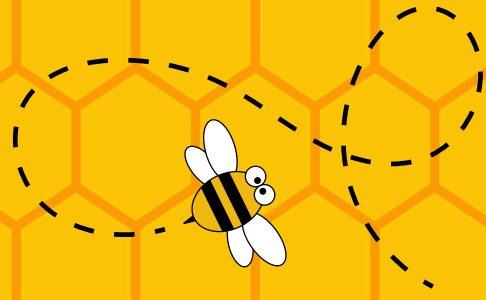


LEARNING FROM BEES



Subject: Biomimicry

Grade Level: 5-8

Topic: Life Science, Engineering Design

Time: 60-90 minutes

Learning Objectives

Students will:

- define biomimicry and explain how nature inspires engineering solutions.
- describe key features of bees and bee colonies (structure, communication, efficiency).
- analyze how the honeycomb structure maximizes strength and minimizes materials.
- design a prototype inspired by bees to solve a human problem.
- communicate and justify design decisions using scientific reasoning.

Materials

images or short video of bees and honeycombs, paper, cardstock, or index cards, straws or rolled paper tubes, tape or glue, scissors, pennies or small weights, rulers, internet access, optional: hexagon templates

Procedure

Engage: To promote student curiosity, *Ask: What inventions were inspired by nature? Why might engineers look to animals for ideas?* Explain that biomimicry is the practice of learning from and mimicking strategies found in nature to solve human problems. Have students examine bee features.

Discuss:

- Hexagon honeycomb structure
- Efficient use of wax and space
- Waggle dance communication

- Colony roles (queen, workers, drones)

Ask: Why do bees use hexagons instead of circles or squares? How does working as a colony help bees survive?

Explore: Help students build an understanding by having students conduct a building challenge.

Instructions:

Students create two small structures:

1. One using square shapes
2. One using hexagon shapes
3. Use paper or straws to build.
4. Test by placing pennies on top.
5. Measure which design holds more weight.

Ask: Which structure held more weight? Which used less material? Why might hexagons be ideal?

Be sure students understand the key concept that hexagons fill space efficiently without gaps and distribute force evenly.

Allow students to use the internet to search for real-world applications inspired by bees.

Explain: Have students begin to show what they have learned by having students share real-world bee inspired structures.

Examples:

- Lightweight aircraft materials
- Packaging design
- Structural panels
- Efficient city planning

Connect to:

- Structure → Function
- Efficiency in design
- Sustainable systems

Elaborate: Have students use their new knowledge by working alone or in groups to design one of the following:

Scenario Options (choose one or assign groups):

- Design an efficient apartment building inspired by hive structure.
- Create a communication system inspired by the waggle dance.
- Develop a community system modeled after bee colony roles.
- Invent sustainable packaging inspired by honeycomb structure.

Requirements:

- Sketch design
- Label bee-inspired features
- Explain how it solves a human problem
- Describe why bee biology makes it effective

Students may create a physical prototype or detailed drawing.

Assessment

Evaluate: Evaluate student learning by having students complete an exit ticket with the following questions:

- How do bees demonstrate structure and function?
- Why are hexagons efficient?
- What problem did your design solve?

The following criteria can be used to develop a rubric:

- Understanding of biomimicry
- Use of bee-inspired features
- Engineering reasoning
- Creativity and feasibility

Extension Activities

- Research swarm robotics
- Explore how bees regulate hive temperature
- Explore the environmental impact of pollinators

NGSS Alignment

Middle School

MS-LS1-1 - Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS2-2 - Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-ETS1-1 - Define the criteria and constraints of a design problem.

MS-ETS1-2 - Evaluate competing design solutions using a systematic process.

MS-ETS1-3 - Analyze data from tests to determine similarities and differences among design solutions.

Grade 5 Alignment

5-LS1-1 - Support an argument that plants and animals have internal and external structures that function to support survival.

3-5-ETS1-1 - Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem.

3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled.



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