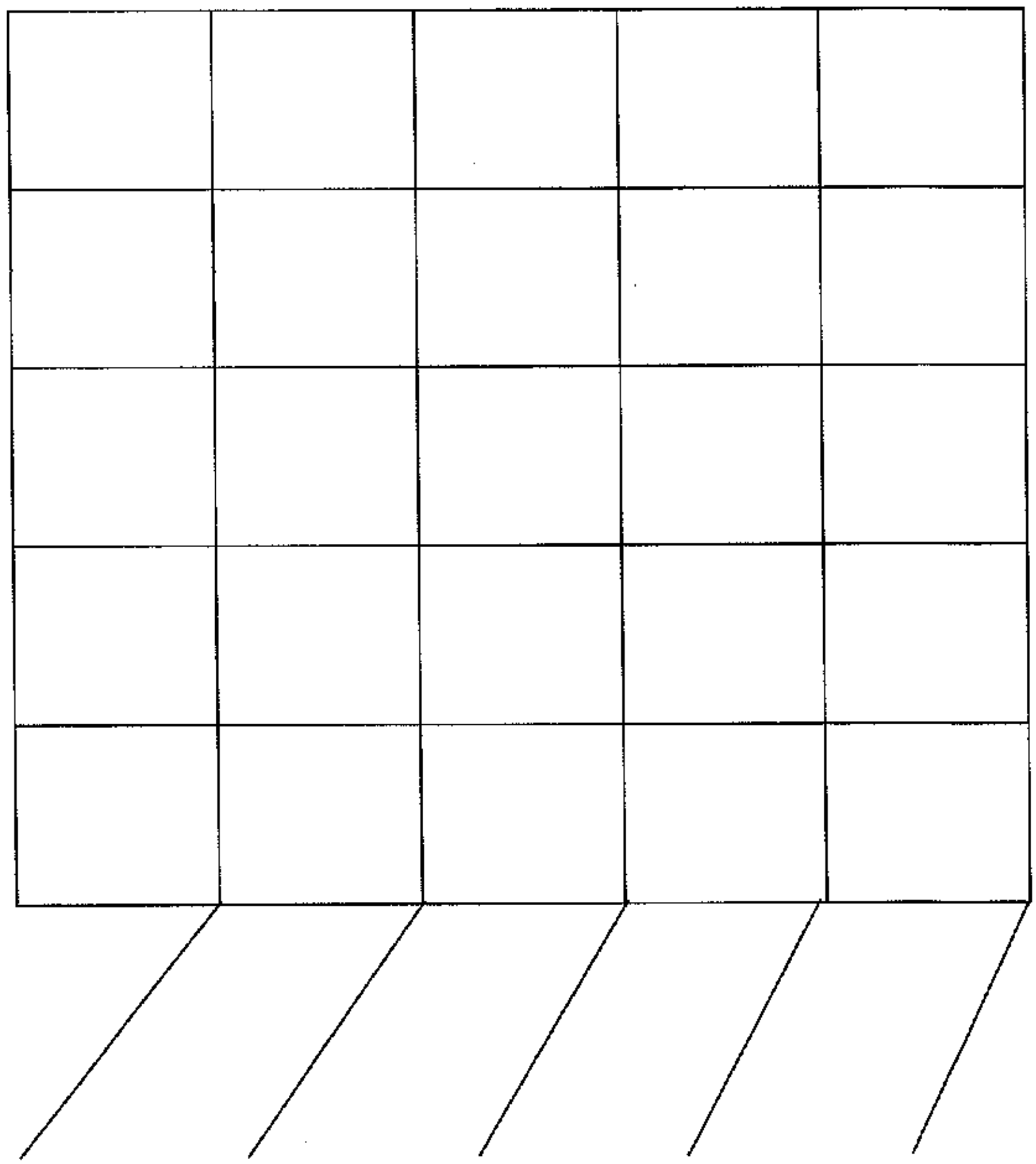
5. ______________________________(name of food) ☆☆☆☆☆

   Describe flavors: ____________________________________

Name of Critic: ______________________________

Title of Picture Graph

Number of Stars Awarded



Foods Tasted

(write name of each food you tasted on a diagonal line)

Title of Bar Graph (for one food):

____

x: Number of Students who Rated this Food (in increments of ____)

y: Star Ratings

Name(s): ______________________________

Create your own bar graph here, or go to the Create a Graph web site to make one online:

http://nces.ed.gov/nceskids/createagraph/default.aspx

Rain Gauge and Mass of Various Veggies

Name: ______________________________

Rain Gauge

- Estimate the volume and record your guess on the chart before taking the actual measurement.
- When measuring the volume of a liquid, get at eye level with the measuring device and look for the meniscus at the surface of the water: it is a curve or dip. Read the measurement mark at the low point of that curved surface.

- Estimated volume: ______________
- Actual volume: _____________
- Pour water from rain gauge to beaker or measuring cup and measure its volume there: ________________

Massive Measurements of Veggies

- **Choose five veggies from the garden to estimate and weigh. Include units in your answers!**

⇩ Types of Veggies	Estimated Mass	Actual Mass

Engineering Design Challenge:

1. a. Given a length of string representing the perimeter of a garden (the total length of lumber or edging available to outline the garden) what shaped garden can you create that will have largest amount of area for planting?

b. Using a string of the same perimeter, what shaped garden design would have the most easily reachable planting area for young gardeners?

2. Given a particular area, what perimeter garden could you design?

3. Design a garden of the same area that makes use of space saving ideas such as vertical planting or stacked beds.

1. Sketch and label lengths of all sides for two gardens of same perimeter and different area. (Hint: use string)

a. Garden with biggest planting area

b. Garden with most accessible beds for short arms

2. Design, sketch and label lengths of sides of two gardens with same area but different perimeters. (Hint: use tiles)

3. Design, sketch and label a garden with best combination of maximum space and accessibility for short arms.

Assessment for Shape Shifters in the Math Garden

Student Name(s): ______________________________ **Date:** ____________

Level of Mastery → ↓ Benchmark or Performance Measure	 **Mastered task @ 90%+ accuracy: 5 pts**	 **Mastered task @ 85% accuracy: 4 pts**	 **Mastered task @ 80% accuracy: 3 pts**	 **More learning needed**	**TOTAL POINTS**
Garden Food Critic Review	Students taste tested all available food and described and rated them.	Student partially completed taste test and / or partially completed review	n/a	No attempt	
Picture and Bar Graphs of Review Ratings	Student used the Food Critic data to create a pictograph with stars and a bar graph reflecting data	Student completed one graph correctly	Student attempted both graphs but neither accurately reflected the data	No attempt	
Rain Gauge	Student accurately measured water in rain gauge and also measured that volume of rain in measuring cup	Students measurements were incorrect or incomplete	n/a	No attempt	
Massive Measurement of Vegetables	Student estimated and measured mass of veggies.				
Engineering Challenge	Student designed garden beds with the same perimeter by different area; the same area but different perimeter; and the most useful shape	Student designed garden beds but not within the given constraints	Student designed one garden bed, or beds did not have measurements	No attempt	
TOTAL in LAST BOX →					__/25 pts

Lesson 2: Solar Cooking Race

LEARNING

Grade
3

Standards
GPS S3P1a, b, c, d;
NGSS PS3a, b

Time
approx 2 hours + cooking time

Supplies
(per student)
- wide-range, instant-read thermometer
- meter stick/meas tape
- black, white, colored construction paper
- aluminum foil
- glue
- pizza boxes and similar cardboard
- old newspaper
- butternut squash slices
- butter, brown sugar
- paper bowl or other cooking surface
- red and blue food coloring
- hot water (thermos?)
- clear cup
- funnel
- solar beads
- chenille stems
- felt squares (3)
- potato clock
- felt
- ice
- cups

Overview
3d grade students will explore heat energy in the garden.

What they will learn
- Heat can be transferred many ways
- Heat absorption of various colors
- Demonstrate heat transfer
- Insulation
- Applied knowledge

How they will learn it
- Ice cube melting race
- Urban heat island investigation
- Radiate, convect, conduct
- Pet ice cube contest
- Design/build solar ovens to cook garden squash

Essential / Guiding Question
How can we measure and transfer heat to cook plants from the garden?

Engaging Students
Potato Clock (optional)

Demonstrate a potato clock to kick off a discussion about energy. Ask students what they know about energy , heat, energy transfer, and insulation.

Ice Cube Melting Race

Pairs of students will be invited to melt an ice cube as quickly as possible, in order to launch a discussion about different ways heat can be transferred: friction, applying mechanical or electrical energy, mixing substances to create a certain type of chemical reaction, or burning.

Exploration
Urban Heat Island Effect

Where would you go to get cool on a hot day in the schoolyard? Students will test their theories about the coolest places by measuring the temperature a 0.5 m above ground level and comparing results at different locations by type of surface (paved, dirt, lawn, garden plants).

Demonstration of Heat Transfer Methods
Students will brainstorm ways heat travels and investigate the following: make bracelets with solar beads and watch them change color when heat is transferred from the sun by radiation; dye cold water in a cup blue and add hot red water to the bottom of the cup with a funnel, to observe 1) convection and 2) transfer of heat energy from warmer area to colder area; and make a pot holder to protect from heat conducted by metal pot handle. Students will also design an experiment to test which color absorbs the most heat and which reflects the most.

Pet Ice Cube Contest
Challenge students to keep an ice cube in solid form as long as possible by in solid form as long as possible by insulating its container.

Engineering /Design Challenge
Students will use any of the following materials: pizza box cardboard, aluminum foil, glue, construction paper, clear plastic wrap, and wadded newspaper , to design and build solar ovens that take into account heat transfer methods, reflectivity, and insulation. They will harvest squash from the garden, top it with butter and brown sugar, and race to cook it in their solar oven, using thermometers to determine oven temperatures and internal doneness.

Explanation
Students will articulate their discoveries about heat, define temperature as a measure of heat, discuss energy transfer.

Debriefing
Teacher will reinforce the key concepts in this lesson and clear up misconceptions. See Background notes on page 2.

Environmental Stewardship
Students will apply what they learned to design and install an improvement to protect tender garden plants from cold.

CONTEXT FOR LESSON ACTIVITIES
Standards
Georgia Performance Standards
S3P1. Students will investigate how heat is produced and the effects of heating and cooling, and will understand a change in temperature indicates a change in heat.
a. Categorize ways to produce heat energy such as burning, rubbing (friction), and mixing things.
b. Investigate how insulation affects heating and cooling.
c. Investigate the transfer of heat energy from the sun to various materials.
d. Use thermometers to measure the changes in temperatures of water samples over time.

Next Generation Science Standards
Core Idea in Physical Science: Energy
PS3.A Definitions of Energy
PS3.B Conservation of Energy and Energy Transfer

Background Information
Teacher Guide on Heat from JPL/NASA: http://genesismission.jpl.nasa.gov/educate/scimodule/heat/explorat_2TG.pdf
AAAS Science Assessment
Atoms, Molecules and States of Matter : Key Ideas and Misconceptions: http://assessment.aaas.org/topics/AM#
AAAS Science Assessment
Energy: Forms, Transformation, Transfer, and Conservation: Key Ideas and Misconceptions:
http://assessment.aaas.org/topics/EG#/
Examples of solar cookers
Darfur Refugee Camp: http://solarcooking.wikia.com/wiki/Iridimi_Refugee_Camp
Solar Cooking Project Best Practices Manual: http://www.jewishworldwatch.org/downloads/scp_best_practices.pdf

Teacher Preparation

- Assemble supplies needed for lesson (keeping solar beads in the dark).
- Copy a lab report form for each student.
- Conduct this activity on a sunny, windless day.
- Do introductory activities about states of matter and heat, if students do not have prior knowledge.
- (See Teacher Guide on Heat, in Background section, for activities)
- Plans for optional potato clock demonstration: http://www.wikihow.com/Make-a-Potato-Clock
  Try this in advance, as you may have to experiment to find an LED clock which requires so little power.

PROCEDURES FOR LESSON ACTIVITIES

1. Describe ice cube melting race challenge to students, distribute ice cubes in cups, set timer, and call times.
2. Distribute instant-read thermometers to small groups of students and invite them to predict the coolest place in the schoolyard, and to measure temperatures at 0.5 meters above the surface in six different types of locations. Discuss the effect it might have if all surfaces in the area were paved and black.
3. Allow students to investigate methods of heat transfer by.
   a. Making a solar bead bracelet with two beads and a chenille strip; then watching effects of radiation.
   b. Making a potholder to remind students that uninsulated pot handles conduct heat.
   c. See what happens when red hot water is introduced to the bottom of a cup of cold blue water with a funnel (hot water rises by convection: red layer of water stratifies and moves to top of cup; then changes to purple as heat energy is transferred from warmer area to colder area.
4. Describe the ice cube preservation challenge, distribute ice cubes in cups, set times, call times.
5. Allow students to conduct their own research on solar cookers using Internet connected computers. Provide materials for cookers and allow teams of students to create any version they choose. Have a race to cook slices of squash in the solar ovens. Determine internal doneness with a clean instant -read, wide-range thermometer.
6. Encourage students to apply what they learned in this lesson to design a structure that will extend the growing season and keep tender garden plants from freezing during winter.

Heat Investigations and Solar Cooking Race Lab Report

1. Ice Cube Melt

Time to melt ice cube: _______ Method of transferring heat: ________________________________

2. Urban Heat Island Effect

Temperatures of the air 0.5 meters above various surfaces:

Surface type: _________	Surface type: _________	Surface type: _________	Surface type: _________	Surface type: _________	Surface type: _________	Surface type: _________
Temp: ___	Temp: ___	Temp: ___	Temp: ___	Temp: ___	Temp: ___	Temp: ___

3.Demonstrations of Heat Transfer Methods

Solar bead bracelet: ______________________

Hot /cold ocean current model: ________________________

Pot handle: _____________________

4. Pet Ice Cube Contest

Test any method for slowing the transfer of energy from a warmer object to a cooler one, such as use of insulation. Describe your technique below. How long you were able to save your pet ice cube? ___________________

____

5. Solar Cooker Design

Start time: ________ End time: ________ Time to cook slice of squash to internal temp of 150 F/ 65C: ______

Weather: ambient air temp______ % sunny __________ wind? _________

Highest temperature recorded inside cooker: _________ after how long? ___________

Color of cooking surface or pot: __________ Type and thickness of insulation used, if any: ________________

Number and total area of reflectors, if any: ______________ Bag, plastic or plexiglass to reflect sun? __________

Number of times solar cooker was re-oriented to face the sun, during cooking: _______________

Sketch your cooker :

Assessment for Heat Investigations and Solar Cooking Race

Student Name(s): ______________________________ **Date:** ______________

Level of Mastery → / Benchmark or Performance Measure ↓	 Mastered task @ 90%+ accuracy: 5 pts	 Mastered task @ 85% accuracy: 4 pts	 Mastered task @ 80% accuracy: 3 pts	 More learning needed	TOTAL POINTS
Student completed lab report reflecting investigations of... **Ice cube melt**	Lab report completed Student identifies at least one method of transferring heat	Lab report partially completed Student cannot identify a method by which heat is transferred	n/a	Lab report not attempted No description	
Urban heat island effect	At least five temperature readings are recorded and places listed for each	Data is incomplete (less than 5 locations compared)	n/a	No data	
Heat transfer methods	Demonstrated heat transfer Identified examples of heat transfer as: 1 radiation 2 convection 3 conduction	Correctly identified two methods of heat transfer	Correctly identified one method of heat transfer	No response	
Insulation: Pet Ice Cube Contest	Demonstrated any method of insulating ice to slow transfer of energy from a warm object to a cooler one	n/a	n/a	No response	
Solar Cooker Design/Build Project	Designed and built solar cooker within project constraints, using given materials. Successfully cooked / warmed squash. Incorporated color of surface, reflectivity, insulation, orientation.	Designed and built solar cooker incorporating at least one of the lesson concepts about heat retention: color, reflectivity, insula-tion, orientation	n/a	No attempt	
TOTAL in LAST BOX →					__/25 p

Lesson 3: Worm Your Way Out of This!

LEARNING

Grade
3

Standards
GPS Science: S3E1 c S3L1 c, d
Next Gen Science: LS2.a, LS2.b, ES

Time
approx 1.5 - 2 hours over 1 or 2 days

Supplies
(per student)
- red wriggler worm
- magnifier
- bug catcher or paper bowl
- Internet-connected computer
- Worm Pre and Post Test
- Worm Investigation Lab Report
- Vermiculture Experiment Report
- any seeds or plants

(per table or group)
- spray bottle
- ruler
- worm bin (or make one from shallow 10 gal tub with lid, drill, mesh screen, glue)
- school garden
- paper towels
- sanitizer or hand soap
- newspaper (from recycling bin)

Overview

3d grade students will learn about recycling food and garden waste, decomposition and how compost can improve soils.

What they will learn
- Worms characteristics
- How to minimize food waste
- Soil composition
- Benefits of compost
- Care for the Earth

How they will learn it
- Game, investigation, observation and research vermiculture / composting
- Making compost, mixing with garden soil
- Design experiment to see how it compares
- Apply worm compost to garden: organic fertilizer

Essential / Guiding Question
What good are worms for making healthy soils or plants?
How can we waste less food and throw less trash away that will end up in the landfill?

Engaging Students
At the beginning of the lesson, students will be asked to draw a worm, label any parts they know, and list five facts. The same worksheet: "Everything I Know About Worms in the Garden" will be used for pre-and post-assessment. Students will view this time lapse of a rotting pumpkin to start a discussion on decomposition. Then students will play an interactive online game called *The Adventures of Vermi the Worm*, to learn about vermiculture.

Exploration
Worms: Up Close and Personal
Each student will investigate a worm by observing it carefully, measuring it, sketching it, and researching it online.

Making Worm Compost

Students will collect leaves, newspaper, and garden waste, and food scraps (fruit and vegetables only), shred everything, add it to the classroom worm bin in layers, wet each layer, and "fluff" the whole thing before adding worms. They will feed and care for the worms.

Fertilizing the Garden and Growing Plants

Students will test the vermicompost to see if it is 'finished', apply it to the garden, and conduct experiments of their own design.

Explanation

Students will be able to explain the components of soil, why compost is needed to enrich soil, how plants benefit from healthy soil, and how people benefit when plants thrive.

Environmental Stewardship

Students will use what they learned about worms, decomposition and compost in this lesson to care for the Earth and

1. Report the first earthworm of spring to a national database http://www.learner.org/jnorth/tm/worm/About.html
2. Enhance the fertility and water-holding capacity of garden soil by adding finished compost.
3. Design and conduct an experiment to test a question about growing plants in vermicompost-enriched soil compared to growing plants in other soils, or other types of compost, or different ratios of soil to compost.

Evaluation

Students will complete the same form that was used as a pre-test, at the end of this lesson.

CONTEXT FOR LESSON ACTIVITIES

Standards

Georgia Performance Standards

Earth Science

S3E1. Students will investigate the physical attributes of rocks and soils.

c. Use observation to compare the similarities and differences of texture, particle size, and color in top soils (such as clay, loam or potting soil, and sand).

Life Science

S3L1. Students will investigate the habitats of different organisms and the dependence of organisms on their habitat.

c. Identify features of animals that allow them to live and thrive in different regions of Georgia.

d. Explain what will happen to an organism if the habitat is changed.

Next Generation Science Standards

LS2 Ecosystem Interactions, Energy and Dynamics

LS2.a Interdependent relationships

LS2.b Cycles of Matter and Energy Transfer in Ecosystems

ESS2 Earth Systems

ESS2.a Earth Materials

Background Information

Worm Composting Basics from Cornell: http://compost.css.cornell.edu/worms/basics.html

Other organisms in vermicompost: http://ei.cornell.edu/teacher/pdf/D%26R/D%26R_Soil_Invert_ID.pdf

Converting Food Waste to Compost: http://www.ct.gov/dep/lib/dep/compost/compost_pdf/schmanual.pdf

School Compost Manual with troubleshooting guide:

http://www.ct.gov/dep/lib/dep/compost/compost_pdf/schmanual.pdf

Criteria for student-designed experiments: http://www.biologycorner.com/worksheets/labreport_rubric.html

Teacher Preparation

- Obtain the necessary supplies and materials for this lesson.
- Arrange to show YouTube time lapse film of Rotting Pumpkin: http://www.youtube.com/watch?v=Q0xPt_jCFtU
- Make copies of the pre/post test: Everything I Know About Worms in the Garden.
- Make a copy for each student of the "Worm Investigation Lab Sheet".
- Make a worm bin by drilling air and drainage holes in a 10 gal shallow plastic bin, before class. Students may help place glue screen or mesh over the holes.
- If students have not previously done inquiry investigations or designed experiments, it would be helpful to review:
  - Science Fair Project Guide: http://www.sciencebuddies.org/science-fair-projects/project_guide_index.shtml?From=Tab
  - Independent and Dependent (Responding) Variables: http://www.biologycorner.com/physics/scimethod/scimethod_variables.html
  - Indentifying Controls and Variables with the Simpsons: http://www.biologycorner.com/worksheets/controls.html
  - Fair Tests: A Do It Yourself Guide: http://undsci.berkeley.edu/article/0_0_0/fair_tests_01
  - Lab Report / Experiment Assessment Rubric: http://www.biologycorner.com/worksheets/labreport_rubric.html
- Emphasize to students that hands must be washed after touching dirt (more because of soil bacteria and microorganisms than worms). Gloves should be worn when handling compost.

PROCEDURES FOR LESSON ACTIVITIES

Engaging Students

- Have students complete the pre test: Everything I Know About Worms, before starting the lesson.
- Show the Rotting Pumpkin time lapse film http://www.youtube.com/watch?v=Q0xPt_jCFtU to spark a conversation about decomposition, soil composition, and worms. Ask students what they know about each of these topics.

Exploration

"The Adventures of Vermi the Worm"

Students may access this interactive game with an Internet connected computer at: http://www.calrecycle.ca.gov/Vermi/default.htm or you may download the game to school computers.

Worms: Up Close and Personal

- Give each student a red wiggler worm from gathered from worm bin / garden soil, or obtained from local bait store.
- Pass out Worm Investigation Lab Sheet.
- Students will investigate a worm by observing it carefully, measuring it, sketching it, and thinking of questions.
- Students will research worms based on their own questions, at Journey North web site: http://www.learner.org/jnorth/search/Worm.html
- If Internet-connected computers are not available, the teacher can print the Frequently Asked questions from this web site, in the categories of Characteristics, Life Cycle, Ecology, and Conservation.
- Additional student research site: http://www.wormdigest.org/content/view/35/2/
- Each student will share with the class one or two facts from their research.

Making Worm Compost (Vermicompost)

- Students will add shredded newspaper, finely chopped food waste, and leaf litter and water to bin, weekly
- Students will mark bin quadrants and record time and location that matter is added to bin
- Students may identify other organisms living in the vermi compost, using this resource: http://ei.cornell.edu/teacher/pdf/D%26R/D%26R_Soil_Invert_ID.pdf
- Students may read about other types of compost: http://www.weblife.org/humanure/chapter3_10.html
- Stop adding food waste two weeks before desired compost completion. Determine when compost is finished using this criteria: http://sarasota.ifas.ufl.edu/compost-info/tutorial/compost-maturity-test.shtml

Fertilizing the Garden and Growing Plants

- Students add finished compost to garden soil and mix in gently

- Divide students into small groups, if desired, for the student-directed experiments.
- Provide information on experimental design and scientific method, as necessary. See Teacher Preparation section
- Students will choose topic and design experiments to test the effectiveness of their vermicompost in terms of plant productivity, soil fertility, soil water holding capacity, etc. Alternatively, students may design projects to see how long specific waste items take to decompose in the vermicompost bin.

Environmental Stewardship

Students will use what they have learned in this lesson to benefit the Earth by. . .

- Contributing to a nation-wide database of the first sighting of an earthworm in Spring at this web site: http://www.learner.org/jnorth/tm/worm/About.html AND
- Restoring the fertility and water-holding capacity of garden soil by adding finished compost AND
- Designing and conducting an experiment to test a question about growing plants in vermicompost-enriched soil compared to growing plants in other soils, or other types of compost, or different ratios of soil to compost.

Debriefing

- Soil consists of minerals in three different particle sizes (textures): sand, silt and clay; organic matter (dead stuff); as well as soil organisms and microorganisms.
- Decomposition is necessary to release the nutrients from dead plants and animals.
- Worms, fungi, bacteria, and other microorganisms are decomposers.
- Vermi-composting food-waste is a kind of recycling.
- Composting can also be accomplished by microorganisms, which generate too much heat for worms.
- It would be even better to throw away less food.
- Administer post test.

Extensions

Vermicomposting Classroom activities: http://www.calrecycle.ca.gov/Education/Curriculum/Worms/98Activities.pdf

Everything I Know about Worms in the Garden

Name:____________________________________ Date: ___________

Drawing of a Worm, with Parts Labeled:

Facts I Know About Worms:

1. ____
2. ____
3. ____
4. ____
5. ____

My Thoughts and Feelings about Worms:

Worm Investigation Lab Sheet

Name: ______________________________

Date: ______________

NOTE: Worms require moist skin. Please occasionally spray or sprinkle it with water while observing. Return worm to soil after investigation is over.

1. Sketch:

2. What I discovered about my worm:

(Look at the whole worm, its body parts, and its behaviors. Observe, measure, count, describe what you see.....)

3. Questions I have about worms (things to research):

____

____

____

____

4. On an Internet-connected computer, go to: http://www.learner.org/jnorth/search/Worm.html and http://www.wormdigest.org/content/view/35/2/ to do research. Write what you learn c the back of this lab report.

Vermicomposing and Plant Growth Experiment

Name: ______________________________

Date: ________

What question will be answered by this experiment? (example: How will ____ be affected by ____?)

____

What is the hypothesis to be tested? (what do you think the answer to the question will be?)

____

What is the independent variable? (what will you intentionally change?)

____

What is the response (dependent variable)? (what will you measure, to see what difference the independent variable made)

____

What are the controlled variables? (what things will you try to keep the same, to make it a fair test)

____

What procedure will you follow? (what are the steps of your experiment?)

____

(Now conduct the experiment)

What happened? (what were the results of the experiment?)

____

What does this result make you wonder about? What do you want to test next?

____

Assessment for Worm Your Way Out of This

Student Name(s): ______________________ **Date:** ____________

Level of Mastery → Benchmark or Performance Measure ↓	 **Mastered task @ 90%+ accuracy: 5 pts**	 **Mastered task @ 85% accuracy: 4 pts**	 **Mastered task @ 80% accuracy: 3 pts**	 **More learning needed**	**TOTAL POINTS**
Pre- and Post-Test on Worms	Showed significant progress in ability to 1) recognize and label parts of a worm 2) tell facts about worms 3) comfort in observing worms	Meets two of the three criteria for progress since pre-test	Meets one of the two criteria for progress since pre-test	Did not attempt	
Worm Investigation Lab	Took advantage of the opportunity for inquiry and discovery, as reflected in fully completed lab report	Lab report reflects engagement in at least three of the four tasks.	Lab report reflects engagement in at least two of the four tasks.	Lab report not attempted or mostly incomplete	
Class Vermiculture Project	Contributed to shredding of paper and feeding food waste to worms in class vermiculture project	n/a	n/a	No contribution	
Vermi-composting and Plant Growth Experiment	Conducted an experiment that was a fair test for the question asked. Student able to identify control, independent and responding variables, draw a conclusion, and generate new questions to explore.	Attempted a vermicomposting experiment despite some flaws in approach, missing information, or limited ability to articulate results.	n/a	No attempt	
Environmental Stewardship	Added vermicompost to garden to improve soil and habitat; contributed to national database reporting first worm of spring; and designed a vermicomposting experiment	n/a	n/a	No attempt	
TOTAL in LAST BOX →					_/25 pts