Sunflower

Life Science | Lesson Guide

5th Grade

Photo Description

This image shows a young plant seedling growing from the soil with its seed coat still attached to the top of the green stem. The striped seed case sits like a cap on the emerging plant, while the first green leaves are beginning to unfold. At the base, you can see the original seed that provided the energy for this new plant to start growing.

Scientific Phenomena

The anchoring phenomenon here is seed germination and early plant development. This occurs when a seed absorbs water, which activates enzymes that break down stored nutrients (starches, proteins, and fats) in the seed. The embryo inside uses this energy to grow a root system downward and shoot upward. The seed coat remains attached as the plant emerges because it takes time for the seedling to fully shed this protective covering as it transitions from using stored seed energy to producing its own food through photosynthesis.

Core Science Concepts

1. Seed Structure and Function: Seeds contain an embryo (baby plant), stored food (endosperm), and a protective seed coat that work together to ensure successful germination.

2. Plant Life Cycles: This represents the critical transition from seed to seedling, demonstrating how plants reproduce and continue their species through generations.

3. Energy Transfer in Living Systems: The seedling is converting stored chemical energy from the seed into kinetic energy for growth until it can begin photosynthesis.

4. Plant Responses to Environmental Stimuli: The shoot grows upward (positive phototropism) seeking light while roots grow downward (positive gravitropism) seeking water and nutrients.

Pedagogical Tip:

Have students keep germination journals with daily drawings and measurements. This helps them observe gradual changes and develops their scientific observation skills while connecting to the slower pace of biological processes.

UDL Suggestions:

Provide multiple ways for students to document plant growth: drawings for visual learners, measurement charts for mathematical learners, and verbal descriptions recorded on devices for students who struggle with writing.

Zoom In / Zoom Out

1. Zoom In: At the cellular level, water molecules are entering seed cells through osmosis, causing them to swell and activate dormant enzymes. These enzymes break down complex starches into simple sugars that fuel cellular respiration and provide energy for cell division and elongation.

2. Zoom Out: This single germinating seed is part of a larger ecosystem cycle where plants convert sunlight into chemical energy, provide food and oxygen for other organisms, and eventually decompose to enrich soil for future generations of plants.

Discussion Questions

1. What evidence can you observe that shows this plant is using energy to grow? (Bloom's: Analyze | DOK: 2)

2. How might this seedling's growth be different if it were planted in complete darkness versus bright sunlight? (Bloom's: Evaluate | DOK: 3)

3. What do you predict will happen to the seed coat over the next few days, and why? (Bloom's: Apply | DOK: 2)

4. How does this seedling's survival strategy compare to how baby animals get the energy they need to grow? (Bloom's: Analyze | DOK: 3)

Potential Student Misconceptions

1. Misconception: "Plants eat soil for food like animals eat other things."
   Clarification: Plants make their own food through photosynthesis using sunlight, water, and carbon dioxide. Soil provides minerals and support, but not food energy.

2. Misconception: "The seed turns into the plant."
   Clarification: The tiny embryo inside the seed grows into the plant using energy stored in the seed, similar to how a baby bird uses nutrients from an egg yolk.

3. Misconception: "All parts of the plant grow at the same speed."
   Clarification: Different plant parts grow at different rates and in different directions based on their functions and environmental signals.

Cross-Curricular Ideas

1. Mathematics - Measurement and Graphing: Have students measure their seedling's height daily and create line graphs showing growth over 2-3 weeks. They can calculate growth rates, compare growth between different seedlings, or predict future height based on patterns. This connects to measurement standards and data representation.

2. English Language Arts - Life Cycle Narratives: Ask students to write from the perspective of the seed or seedling, describing the journey from seed to sprouting plant. They could create "seed journals" written as if the seed is narrating its own germination experience, combining creative writing with scientific understanding.

3. Social Studies - Agriculture and Food Systems: Explore how farmers use seed germination knowledge to grow crops that feed communities. Discuss how different cultures around the world depend on seeds (rice, corn, beans, wheat) and how understanding plant growth helps ensure food security.

4. Art - Nature Observation and Sketching: Have students create detailed scientific illustrations of their seedlings at different growth stages. This develops observational skills and artistic technique while documenting the natural world, connecting to both visual arts and scientific documentation practices.

STEM Career Connection

1. Botanist - A botanist is a scientist who studies plants, including how they grow, what they need to survive, and how to help plants thrive. Botanists might work in gardens, forests, universities, or even create new plant varieties to feed more people. They use microscopes, conduct experiments, and observe plants carefully. Average Annual Salary: $63,000 USD

2. Agricultural Scientist - An agricultural scientist helps farmers grow better crops by understanding seeds, soil, water, and sunlight. They experiment with different growing methods to produce more food, solve plant diseases, and protect the environment. Some work in laboratories while others work in fields and farms. Average Annual Salary: $68,000 USD

3. Horticulturist - A horticulturist is an expert in growing plants like fruits, vegetables, flowers, and trees. They work in nurseries, greenhouses, farms, and botanical gardens, using their knowledge of seeds and plant care to help plants grow healthy and strong. They might also teach others how to garden and grow their own food. Average Annual Salary: $58,000 USD

NGSS Connections

- Performance Expectation: 5-LS1-1 - Support an argument that plants get the materials they need for growth chiefly from air and water.
- Disciplinary Core Ideas:
  - 5-LS1.C - Organization for Matter and Energy Flow in Organisms
  - 5-LS2.A - Interdependent Relationships in Ecosystems
- Crosscutting Concepts:
  - Energy and Matter
  - Systems and System Models

Science Vocabulary

* Germination: The process when a seed begins to grow into a new plant.
* Seedling: A young plant that has just started growing from a seed.
* Embryo: The tiny baby plant inside a seed that will grow into a full plant.
* Photosynthesis: The process plants use to make food from sunlight, water, and air.
* Cotyledons: The first leaves that appear on a seedling, often still inside the seed coat.

External Resources

Children's Books:
- From Seed to Plant by Gail Gibbons
- The Tiny Seed by Eric Carle
- A Seed Is Sleepy by Dianna Hutts Aston