

# Thinking like Bees and Flowers

## A science-art learning activity

### Summary

A two-part art-science lesson plan exploring the concepts of **pollination**, **mutualisms**, and **coevolution**. Suitable for grades K-5, but can be adapted for middle and high school.

### Lesson Objectives

- Introduce the ecological concepts of pollination, mutualism, and coevolution through the example of bees and flowers.
- Apply understanding of bee-flower coevolution in an art project creating clay flowers using the flower traits bees might like best.
- Practice observational science by hypothesizing and observing bee activity using artificial flowers.

### Materials

(Part 1) "Think Like a Flower" Activity	(Part 2) "Think Like a Bee" Experiment
<ul style="list-style-type: none"> <li>→ Bakeable clay*</li> <li>→ Clay shaping tools*</li> <li>→ Flower petal cookie cutters*</li> <li>→ Rolling pins*</li> <li>→ Paint*</li> <li>→ Paint brushes*</li> <li>→ Parchment paper + tape to keep desks clean</li> <li>→ "Think like a flower" worksheet</li> </ul>	<ul style="list-style-type: none"> <li>→ Tube inserts (5 mL)*</li> <li>→ 1:1 sugar water solution</li> <li>→ Stakes (18")*</li> <li>→ Stopwatch</li> <li>→ "Think like a bee" worksheet</li> </ul>

\*Materials provided in kits

### Definitions:

**Pollination:** Pollination occurs when the pollen grains from the anthers of one flower are transferred to the stigma of another.

**Mutualism:** ecological interaction between two or more species where each species has a net benefit.

**Coevolution:** the influence of closely associated species on each other in their evolution

## Part 1: Think Like a Flower

Time required: 20 minutes prep, 20-30 minute lesson, 60 minute activity

1. Introduce the concept of **pollination**.
  - a. Show the flower parts on a screen, drawn on a whiteboard, or using a real flower (lilies work great).
  - b. Point out the parts of the flower that are used in pollination: pollen, anthers, and stigma.
  - c. Pollination can happen by abiotic agents like wind or rain, or by biotic agents like insects (like bees and butterflies), birds, and bats
  
2. Explain the **symbiotic mutualism** between bees and flowers.
  - a. Why are bees the most efficient pollinators? They share a mutualism with flowers!
  - b. Flowers receive pollination from bees visiting them. Bees are great pollinators because:
    - i. They are fuzzy (they even have special features on their bodies (honeybees and bumblebees: pollen baskets) to carry pollen from one flower to another!
    - ii. They can fly long distances! Flowers are limited because they have to stay in place.
  - c. Bees receive food from flowers. Larvae eat the pollen, which has fats and proteins, and adults eat the nectar, which is full of sugars.
  
3. Describe **coevolution** between bees and flowers.
  - a. The best way I know of to describe coevolution is the idea of “being best buddies throughout time.” If your students are not familiar with evolution yet, the term coevolution might not be necessary, but the main ideas behind this concept can still be grasped.
  - b. Evolutionary time:
    - i. The first flower appeared 140 million years ago
    - ii. The first bee appeared 130 million years ago
    - iii. Bees existed at the same time as dinosaurs!
  - c. Bees and flowers are closely linked through their mutualism. Because they help each other out so much, they have both evolved in a way that helps them find each other.
    - i. Bees: development of amazing memories (bees can remember the locations of flower patches in a landscape) and floral fidelity (bees have the tendency to visit the same type of flowers again and again)
    - ii. Flowers: flashy colors which bees like (bees see yellow and blue/ purple the best), nectar guides to show bees where pollen is, different petal shapes and sizes, smells made by the plant to attract bees
  
4. **“Think like a Flower” worksheet.**

- a. Notice the most common color, size, and shape traits flowers have. Which traits might be most successful in attracting bees?
5. Flower sculpting activity.
- a. Using bakeable clay and clay-shaping tools, have students create flowers inspired by the flower traits from their “Think Like a Flower” worksheet.
    - i. There are several ways to form petals. Students can use the provided cookie cutters, shape their own, or draw their own petal shapes on a rolled out slab of clay that an instructor can cut for them.
    - ii. Tip: use parchment paper taped onto each student’s workstation to keep the space clean.
    - iii. Have students carve their initials using a sculpting tool or a toothpick to keep track of each person’s flower.
    - iv. The centers of these flowers should be large enough to punch a hole the size of a dime into before baking. This will be where the tubes containing “nectar” go.
    - v. The flowers should be big enough to rest on the circular “holders” for the 18” stakes provided in the teacher kit.

Examples of flowers created by children:



- b. Punch a hole large enough to fit a 5 ml tube in the center, then follow the baking instructions for the clay.
- c. Using acrylic paint, have students paint their clay flowers inspired by the flower traits from their “Think Like a Flower” worksheet

## Part 2: Think Like a Bee

Time required: 1 hour prep, 30-60 minute activity

1. A few hours to a few days before the lesson, **prepare the flowers** for the outdoor experiment. The more time outside, the better, so bees in the area can learn to recognize the flowers as a tasty food source!
  - a. Prepare the sugar water in a 1:1 ratio
  - b. Place the 5 mL tubes in the clay flowers. Glue them if needed, then fill the tubes with sugar water.
  - c. Push the 18" stakes in the ground several inches to ensure that they are stable.
  - d. Place the flowers on the top of the circular "holders" for these stakes. Use rubber bands or wire to secure the flowers.
  - e. Replenish sugar water as needed before the activity.

Flower set-up should look like this:



2. Introduce the different **types of bees** which might visit flowers.
  - a. I recommend using the WiBee Groupings:
    - i. Honeybees
    - ii. Bumble bees
    - iii. Large dark bees
    - iv. Small dark bees
    - v. Green bees
    - vi. Non-bee pollinators (flies, beetles, butterflies, etc.)
  - b. What do you think bees look for in a flower?
    - i. Color, shape, size, smell
    - ii. Other?
3. Practice the scientific method using the PHEOC method in the **"Think Like a Bee" worksheet**. This can be done individually or as a class.

- a. Example:
- i. Problem: We are not sure which flowers bees like the best.
  - ii. Hypothesis: I think that bumblebees will like yellow flowers the best and green bees will like green flowers the best.
  - iii. Experiment: I will watch bees for 1 minute and write down the number of bees I see visiting my flower. Then I will do the same at another person's flower with a different color. I will do this 4 times.
  - iv. Observation: On yellow flowers I found 4 bumblebees, 2 honeybees, 1 green bee. On green flowers I found 1 bumblebee and no other bees.
  - v. Conclusions: Based on my observations, the bees seemed to like yellow flowers better than green flowers!