

Topic: Bean Plant Growth

Kristen Covino

National Science Education Standards:

Content Standard A: Science as Inquiry

Abilities necessary to do scientific inquiry

Understandings about scientific inquiry

Content Standard C: Life Science

Matter, energy, and organization in living systems

MS Science Frameworks:

1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.
 - a. Conduct a scientific investigation demonstrating safe procedures and proper care of laboratory equipment. (DOK 2)
 - b. Formulate questions that can be answered through research and experimental design. (DOK 3)
 - c. Apply the components of scientific processes and methods in classroom and laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, theory development). (DOK 2)
 - d. Construct and analyze graphs (e.g., plotting points, labeling x-and y-axis, creating appropriate titles and legends for circle, bar, and line graphs). (DOK 2)
 - e. Analyze procedures, data, and conclusions to determine the scientific validity of research. (DOK 3)
 - f. Recognize and analyze alternative explanations for experimental results and to make predictions based on observations and prior knowledge. (DOK 3)
 - g. Communicate and defend a scientific argument in oral, written, and graphic form. (DOK 3)
2. Describe the biochemical basis of life and explain how energy flows within and between the living systems.
 - g. Analyze and explain the biochemical process of photosynthesis and cellular respiration and draw conclusions about the roles of the reactants and products in each. (DOK 3)
3. Investigate and evaluate the interaction between living organisms and their environment.
 - b. Provide examples to justify the interdependence among environmental elements. (DOK 2)

Objectives:

- Experimental design and hypotheses
- Review Photosynthesis and chlorophyll
- Understanding the visible light spectrum
- Understanding absorption and reflection of light
- Taking measurements and data collection
- Graphing

Engage:

We will discuss the different things plants need to grow. I will ask the students questions about this. “What do we need to provide the plants in our garden to ensure they will grow properly?” Water, light, ...don't forget carbon dioxide. I will draw the formula for photosynthesis and review it. $\text{CO}_2 + \text{H}_2\text{O} + \text{light energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$.

I will tell them that we are going to investigate the effects that light may have on plant growth, specifically, different colors of light.

Explore:

In pairs, the students will plant bean seeds to investigate the effect of colored light on plant growth. Each pair will have a control plant (clear cellophane) and an experimental plant with colored cellophane. They will have to measure and water their plants over the 6 weeks of this experiment. They will then graph their results.

Explain:

We will again review photosynthesis, chlorophyll, and what makes things appear to be different colors. I will cover the components of the visible light spectrum and then use the prism to demonstrate this. We will cover what absorption and reflection mean with many examples. We will also cover transmission of light with examples. Some practical situations will be covered; e.g. ‘why does it make you hotter if you wear black on a sunny day?’ This information will be used to explain our results.

Evaluate:

The students will fill out a series of questions on their handout which will begin with simple concepts/definitions, support/rejection of their hypothesis, and then lead into some critical thinking. Their graphs will also be evaluated for the required component parts.

Elaborate:

The students will be asked two thought-provoking questions that will make them think beyond our experiment. First they will need to consider the type of control that we selected (clear cellophane, a 'positive' control). They will come up with an alternative control (e.g. no cellophane) and then need to speculate whether they would see a difference in the plant growth between these two types of controls. Finally, the students will be asked to consider other things that may influence plant growth and to design an experiment to test them.