Elementary Bee Hive Game – Build a Hive

Purpose

To introduce students to the basics of how honeybees work as a group to grow the population of their colony and consider some of the challenges that a hive may face.

Objectives

1) Students will participate in a physical activity that promotes learning about the behaviour and life cycle of honeybees, while working as a team.
2) Students will recognize the importance that flowers play in the lifecycle of bees.
3) Students will consider the limiting factors and threats that a colony of bees can face.

Duration

30-60 minutes

Group Size

Ideal group size between 20-30 students, though a larger group could be accommodated with more materials and adaptations to the game's rules.

Materials

- Hula hoops (or another plentiful object to be used as hive cells and flowers)
- Tennis or foam balls (or another small, plentiful object to represent food)
- Plastic container for food to go into when it is used or "eaten"
- Pylons to mark the boundaries of the game
- Costume Props (optional)
    - Plastic tiara for the queen
    - Orange construction vests for the workers
    - Feather boa for the bird
    - Black pinney for the spider
    - Construction paper wheels for the car
- Whistle
- Stopwatch/Timer

Set-Up

- Place pylons around the activity space that you plan to use to set the boundaries of the game. This may not be necessary in a gym as the total space would be adequate.
- Place pylons across the activity space to set the boundaries that the "hazards" (car, spider, bird) can move.
- Place four hula hoops (or other object to delineate a hive cell) adjacent to each other at the end of an open space (gym or field).

- Place six to eight more hula hoops (or other objects) at various distances from the "hive" and place eight to ten "food" objects (balls or other) in each one. Numbers of flowers and food will vary depending on the number of students.
- Place ten or more extra hula hoops (or other) next to the "hive" for workers to build with.
- Place a small garbage can or plastic container close to the "hive" for students to place their used or "eaten" food.
- Optional: Have props that students can wear to denote their role in the hive (queen or worker) or as a hazard in a container readily at hand.

Procedure

When set-up is complete, have students gather at the starting point beside the "hive" to explain expectations during the activity and the rules of the game. When first starting, keep the rules basic and build upon them in successive games, adding new rules to introduce new concepts and provide challenges to the survival of the hive.

<u>Basic Rules</u>

1. The queen lays eggs by guiding a student from the starting point to an empty cell. In order to lay an egg, the queen must be given one piece of food by a worker. Only the queen can lay eggs.
2. When an egg is laid, the student cannot leave their cell until they receive two pieces of food from the workers. When they get both pieces, they become an adult worker and can begin helping build the hive and gather food.
3. The workers can also store up to three pieces of food in a cell. The queen cannot lay an egg in a cell being used to store food.
4. When food is "eaten" it is placed in the plastic container beside the hive.
5. Workers collect their food by leaving the "hive" and visiting the flowers represented by the hula hoops distributed around the field/gym.
6. Workers can only pick up one piece of "food" from a flower and can only carry two pieces at a time (one in each hand). This means they must visit more than one "flower" if they want to bring back the maximum amount of food to the hive.
7. Workers need to build more cells to expand the hive. In order to build a new cell (place another hula hoop) they must have five workers carry it over and place it down beside the other cells. The more cells there are, the more eggs the queen can lay and the more food can be stored.
8. A few students selected as predators/hazards (bird, spider, car etc.) can catch bees that have left the hive. They cannot leave the designated hazard zone, which should be situated so the workers must pass through to access their food. If a student is tagged, they return to the starting point until they are laid as another egg by the queen.

To Begin

1. A single student is randomly chosen to be the queen and enters the “hive”. Explain that all worker bees are female, in case there is concern about a male student being embarrassed about playing a queen.
2. Four other students are randomly chosen to be the first workers in the “hive”. They stand in each of the four “cells” (hula hoops).
3. Three students are chosen to be the “hazards”, a car, a spider, and a bird. They are situated in the hazard zone enclosed by pylons, which they cannot leave. They try to tag passing workers when they go through the hazard zone to get to their food.
4. The rest of the students stand at the designated starting point until they are chosen by the queen.
5. Emphasize to the students the importance of working as a team to try a build their hive and help the queen lay lots of eggs.
6. When the students are in their places and ready, begin the game. Provide guidance if the students are unsure what to do first. Remind them that they need five workers to build more cells, so it’s important to get food for the queen so she can lay eggs and produce more workers who can help expand the hive and collect more food.

As the game progresses, make sure that students waiting to become workers are being chosen fairly. The facilitator could queue up the students to be chosen by the queen to ensure that no one gets overlooked or ends up watching from the sidelines for too long. Allow the game to progress to the point where the majority of the students are active and the hive has been built to its maximum size, based on the number of “cells” you have at your disposal.

Use the whistle to gather the students back at the starting point. If time allows, set-up for another round (have students replace food pieces and hive cells) with new students assuming the roles of queen and the hazards. Now that the students have had a chance to become familiar with the various rules, you can begin to introduce new scenarios and rules if you choose. These changes can be used to reflect different aspects of how bees work together and problems that can arise for hives.

Rules & Scenarios to Extend Gameplay

The facilitator can introduce some or all of these extra rules and scenarios to introduce new concepts and challenges to the students. It is advisable to introduce them gradually, as students become more familiar with the basics of the activity. Discussion could directly follow each scenario or they could be reflected upon in the classroom after the activity.

1. Introduce a variation where student worker bees who have flown from the hive three times must then consume a piece of food in the hive (either one stored in a cell or brought back by a fellow worker) before they can leave the hive again.
    - Before starting, remind students of storing and sharing food with each other and the queen.
    - Explain how they will only have enough energy to leave the hive on three flights before they must eat.
    - Encourage the worker bees to communicate with each other for strategies to help with survival.

2. Newly emerged workers, who have never left the hive must have another worker do a "waggle dance" for them before they can leave the hive.
    - The waggle dance is a series of movements used by honey bees to communicate direction and distance to flowers.
    - Before beginning the round explain what it is used for and how to perform one. A simple waggle dance can be students wiggling, then walking in a figure eight and wiggling once more.
    - The first workers can leave the hive normally to "scout out" the flowers.
    - A version of the game could have students not allowed to speak, but have to perform one of a number of simple dances to communicate with each other (Ex: zig zag motion to indicate hive building, waggle dance for collecting food, etc.)

3. When the hive is fully built and most of the students are active workers, remove the queen (make that student a worker). Try removing the queen when there are developing bees in some cells. Then try removing the queen when the cells are empty.
    - Since the queen is the only one who can lay eggs, this could lead to a colony collapse.
    - Before starting the round introduce a new food type that can be found in the hive, called royal jelly (different coloured balls). In nature, bees produce this substance from glands in their body. Explain that if the queen dies the workers must feed a developing bee this royal jelly to create a new queen.
    - If there are no developing bees in any cells when the queen dies, the hive will inevitably collapse.

4. Introduce a variation in which when the facilitator gives two blows of the whistle, the workers and queen must all find a piece of food to eat within 30 seconds, at which point the facilitator again blows the whistle twice. If they cannot find food within that time they starve and go back to the sideline area. Ensure that during this round there is lots of food available in the flowers.
    - Before starting, explain to students that they can also use their cells to store extra food so that it is readily accessible when the whistle is blown.
    - This is why honeybees create honey from the nectar of flowers and store pollen. They require a large store of food to sustain the hive during the winter months.
    - Only allow the students to store three pieces of food in a cell. So they will need to create a number of extra cells in the hive.

5. Remove some students from the sidelines and add them to the hazard zones to represent a sudden increase in the population of predators, making it more difficult for workers to safely collect food after the more accessible flowers have been all used up.

6. Before starting another round, explain to the students that there has been a sudden die off of flowers due to new construction, an invasive species, or the changing seasons. When they begin the round, begin removing food from the flowers after they have had a chance to store food at the hive (if they remember to employ that strategy).
    - Use the "starvation" rule above to show the seriousness of a food shortage and the importance of storing food during times of plenty to be ready when food becomes scarce or unavailable.

7. If a very large group is taking part, create two separate hives that work separately from each other, demonstrating the presence of competition for resources that can exist in the wild.
    - It could be framed as a competition between teams based on amount of food stored at the end of the round.
    - If avoiding a competitive game is preferable don't bother keeping track of who gathers more food, but have the students reflect on how having another bee hive in the area affected their hive's growth.

8. When students are still in their cells waiting for food so they can emerge, the facilitator marks some of them with a round piece of construction paper stuck on with tape. This represents a parasite that feeds on them as they are developing.
    - Explain that these students must hop on one foot as they move around collecting food and constructing the hive.

- There is a species of mite, known as the Varroa destructor, which feed on honeybees as they develop in their cells. This weakens the bee and can transmit virus' that cause deformations of the wings.
- If scaled up to the relative size of a human, these mites would be roughly the size of a Frisbee.