SUNFLOWER HEIGHT CHART

Summary: Students will observe and measure sunflower growth overtime. They will record, compare, and graph measurements in reference to their peers' height.

Standards Covered:

1. 3.MD.3 Create scaled picture graphs to represent a data set with several categories. Create scaled bar graphs to represent a data set with several categories. Solve two-step "how many more" and "how many less" problems using information presented in the scaled graphs. For example, create a bar graph in which each square in the bar graph might represent 5 pets, then determine how many more/less in two given categories.
2. 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch.

Time Frame: Varies

Ages: 1st-5th grade

Season: Spring and Summer (may be done in the Fall without the seedling portion)

Procedure:

1. Tape a long piece of paper to your classroom wall or door. Draw a tall sunflower on the paper.
2. Have each student cut a leaf out of construction paper and label it with their name.
3. Each student stands against the picture and marks their height, attaching their leaf in the corresponding spot (it may be useful to assign partners to assist in this process).
4. Assist the students in creating various graphs of the data they see on the creation—how many kids are taller than 4 feet? How much taller is Joe than the drawn sunflower?
5. Have students measure the seedlings before planting them in the school garden. Draw additional stalks to represent the seedling heights, marking their heights with a leaf with today's date.
6. Keep measuring the sunflower as it grows, charting progress on the classroom picture. If applicable, measure the students again after the Summer to see how much they have grown.

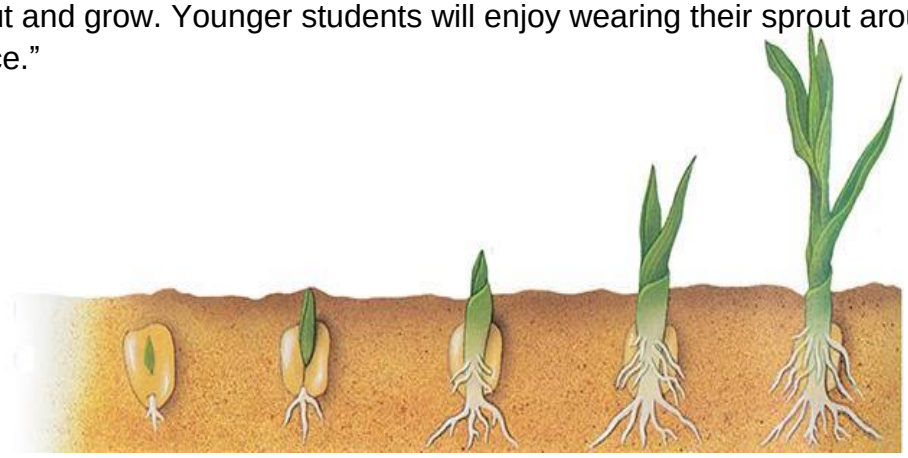
Materials:

- Cardstock or construction paper
- Markers
- Scissors
- Long roll of paper
- Tape
- Tape measure or rulers
- Sunflower seedling plant

Recommendation: Refer back to the PRE-K Sunflower Seed Starts lesson for more ideas about Sunflower lessons.

LIVING CORN NECKLACE

Summary: Students will discuss the concepts of heredity, germination, and pollination. They will then observe the growth of Indian corn and popcorn seeds, finding similarities and differences between the two varieties as they sprout and grow. Younger students will enjoy wearing their sprout around their necks like a "living necklace."



Standards Covered:

1. 3.ESS.1: Earth's nonliving resources have specific properties.
2. 3.ESS.2: Earth's resources can be used for energy.
3. 3.ESS.3: Some of Earth's resources are limited.
4. 3.LS.1: Offspring resemble their parents and each other.
5. 3.LS.2: Individuals of the same kind of organism differ in their inherited traits. These differences give some individuals an advantage in surviving and/or reproducing.
6. 3.LS.3: Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.

Time Frame: 1hr
Ages: 3rd-6th Grade
Season: Any

Materials:

- Various photos of corn crops, both seed form and mature
- Dried popcorn and Indian corn
- Cotton balls (one per student)
- Small plastic bags or glass jars (one per student)
- Yarn
- Journals, markers
- Water (one cup per group)
- Magnifying glasses
- Rulers

Key terms to review with students prior to the activity:

- **tassel**: the male part of a corn plant that emerges from the top of the plant and bears many small flowers that release pollen grains
- **self-pollination**: transfer of pollen from the male part of a flower to the female part of that same flower or another flower on the same plant; in

corn this rarely happens in the field, but it may be done by plant breeders to develop desired traits

- **open-pollination**: pollination that occurs naturally without human interference; open-pollinated varieties are developed simply by saving seed from the most desirable plants, resulting in high genetic diversity among offspring
- **hybrid**: produced by cross-pollinating two different inbred parent plants; plants are high-yielding and vigorous but results of saving seed are unreliable
- **ear**: female part of a corn plant that contains the cob, the silks, and the eggs that will become kernels
- **kernel**: the seed of a corn plant and the part that we eat
- **cross-pollination**: transfer of pollen from one plant to another

Concepts to review with students prior to the activity: Understanding heredity in plants—especially crop plants—can be complicated.

- Every corn plant has both male (tassel) and female (ear) parts. In order for kernels to form on a cob, each one must be fertilized by a grain of pollen. Pollen comes from the tassels at the top of the plant where it is easily picked up by the wind. For fertilization to occur, the pollen must land on a silk strand that sticks out the end of the ear. The pollen is transported down the silk to the egg, which will grow into a kernel after fertilization. As in all organisms that reproduce sexually, the sperm (pollen) and the egg each contribute half of their genes to the offspring (in this case, the corn that will grow from the kernel), creating a genetically unique individual with some traits from each parent.
- If farmers select kernels from their best corn plants to save for seed, they know that half of the genes came from the mother plant. However, they do not know anything about the father plants. In the field, most corn silks are pollinated by surrounding plants, a process known as cross-pollination. Because pollen is blown in on the wind (open-pollination), the many kernels on a single ear can be pollinated by many different father plants. Planting the kernels from an open-pollinated ear of corn produces plants as similar as half-brothers or -sisters. In order to select for a more uniform and genetically similar crop, the source of pollen must be controlled—a difficult proposition on a windy day. The ears must be protected from chance pollination and then hand-pollinated with a tassel from the desired father plant. Then, the kernels will produce plants that are as similar as brothers and sisters.
- Explain how many farmers and gardeners plant hybrid varieties of corn and other vegetables. It takes years of controlled pollination to develop

hybrids. First, a carefully selected plant with desirable characteristics is self-pollinated for seven+ generations, resulting in an inbred plant. Inbred plants have stunted growth and do not yield well, but when two different inbred plants are cross-pollinated, their progeny grow vigorously, yield well, and reliably express desired traits—these are hybrid varieties. Development of hybrids has greatly increased agricultural productivity, but seed saved from a hybrid is unreliable. For this reason, some gardeners and farmers prefer non-hybrid varieties.

Procedure:

1. Go over key terms and concepts with students before beginning the activity.

2. Remind students about the similarities and differences among humans that come from inherited traits. Ask students to list various inherited traits. Ask students if plants have traits that are inherited through their genetics just like humans. Tell your class that you are going to investigate the genetic variation present in plants.

3. Provide each student with one popcorn seed and one Indian corn seed. Ask each student to begin his or her 'corn journal' by drawing a picture of each seed and writing several sentences to describe it.

4. Provide each group with a plastic jewelry bag, cotton balls, and yarn, permanent markers and a cup of water. Use the permanent marker to label one side of the bag or container with *P* and the other side *I*.

5. Dip a cotton ball in water so that it is thoroughly wet but not dripping. Excess water will cause the seeds not to sprout.

6. Place the cotton ball in the small plastic bag or container.

7. Put one popcorn seed on the side of the cotton ball facing the label *P*. Put one Indian corn seed on the other side of the cotton ball, facing the label *I*. The labels will help students remember which seed is which.

8. Seal the bag. String the yarn through the hole in the jewelry bag. Tie a knot in the end of the string to form a necklace. (If you opted to use the jars or small containers, the necklace aspect of this project will not work- students would simply observe the growth).

9. Bags can be hung from tacks on a bulletin board and taken down for student observations.

10. For one week or longer, have students record in their journals the changes they observe in their seeds, including information about observable traits such as: number of days from “planting” until the root and the shoot can be seen, root and shoot lengths and color, and number of leaves and roots. Use hand lenses to observe the roots and shoots as they emerge and grow. Use rulers to measure the length of roots and leaves as they grow. Note: It is difficult to take the seedlings out of the bags and get them back in without breaking the roots. Ask students to measure through the bag instead. The roots will curl, so you may want to suggest measuring them in sections and estimating as necessary.

11. As a class, discuss how each group compared their data for popcorn and Indian corn. Were there noticeable differences between the popcorn and Indian corn seedlings?

12. Discuss how plant breeders control inheritance and work to develop seeds that will reliably express desired traits. Popcorn has been selected for different traits than Indian corn. Compare the traits of the corn seedlings to those of mature corn plants (using photographs).

Recommendations: The corn seeds will sprout in three to six days. Starting on a Friday and making the first observations on Monday will speed up this activity.

HOST A PLANT OLYMPICS

Summary: Bring measurement and weighing into the school garden by hosting a fruit and vegetable olympics to see who the champion growers of the year are. This is a fun way to incorporate many elements of math into one lesson.

Time Frame: 45 min-1 hour
Ages: 3rd-5th grade
Season: Spring, Summer, Fall

Standards Covered:

1. 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot graph, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.
2. 3.ESS.1: Earth's nonliving resources have specific properties.
3. 3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement:
   a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.
   b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.

Materials:

- Fruit and vegetables from the garden
- Tape measure or rulers
- Weighing scales
- Clipboards, paper, or chalkboards/whiteboards
- Card stock

Procedure:

1. Prior to the "event", have the students create gold, silver, and bronze metals from the cardstock to award at the end of the activity (and perhaps make "Olympic rings" out of natural materials found in the garden).
2. Students will organize a survey of their school garden and the produce growing, measuring and recording several characteristics of the plants as well as the produce itself: height, width, diameter, circumference, weight, etc.
3. Assist students in graphing their results in various ways, ranking the "winners".
4. Be creative with the categories! Some ideas: tallest sunflower, heaviest squash, sunflower head with the biggest diameter, pumpkin with the biggest circumference, longest carrot, potato vine that covers the biggest area, pea pod that contains the most peas, etc.