BRINGING THE GARDEN INTO YOUR MATHEMATICS LESSONS

Lessons compiled by

The New Jersey Agricultural Society's

LEARNING THROUGH GARDENING

Program

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DISCOVER AN ACRE

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

One acre = 43,560 square feet

Grades: 3-5

OBJECTIVES

The student will be able to:

- Calculate area by using one-foot paper squares.
- Calculate the area of the classroom by using one-foot paper squares.
- Calculate area by multiplying length x width.
- Calculate how many classrooms would fit into one acre.

ACTIVITY

Explain that the size of farms is measured by using a measurement of area called an acre. (If possible, tell students the acreage of a few local farms.) Area is the number of square feet in a space and can be calculated by measuring length x width. An acre is 43,650 square feet.

Today we are going to see how big an acre is by figuring out how many of our classrooms would fit inside an acre. Give each student three one-foot squares of paper and place students in groups of four or five. Allow students time to experiment with the one-foot squares by creating shapes and figuring out their area.

Next, ask students to figure out the area of the classroom by lining up the one-foot squares across the length of the classroom and the width of the classroom. Multiply to find the square footage. Once the area of the classroom is determined, ask the students in small groups to come up with a way to figure out how many classrooms would fit inside an acre. Allow them to use calculators if their multiplication skills are not advanced enough.

Bring the whole class together and discuss the strategies for finding out how many classrooms equal an acre and determine the answer.

EVALUATION:

The student can calculate area by using one-foot paper squares and by using the formula length x width. The student can work with a small group to determine how many classrooms can fit into an acre.

EXTENSION:

Ask students to use the one-foot squares to explore the difference between perimeter and area. Have the students create a shape with the squares and then calculate the perimeter and the area. Next students use the same number of squares to create different shapes and calculate the perimeter and area. Does the area remain the same? Does the perimeter remain the same? Why?

NEW JERSEY LEARNING STANDARDS

Math 3MD8, 4MDA3, 5MDA1

MATH IN THE GARDEN

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

There are so many ways to teach math in the garden! Just look at all the opportunities on the back on any seed packet. Teachers at every grade level can find a way to discuss math while planning, planting, observing, and harvesting a garden. At the same time, you'll be showing your students how math is used in everyday life.

Here are some ways to dress up your math lessons with a little green:

ACTIVITIES:

Algebra

• Use algebraic formulas to compute a variable, such as the amount of fertilizer to add per quart or liter of water. (Most fertilizer packages indicate how much to add per gallon of water.)

• Collect various dry bean seeds or plant leaves, and ask students to sort them by size, shape, color, and number.

• Plant lima bean seeds in small pots. Place half the pots in a bright window and half in a dark closet. Measure growth daily. After two weeks, compile information into a chart and determine the average growth rate of plants grown in the light versus the dark. Discuss and calculate the effect of the variable of light on the variable of plant growth. •

Communication

• Find out how much money your school spends on cafeteria waste removal. Spend a number of days weighing the food waste and chart the data. Write a report and publish the results within the school and/or do a presentation for students and staff about saving money by reducing food waste and composting the waste you can't avoid. You could take it to the next step and figure out the expenses versus savings of different composting options and share these with the school board!

• Participate in the Journey North Project at: http.//www.learner.org/jnorth/tm/tulips/Planting.html • Track the appearance of tulip

bulbs in your schoolyard and share the data with other students and teachers participating throughout the country.

Connections

• Measure the perimeters of the entire garden, various beds, paths, and other features. Compute the overall area of garden and garden beds. Draw a map to scale using graph paper. Use the map to plan new garden designs. Data Analysis and Probability

• Count the total number of flower buds on cucumber plant. Gently attach a piece of tape around the stem near the flower to mark those you counted (be careful not to damage the stems). A few weeks later, examine your marked flower buds and look for signs of baby fruit. Figure out what percentage or fraction of the total flowers produced fruit (number of fruit divided by the number of flowers). Discuss the probability of a cucumber flower producing a fruit.

• Host a bean race. Plant a number of beans at the base of a trellis and track their growth on a chart. Determine the rate of growth. Award the fastest growing plant a blue ribbon.

• Measure the height of a group of plants and determine the mean, median, and mode.

Geometry

• Estimate the number of pots that will fit on your windowsill or under your grow lights. Calculate using different sizes of pots.

• Plant a classroom window box. Determine the volume of soil you will need to fill your box. As you prepare the potting soil, first determine the weight and volume of potting mix when it is dry, then recalculate the weight and volume of moistened mix

• Complete a scavenger hunt in your garden. Look for objects representing different geometric shapes such as circles, squares, and triangles.

Measurement

• Calculate serving sizes of common fruits and vegetables using measuring cups.

• Make a recipe using harvest from the garden requiring different measuring techniques. Search the Internet for recipe ideas

. • Measure the height of garden plants using standard (inches and centimeters) and nonstandard (such as pencil lengths or hand widths) measuring techniques. Chart, compare, and discuss your results.

• Plant bean seeds and let them grow for a few weeks. Remove them from the soil and carefully wash soil away from the roots. Measure part of the root system. Estimate the percentage of total roots you measured and then estimate the length of the entire root system on that plant. After estimating, measure the rest of the roots and compare to your length estimate.

Number and Operations

• Plant lettuce seeds in a flat or pot carefully keeping track of the number planted. As the seeds emerge, count the number of seedlings. Use these two numbers to calculate

the germination rate (number of seedlings divided by number of seeds planted, multiplied by 100).

• Ask students to estimate the number of seeds in a tomato, then slice it open and count the number of seeds actually present. Compute the difference between the estimate and actual number of seeds using subtraction.

• Collect five to ten flowers from the same plant in your garden. Count the number of petals on each flower and create a chart to display your results. Repeat with other types of flowers in the garden. What do the results say about the characteristics of plants?

Problem Solving

• Create a planting schedule for your garden. First, determine the desired harvest date for each crop. Next, find the days-to maturity for each, and count backwards from the harvest date to decide when each crop should be planted.

• Track the cost of garden supplies against the amount of produce you harvest. Figure out the cost per unit (weight, volume, piece) of fruit or vegetable. Compare your cost to the cost of similar produce at the supermarket.

Reasoning and Proof

• Plant a variety of seeds. Find out the number of days it should take for them to germinate (often this is listed on the seed packet). Chart the researched data, then track the actual time for germination and compare the results. Discuss the accuracy of the researched information and how seed producers may have arrived at those numbers. Discuss variables that may have affected your results. Representation

VEGETABLES TAKE OVER THE WORLD

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

In this fun math lesson, students use their addition and multiplication skills to answer the question “could vegetables take over the world?” Students count the many seeds in sweet peppers, or other vegetables with many seeds such as cucumbers, squash, or tomatoes. Then they must determine the number of plants that would grow from future seeds. In two years? How about three, four, or five years? The lesson can be modified for many grade levels.

Grades: 2-5 (Younger grades can count seeds and use addition skills to calculate the number of plants in one or two years. Older grades can use multiplication and numerical expressions for this calculation and extend the count for more years.)

OBJECTIVES

The student will be able to:

- Count the seeds in a vegetable with numerous seeds
- Calculate the number of plants that would grow in each subsequent year if every seed grew into a plant.
- Determine the total number of plants in subsequent years.
- Graph results of seeded count and vegetable taste test

MATERIALS NEEDED

- one paring knife
- A vegetable with many seeds for each group of three or four students such as: sweet peppers zucchini yellow squash cucumbers tomatoes Depending on the vegetables you have available, each group could use a different vegetable, or every group could use the same vegetable. If each group uses the same vegetable, you could have students take the average number of seeds from all the vegetables and use that number for future calculations.
- Newspaper or paper towels to cover workspace
- Optional: a copy of the Vegetables Take Over the World Worksheet (at the end of the lesson) for each student

INTRODUCTION

Begin by asking which part of the plant contains the seeds – the fruit. Ask students which vegetables they eat have seeds inside. Make a list of the responses. Ask students how a vegetable can also be a fruit? Explain that in botany, the scientific study of plants, a fruit is the part of any plant that contains the seeds. When we talk about food we eat, however, we call something sweet a fruit and something that is not sweet a vegetable. For the purpose of this lesson, we will be counting the seeds in fruits that are vegetables.

Ask students how many seeds are in one of the vegetables on their list. Do all the vegetables on the list have the same number of seeds? Why do they think vegetables would have different numbers of seeds? Ask why they think a plant would make many seeds? Explain that different plants have different strategies when making seeds. Some plants pack as many seeds as possible into each fruit to make sure that at least some will grow into new plants. Other plants, like the avocado, put all of their resources into producing and protecting one very large seed.

ACTIVITY

Teacher starts the lesson by telling students, “Today we are going to discover whether vegetables can take over the world.” Ask students if they know how many seeds are in the vegetables on the list, they made of vegetables that contain seeds. Are there many or are there a few? Tell them they are going to count the seeds in one vegetable. Teacher divides the class into groups of three or four students. Place a vegetable in the middle of each group. Tell the students you are going to cut the vegetable in half, but before you do, they must estimate how many seeds will be inside. Ask the groups to discuss how many seeds might be inside. Then each child should then write down his/her own estimate. When a group has finished estimating, the teacher will cut its vegetable in half. Cucumbers and squash should be cut lengthwise. Tomatoes and peppers should be cut from the top (stem) down.

Before they begin to count, ask each group to decide how they will divide the task of counting among the members, and how they will arrive at a final count. When each group has a final tally of seeds:

• Ask each group if each seed grew into a plant next year, how many vegetable plants would there be?

• If each plant grew one vegetable with the same number of seeds, how many seed would there be after one year?

As a group, students should discuss how to do this before they make the calculation. Remember you are assuming that only one vegetable with the same number of seeds grows on each plant in each subsequent year. Explain to students that in nature, each plant would not grow the same number of vegetables, nor would the vegetables all have the same number of seeds.

Optional: After counting the seeds in one vegetable in small groups, older students can take the average of seeds in the vegetables of all the groups before they calculate the

number of plants in future years. Students graph the results of their seed count and the number of vegetable plants and/or seeds that could grow in subsequent years.

EVALUATION:

Completed Vegetables Take Over the World worksheet Completed graph of seed count

EXTENSION:

- If each group uses a different vegetable, when the lesson is completed, conduct a taste test with the students, asking them to select the vegetable they like best. The class can then graph the results of the taste test. Older students can rank the vegetables from one to five according to students' preferences.
- Ask students in small groups to brainstorm what would happen if vegetables took over the world – would the results be favorable or not? Then ask students individually to write a short story of a few paragraphs imagining if this happened.
- How likely is it that every seed in a vegetable will grow into a plant? Do an experiment to find out. Give each group a packet of seeds for their vegetable, or if every group used the same vegetable, divide seeds from one packet among each group. Ask each group to plant the seeds. Egg cartons with holes punched in each cell for drainage work well. The students observe how many seeds germinate. This is the germination rate. They can graph the results of their experiment.
- Students research the vegetable they used for this lesson to learn how many vegetables grow on average on one plant.

NEW JERSEY LEARNING STANDARDS

Math2:OA.A,B,C, 2.NBT.A,B 3.OA.A,B,C, 3.NBT.A 3.MD.B 4.OA.A,C, 4.NBT.A,B 5.OA,B 5.NBT.A.1,2,5

NAME_____

Vegetables Take Over the World Worksheet

My group's vegetable is a _____. I estimate there are _____ seeds inside. We discovered _____ seeds inside our vegetable.
My estimate was more or less than the actual number. (Circle more or less)

Imagine that each seed grows into a plant that has one vegetable with the same number of seeds you counted.

In one year How many plants would there be?_____ How many seeds?_____

In two years How many plants would there be?_____ How many seeds?_____

If each of these seeds were planted and grew into a plant with one vegetable with the same number of seeds: in 3 years, how many plants? _____ how many seeds?_____

in 4 years, how many plants? _____how many seeds?_____

in 5 years, how many plants? _____how many seeds?_____

YOU ARE THE RULER!

A lesson from the New Jersey Agricultural Society Learning Through Gardening program

OVERVIEW & PURPOSE

No need to drag those measuring tools out to the garden when you are planting seeds. Teach your students about nonstandard measurement and have them use their fingers and feet to measure.

GRADES: 1-4

OBJECTIVES

The student will be able to
• use nonstandard measuring techniques to plant seeds in the garden.

MATERIALS NEEDED

- Rulers
- Yardsticks
- You Are the Ruler worksheet for each student

ACTIVITY

Measuring planting depth: Have the students measure parts of their fingers so they can easily figure the planting depth for seeds. Most seeds are planted between ¼ inch and 2 inches deep.

Ask the students to first measure the length of the fingernail on their pinky finger and record it on the measuring sheet. How long is it? Next ask the students to measure from the tips of index fingers to the first joint. How long is it? Then ask the students to measure the length of their index finger. How long is it? And ask the students to measure the reach from their thumb to their little finger. How long is it?

When the students go out to the garden, have them use their fingers to figure the planting depth for the seeds. Measuring spacing between plants: Have students measure their feet so they can easily figure the spacing between plants. Most plants are planted between 8 inches and 3 feet apart. Ask the student to place his/her shoe beside a yardstick or ruler to measure how long it is. Next, ask the student how long two of his/her shoes are. Then ask the student how long three of his/her shoes are. When the students go out to the garden, have them use their feet to figure the spacing between plants.

EVALUATION:

Students correctly use nonstandard measuring techniques to plant in the garden.

NEW JERSEY LEARNING STANDARDS:

Math: 1:MD.A,C 2.MD.A,B,D 3.MD.A,B 4.MD.A,B

Name_____

You Are the Ruler

1. My pinky fingernail is _____ long.
2. From the tip of my index finger to the first joint is _____ long.
3. My index finger is _____long.
4. My shoe is _____ long.
5. Two of my shoes are _____ long.
6. Three of my shoes are _____long.