Lesson: The Waggle Dance

Grade Level: Third Grade & Fourth Grade, Life Science

Overview: Students will learn about the importance of communication among species, focusing on the dwarf honey bee, *Apis florea*. Students will learn about the **Waggle Dance**, a way for bees to inform and receive information about new food sources. Students will also learn about the importance of collecting pollen and nectar as a food source for the whole hive. Students will participate in modeling this process through embodiment. As teams, students will act as worker bees in a hive. Students will have to work together and dance as a form of communication to explain where the local food sources are. Students will model similar movements bees use when demonstrating the Waggle Dance. Students will also receive time to discuss and reflect on ways to improve communication within their own hive.

Science content and standards:
Pennsylvania New Academic Standards for Science-
https://www.pdesas.org/Page/Viewer/ViewPage/11

Third Grade: Life Science, Heredity: Inheritance and Variation of Traits

Standard- 3-LS4-2: Use evidence to support the explanation that traits can be influenced by the environment.

Fourth Grade: Life Science, From Molecules to Organisms: Structures and Processes

Standard- 4-LS1-1: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Science Practices:
APPENDIX F – Science and Engineering Practices in the NGSS
https://www.nextgenscience.org/sites/default/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

Practice 2- Developing and Using Models

- Develop and/or use models to describe and/or predict phenomena.
- Develop a diagram or simple physical prototype to convey a proposed object, tool, or process.
- Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

Practice 3- Planning and Carrying Out Investigations

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.

Math content and standards:
Pennsylvania Academic Standards for Mathematics-
https://www.stateboard.education.pa.gov/Documents/Regulations%20and%20Statements/State%20Academic%20Standards/PA%20Core%20Math%20Standards.pdf

Third Grade- 2.4 Measurement, Data, and Probability, A) Measurement and Data

Standard- CC.2.4.3.A.1: Solve problems involving measurement and estimation of temperature, liquid volume, mass, and length.

Fourth Grade- 2.4 Measurement, Data, and Probability, A) Measurement and Data

Standard- CC.2.4.4.A.1: Solve problems involving measurement and conversions from a larger unit to a smaller unit.

Math Practices:
Pennsylvania Common Core State Standards for Mathematical Practices.
https://static.pdesas.org/content/documents/Math_Practices_and_Grade_Progressions_rev%201-24-13.pdf

1. **Model with mathematics.**
    - Experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc.
2. **Use appropriate tools strategically.**
    - Consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful.
3. **Attend to precision.**
    - Use clear and precise language in their discussions with others and in their own reasoning.

Science & Math Connection:
Relationships and Convergences Found in the Common Core State Standards in Mathematics (practices), Common Core State Standards in ELA/Literacy*(student portraits), and A Framework for K-12 Science Education (science & engineering practices) ***Venn Diagram NSTA Science, Math, & ELA-***
https://static.nsta.org/ngss/PracticesVennDiagram.pdf

- S2. Develop and use models

- M4.Model with mathematics
- S5. Use mathematics & computational thinking

Materials:

- Pencil & scratch paper
- Outdoor location
- Use a large object as the “food source”, example- a big ball.
- Optional- Stopwatch/Timer

Resources:

- The Waggle Dance Student Guide PDF
- "*Dance Language of Honey Bees"* By education.com, reading passage, https://www.education.com/worksheet/article/waggle-dance/
- *"Bee Dance Language - the linguistics behind animal language", short video, https://youtu.be/pb1IRI-YePU*
- "*Bee Dance"* By: Rick Chrustowski, https://www.amazon.com/Bee-Dance-Rick-Chrustowski/dp/0805099190/ref=sr_1_1?crid=2H4KXVR4MKQL7&keywords=bee+dance&qid=1670947985&sprefix=bee+dance%2Caps%2C68&sr=8-1

Learning Objectives:

- Students will learn that bees and flowers depend on each other to survive and thrive in an ecosystem.
- Students will learn that the Waggle Dance is a form of communication for bees.
- Students will learn that this form of communication is spoken through body movement and not language.
- Students will create a model by embodying the bees to interpret the location of food sources to other peers.

Lesson Procedure:

1. Students will watch a short video, *"Bee Dance Language"* to watch a visualization of bees communicating when expressing a food source to other bees.
2. The teacher will demonstrate the activity and teach students how to do the waggle dance using the Waggle Dance Student Guide and teacher guided directions, page 4.
3. The teacher will then guide students with the Waggle Dance game directions, outside or in an open area.
4. Students will work in small groups to model the activity.
5. Students can switch groups and/or reverse roles as an extension to the activity.
6. The teacher will conclude the lesson with reading, *"Bee Dance"* By: Rick Chrustowski.

Directions: How to play the Waggle Dance Game-

Activity Time: 30 minutes

1. Find an outdoor area that has trees, bushes, and other places to hide the bee food source. Show the students the food source, (ball). Practice the Waggle Dance steps together as a class (see directions below and/or on student guide).

3. Place students in two groups and explain the game to students.Then have students close their eyes. Place the food source in a somewhat discrete location. Do not show students where the food source is. (Teachers can make small groups instead, 4-5 students per group.)

4. Students will model the *Apis florea*, dwarf honey bee. Have one group be the bees protecting and working the hive. (These bees will be stationed in place.) Then have the other group be the active bees looking for the food source.

3. Have the active bees look for the food source within the outdoor area. While the beehive workers stay in place. (At this time, bees in the hive could read or work with some type of manipulative to stay busy.)

4. Once the active bees have found the food source they will then practice their waggle dance. When ready, the active bees will return to the beehive workers and will present the Waggle Dance to describe how far and in what direction to find the food source.

5. Have the colony of bees find the food source after interpreting the waggle dance. The goal is for students to be able to find the food source and communicate through the waggle dance properly.

Helpful tips: If stumped, beehive workers can ask active bees to dance again.

Extension idea: Students can repeat the game by switching roles and/or the teacher making smaller groups. Students could study other species of bees that interpret the Waggle Dance differently.

How to Waggle Dance-

First step! Decide how far away the food source is from the hive by estimating the distance/time. The time duration of “waggles” tells the other bees how far the flowers are. Use the three estimation dance suggestions below for how many waggles to use.

Nearby: Do 5 seconds of Waggle, (Left side waggle AND right side waggle and repeat.)

Medium: Do 10 seconds of Waggle Dances

Far: Do 15 seconds of Waggle Dances.

1. Face the direction of the flower.
2. Walking forward, waggle your bottom to the left and then to the right while walking.
3. When waggles are completed, stop and circle to the right without waggling, back to start.
4. Waggle-walk again, the same distance from step 2.
5. Then stop and circle to the left without waggling, back to start.
6. That's one waggle dance!
7. Repeat steps 1-6 to relay the message again!

THE WAGGLE DANCE

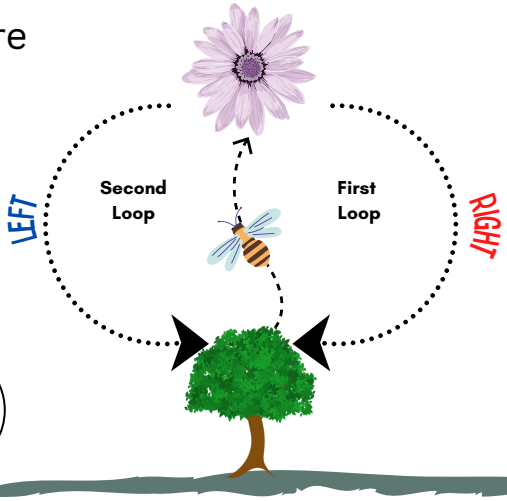
Name: _____

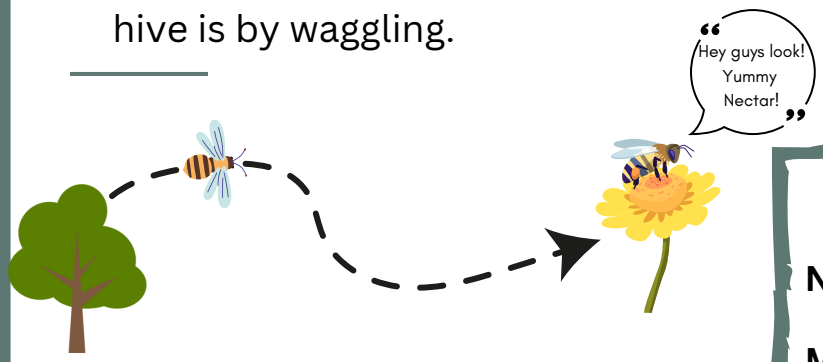
Directions: Follow the step-by-step instructions to use the **Waggle Dance** to communicate with your "bee-mates" where the closest food source is located.

The Goal: To be able to communicate where the food source is by Waggle Dancing.

The Rules:

1. No speaking to tell other classmates where to go.
2. The only way to communicate to the hive is by waggling.





If the food source is.....

Nearby: Do **5 seconds of** Waggles.

Medium: Do **10 seconds of** Waggles.

Far: Do **15 seconds of** Waggles.

Practice the Waggle Dance!

1. Face the direction of the food source.
2. Walking forward, waggle your bottom to the left and then to the right while walking.
3. When waggles are completed, stop and circle to the right without waggling, back to start.
4. Waggle-walk again, the same distance from step 2.
5. Then stop and circle to the left without waggling, back to start.
6. That's one waggle dance!
7. Repeat steps 1-6 to relay the message again!

How to find the distance?

Decide how far away the food source is by using a stopwatch! The length of time of completed "waggles" tells the other bees how far the food source is.

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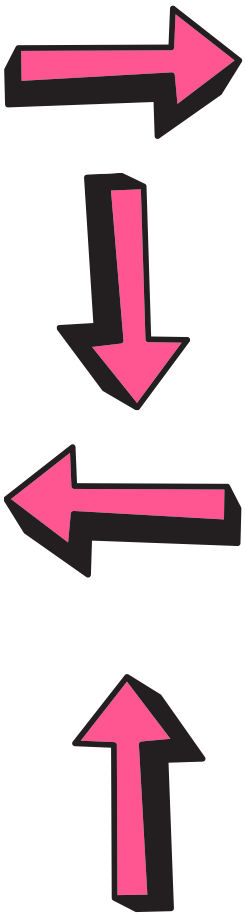
THE WAGGLE DANCE

Direction: Use the space below to sketch out your dance! You can use arrows to help you.



DID YOU KNOW?!

Bees are natural mathematicians!

This form of waggle dance is special to the dwarf honey bee species called the ***Apis florea***. Research scientists have discovered other species of bees that use a different method to the waggle dance!

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