“What's The Buzz?
A fun, interdisciplinary, hands-on activity with circuits, engineering, and bees

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Agenda

• Background

• Facilitator's Guide & 5e Model
  • **Engage** – “How do things move?”
  • **Explore** – circuit basics & energy transfer
  • **Explain** – apply concepts while building brush bot
  • **Elaborate** – “How can we model the role of bees in flower pollination?” – The Waggle Dance & Zip-line
  • **Evaluate** – formative/informal assessments
    • (think of ways you can create assessments for your own students)

• Wrap-up
Background

- Who are you? Who am I?
- IMSA’s Center for Teaching and Learning
- Student STEM enrichment & outreach
- Part of a pilot for 2\textsuperscript{nd} graders
  - Hour 1 (bee bots – circuits, energy transfer, engineering)
  - Hour 2 (bee communication and hive hierarchy)
- Opportunity to extend across STEM disciplines (and beyond)
- Funded through a ComED Community Education grant through IMSA Steve and Jamie Chen Center for Innovation & Inquiry Center
Today

• Emphasizing: Explore, Explain & Elaborate

• Engage and Evaluate – discuss as time permits
  • Be thinking of strategies that would work with your own students
  • Model Socratic, inquiry-based strategies that we emphasize in our enrichment setting

• NOTE: These activities were originally done in ~90min with three student helpers/teacher assistants
Supplies

ALSO
• Scissors
• Mounting tape

Optional:
• Googly eyes
• Craft glue
Engage

• Introduce the first essential question:

  *How do things move?*

• Emphasize answers:
  * Some force
  * Energy

Explore

• Distribute 3v coin battery and motor
  * What are your observations?
  * Why do you think there are two wires?
  * Why do you think there are two different sides of the battery?
  * Can you make the motor move?
  * When did the motor not work?
  * Did the motor stay on the whole time?
  * What can you do to stop it?
Circuit Basics & Energy Transfer

• Path for energy flow
• Energy Source (battery)
  • Potential energy
  • Relate to food we eat
• Conductors (wires)
  • Allows for energy transfer
• Load (motor)
  • What we are powering
• Switch
  • On/off
  • Open vs. closed circuits
Explore – cont’d

- Additional materials distributed
  - Toothbrush tip
  - Mounting tape
  - Bee “body”
    - coffee straw, segment
    - 2 yellow 1” pom pom
    - 1 black ½” pom pom
  - Bee “wings” & “stripes”
    - Black pipecleaner
  - (Googly eyes)
  - (Glue)
  - Small, clear rubber bands

- Students planned how they could build a bee-bot using these materials
Bee body Prep

• Using an Awl, pierce center of pom pom and slide onto awl
• Place coffee straw on pointed end of awl
• Slide pom pom off awl & onto straw
• Repeat until body complete (2 yellow, 1 black pom pom)
Explain: 2 challenges

1. Make a brush-bot that moves and remains upright
2. Decorate a brush-bot to look like a honey bee

(adapted from Monsanto, 2017).

Before building:

- How will you know your brush bot is on?
- Is that an open or a closed circuit?
- What is the load?
- How will you assemble your brush bot?
- Where will the energy come from?
Explain: Two phases

First (prep for phase 2)
- Decorate bee body
- Add wings/stripes
- Add googly eyes
- Set aside to dry (bees are “resting”; related to energy concepts from before)
- Add to completed brush bot later, using small rubber bands

Use questioning strategies along the way
- Promote inquiry & risk-taking

PHASE 1
- Build a brush bot
- How can you build a brush bot?
  - Toothbrush
  - Motor
  - Mounting tape
  - Battery
- Does it move?
- Can it stay upright?
- What can you do to change/improve it?
Elaborate

• Close your circuit & observe what happens

• **Bee Video**

• How does our model represent the Waggle Dance?

• Zip-line time!!
Evaluate

• Formative/informal checkpoints along the way
  • Questioning strategies
    • Recalling
    • Explaining
  • Students applying knowledge progressively

• Summative assessment ideas:
  • What are some of your ideas?
  • Writing prompts; diagrams/label (circuits, bee/insect anatomy); reflections (oral, written, drawings); etc.
NGSS

PE: 2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Connections to Classroom Activity</th>
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<tbody>
<tr>
<td>Science and Engineering Practice</td>
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<tr>
<td>• Developing and using models</td>
<td>Students created and used a model to explore honey bee communication (the Waggle Dance) and its role in pollination.</td>
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<td>• Asking and Answering questions</td>
<td>Students were asked a variety of questions along the way (examples provided in text); students addressed our essential question of “how do things move” using all the described activities.</td>
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<td>• Constructing explanations and Designing solutions</td>
<td>Students were challenged to explain the functioning of their brush-bot using the circuitry language/terminology to which they were introduced; students were challenged to explain how bees communicate and pollinate plants.</td>
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<td>Disciplinary Core Idea</td>
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<td>• LS2.D - Social Interactions and group behavior</td>
<td>Students, through modeling with their bee-decorated brush-bots, explored how honey bees use a special dance to communicate with others bees about the location of a food source (flower patch) which, when visited by the bee colony members, results in pollination.</td>
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<td>• PS3.D - Energy in Chemical Processes and Everyday Life</td>
<td>Students cited examples of items at home that require power/an energy source; students described that they get energy from food which powers their own movements; students related their need for food energy to the food energy required by the bees (pollen, honey).</td>
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<td>Crosscutting Concept</td>
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<td>• Matter and energy</td>
<td>Students explored how energy from a battery can be transferred to a motor (load, such as our motors); students noted that bees collect and create the food which takes energy, and also results in pollination.</td>
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<td>• Cause and effect</td>
<td>Students explored how circuits need to be closed (cause) in order to power a load (effect); students explored how bee movements (the Waggle Dance) is a type of communication (cause) which leads to other bees finding food source and pollinating plants (effect).</td>
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• Built a brush bot & decorated as a bee
• Circuit basics
  • Load, energy source, conductor, switch
• Energy transfer
  • From battery to motor
  • Potential \(\rightarrow\) kinetic
• Engineering
  • Trouble-shooting, improving, trial & error
• Insect (bee)
  • Anatomy
  • Communication
  • Energy
• Math & ELA connections
  • Assessments
  • Taking it further
Thank you!

Questions?

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References/Resources


