K-2 / Math: The Life of a Plant through Yoga and Gardening
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Overview:

> Students will explore how much space plants need to grow by participating in a yoga sequence that represents the plant life cycle and by exploring how plants grow in the garden. Then, students will work in small groups to fold a 12x12 inch sheet of newspaper into either two or four sections vertically and then the same amount of sections horizontally, resulting in either four or sixteen equal squares. Students will paste a bean seed (or other legume seed) in the middle of each of the squares. After they dry, the square foot gardens will be planted in the garden in a place where they will get plenty of air and light. Students will provide them with their other plant needs by covering them with a little bit of soil and watering them daily. A few weeks later, students can measure the plants to compare the height of the beans that were planted with four to a square foot to the beans that were planted with sixteen to a square foot to draw conclusions about the best way to space beans in the garden to grow as much as possible and provide for the plants' needs.
>
> *(Time Needed: 40 minutes on first day, 15 minutes on day a few weeks later)*

Georgia Performance Science Standards:
- Life Science
  - 1st Grade
    - S1L1a. Students will identify the basic needs of a plant: air, water, light, nutrients.
  - 2nd Grade
    - S2L1c. Investigate the life cycle of a plant by growing a plant from a seed and by recording changes over a period of time.

Common Core Math Standards:
- Fractions
  - 1st Grade
    - CCSS.MATH.CONTENT.1.G.A.3. Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.
  - 2nd Grade
    - CCSS.MATH.CONTENT.2.G.A.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc. and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.
- Measurement
  - Kindergarten
    - CCSS.MATH.CONTENT.K.MD.A.2. Directly compare two objects with a measurable attribute in common, to see which object has "more of" / "less of" the attribute, and describe the difference.
  - 1st Grade
    - CCSS.MATH.CONTENT.1.MD.A.2. Measure and estimate lengths in standard units.
  - 2nd Grade
    - CCSS.MATH.CONTENT.2.MD.A.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
    - CCSS.MATH.CONTENT.2.MD.A.3. Estimate lengths using units of inches, feet, centimeters, and meters.
    - CCSS.MATH.CONTENT.2.MD.A.4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.
    - CCSS.MATH.CONTENT.2.MD.B.5.Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units.

Objectives:
- Students will partition their square foot of newspaper into two equal parts both vertically and horizontally to create four squares total. Students will partition their square foot of newspaper into four equal parts both vertically and horizontally to create sixteen squares total.
- Students will provide their bean seeds with air, water, light, and nutrients.
- Students will directly compare the beans grown with four plants to a square foot and sixteen plants to a square foot.
- Students will estimate and measure the height of the bean plants in standard units by selecting and using the appropriate tools such as rulers, yardsticks, meter sticks, or measuring tapes.
- Students will measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Materials:
- bean (or other legume) seeds (9 seeds per small group)
- 12x12 inch Newspaper (1 page per small group)
- Pencils
- Flour, water, bowl to make paste
- Popsicle sticks for paste (1 per small group)
- Rulers, yardsticks, meter sticks, measuring tapes

Reproducibles:
- [Yoga Pose Posters - From Seed to Plant](#) (1 set)

Outline:
- Engage: Complete yoga sequence representing plant growth
- Explore: Explore garden examining plant spacing
- Explain: Create square foot gardens with varying plant spacing
- Extend: Measure plants to determine ideal plant spacing

Lesson Plan:
- Engage (whole group / on the carpet) - 10 minutes
    - Model a yoga sequence to represent a seed growing into a plant while students follow using the [Yoga Poses Posters - From Seed to Plant](#). First with students spaced so every student has enough personal space to complete the poses fully and then with students spaced side by side, moving carefully through the poses without full extension.
    - After completing the sequence, ask students to imagine if they were a seed – Did they have enough room to grow? Could any other "seeds" fit in their "farm"?
- Explore (whole group / in the garden) - 10 minutes
    - Give students the opportunity explore out in the garden to investigate how far apart different plants grow. Encourage students to make a hypothesis - "Do plants like to be close to their friends or planted far apart?"
- Explain (small groups / in seats) - 20 minutes
    - Explain that the class will conduct an experiment to determine if bean plants grow larger when they are planted closer together or further apart.
        - Provide small groups of students with a 12 x 12 inch piece of newspaper.
        - Instruct on-level learners to determine how to divide their newspaper into 4 equal parts and above-level learners to determine how to divide their newspaper into 16 equal parts.
        (beans actually typically requires 4" spacing which would occur when the newspaper is divided into 9 equal parts but folding in thirds can be very challenging. This method of 4 and 16 equal parts will provide an opportunity for experimentation for the class to determine which method was most effective.)
        - Provide students with bean seeds and a bowl of paste made of flour combined with enough water for a paste consistency (or allow students to make the combination themselves). Students can use popsicle sticks to put a dot of the paste in the middle of each of their newspaper squares. Then students can place a seed on top of the paste dot.

- ○ After the paste has dried, the class can plant their square foot gardens outdoors. They should be placed in an area that receives plenty of sunlight and the newspaper sheet should be covered up with about ½ inch of soil. The gardens should be watered regularly when rain is not consistent.

- ● Extend (small groups / in the garden) - 15 minutes on a day a few weeks later
  - ○ Visit the garden with rulers to determine which beans plants grew taller - the beans planted closer together or further apart.
- ● Evaluate:

Example Evaluation

Kindergarten		
CCSS.MATH.CONTENT.K.MD.A.2.	Did the beans planted with 4 plants in each square foot or the beans planted with 16 plants in each square foot grow taller?	
1st Grade		
S1L1a.	What are the four plant needs that our bean plants needed to grow?	
CCSS.MATH.CONTENT.1.MD.A.2.	Estimate the average height of the beans planted with 4 plants in each square foot.	
CCSS.MATH.CONTENT.1.MD.A.2.	Estimate the average height of the beans planted with 16 plants in each square foot.	
CCSS.MATH.CONTENT.1.MD.A.2.	Choose a measuring tool and measure the tallest bean plant that is planted with 4 plants in each square foot.	
CCSS.MATH.CONTENT.1.MD.A.2.	Choose a measuring tool and measure the tallest bean plant that is planted with 16 plants in each square foot.	
2nd Grade		
CCSS.MATH.CONTENT.2.MD.A.4. CCSS.MATH.CONTENT.2.MD.B.5.	How much shorter / taller is the bean plant that is planted 4 plants in each square foot compared to the bean plant that is planted with 16 plants in each square foot?	
Conclusion		
Does this lead us to believe that bean seeds like to be planted closer or further away from other plants?		