A Bee's Home
Pre-Lab Activity - Teacher Guide
Grades 2-3

Overview
This problem based lesson challenges the students to create a home for bees based upon a set of guidelines and a rubric. Teams will compete against each other to get the most points for their creation.

Materials
50 toothpicks per team
1 copy of the *Bee Template* per team
A strip of scotch tape per team
1 copy of *Bee Home Rubric* per team
Scissors (to cut bees apart)

Getting Ready
- Divide students into equal groups
- Place 50 toothpicks in a baggie (one baggie per team)
- 1 copy of the *Bee Template* and *Bee Home Rubric* per team

Procedure
Divide the students into equal groups (suggested 3-4 students per team). Explain the team challenge of the day by saying:

> "Today your team is faced with a challenge. A local bee hive has been damaged and some of the bees have been displaced (without a home). We need to build them a new home so they can continue their honey production. Your goal today is to provide as many bee cells (the holes that bees use to store honey) using 50 toothpicks. Your materials today will be as follows: 50 toothpicks, a sheet of bee templates (this size bee must be able to fit inside of each cell), scotch tape (to secure the toothpicks to a flat surface so they will not move as easily while building), and a rubric that will show you how you can earn points for your team. The bee's new home will be the structure that receives the most points at the end of time. Are there any questions?"

Please answer any student questions as vaguely as possible. The purpose of this lesson plan is for the students to problem solve through exploration rather than assistance from an adult.

Review the rubric with the students.

- How many cells were created? A cell is a hole that the bee template can physically fit inside of the toothpick structure without sticking out. The breakdown is pretty self-explanatory as far as quantitative numbers.
- How many toothpicks were used? Each toothpick represents a wall of a cell that they bee would physically have to create. Each wall the bees create requires resources (materials to produce the wax) and time (to build, dry, etc.). The goal is to create the most bee cells using the least amount of material (toothpicks).

- How much wasted space was there? Wasted space is defined as space within the bee's home where a bee is unable to physically fit. This extra space is "wasted space" because the bee is unable to use the space to hold honey or a bee's egg. If too much wasted space is in the bee's home the bees will quickly run out of space and require a new home. This category will be scored by the teacher.
- How well did my team work together? Bees must work together to create a successful home for everyone. Therefore your team must work together as well. This category will be scored by the teacher.

Each team has the possibility of scoring 12 points. The team with the most points at the end of time will be the winner for the bee's new home.

Allow the students time to plan and build their structure. Please monitor the classroom of their progress and their teamwork. Feel free to offer friendly reminders that you will be scoring them on their teamwork. The time frame of the building section of this lesson plan depends on your student's progress. Take as much or as little time as you wish (and your schedule allows).

At the end of time have the students share their work. This can be done in a presentation manner or as a gallery walk around the room allowing each time to visit every team's work. Don't forget to score each team on the two teacher scored categories (wasted space and teamwork).

Announce the winner(s) of the challenge. Share the explanation section of this lesson plan with the students as to why bees use the hexagon shape for their cells.

Explanation

In an actual bee hive, the bees choose to create each cell in the shape of a hexagon (6 sided shape). There are many reasons for this procedure. The first reason is that hexagons can fit together with no wasted space. The hexagon shape can be repeated in a pattern on all six sides of the shape. Unlike the circle where there would be a gap between all of the cell walls. The extra gaps between the cells would require extra wax to hold them together. Extra wax equals extra time and resources the bees would need to finish their cells. The second reason bees prefer hexagons is the queen bee uses the cells to lay the eggs in. Think about the shape of a baby egg and a bee. The bee fits best in the hexagon shape rather than a square or rectangle. Once again, extra space equals extra materials and time. Third, the geometry of the hexagon shape uses the least amount of material to hold the maximum amount of weight.

Assessment

The assessment for this lesson plan is the rubric. Please refer to the procedure section of the lesson plan as to the reasoning behind the scoring of each category on the rubric.

Bee Home Rubric

How can we earn points?	3 points 	2 points 	1 points 	0 points 
How many cells were created?	8+ cells	6 - 7 cells	3 - 5 cells	0 - 2 cells
How many toothpicks were used per cell?	0 - 6 toothpicks	7 - 14 toothpicks	15 or more toothpicks	
How much wasted space was there? *Teacher Scored*	No wasted space, all of the cell walls touched another cell wall.	A little bit of wasted space.	A lot of wasted space.	Unable to determine because the cells were not attached together.
How did my team work together? *Teacher Scored*	Everyone worked together without any problems!	We did a pretty good job, but we had a few issues.	We tried, but there was some big problems!	Nobody worked together! We argued a lot!

Team Name: _____

How many points did my team earn? _____