UBC Geering Up
Engineering Outreach

Pollinator Hotel Challenge

Subject: Science	**Grade:** 4-8	**Duration:** 1–2 hours to build, plus ongoing observations over several weeks
Lesson Overview	Students investigate the role of native pollinators in local ecosystems and explore why pollinator populations are declining. Using the Engineering Design Process, they research the nesting needs of pollinators found in British Columbia, then design, build, and test a pollinator hotel using sustainable and recycled materials. If installed outdoors, students can monitor their designs over time to observe which pollinators visit and evaluate how effectively their habitat supports local biodiversity.	

Curriculum Ties (in addition to satisfying multiple core competencies):

ADST

Big Ideas

- Designs can be improved through testing and iteration.
- Complex problems require creative and evidence-based solutions.
- Design can respond to environmental and community needs.

Curricular Competencies

- Understanding Context
- Defining
- Ideating
- Prototyping

- Testing
- Making
- Sharing

Science

Big Ideas

- Grade 3: Biodiversity in the local environment.
- Grade 4: All living things sense and respond to their environment.
- Grade 5: First Peoples concepts of interconnectedness in the environment.
- Grade 6: Multicellular organisms rely on internal systems to survive, reproduce, and interact with their environment.
- Grade 7: Evolution by natural selection provides an explanation for the diversity and survival of living things.

Content Objectives

By the end of this lesson, students will be able to:

- Explain the importance of pollinators and the role they play in healthy ecosystems and food production.
- Research the habitat and nesting needs of native pollinators found in their local area.
- Apply the Engineering Design Process to design, build, test, and improve a pollinator hotel using sustainable or recycled materials.

Materials & Equipment Needed

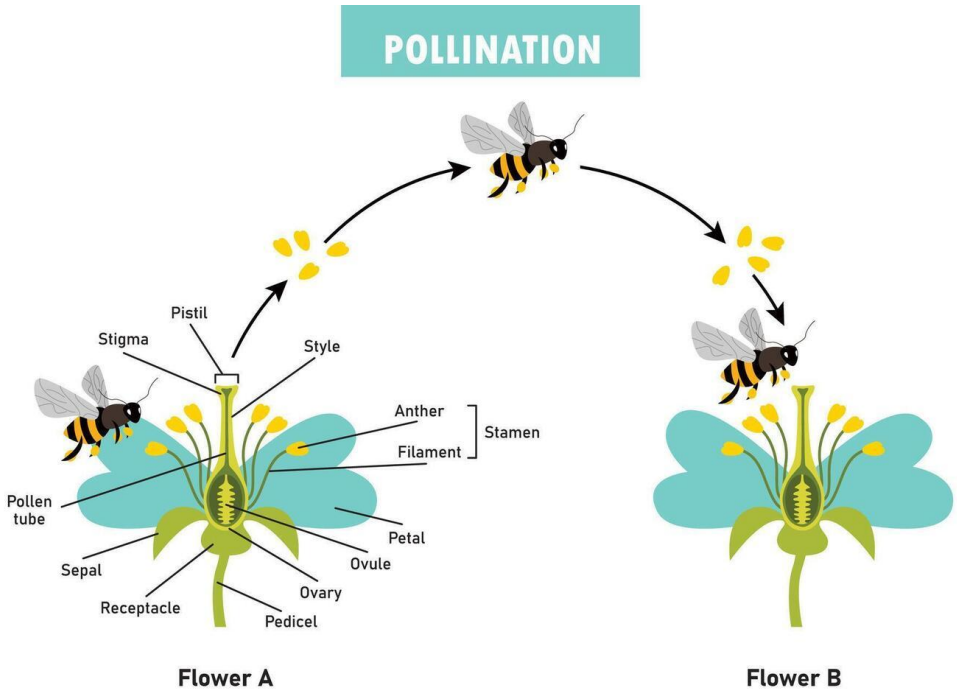
Consumables:	Non-Consumables:
• Bamboo stems or canes (cut into different lengths)	• Cardboard or recycled containers (optional frame)

• Untreated wood blocks or wooden scraps • Pinecones • Twigs or small branches • Paper straws or cardboard tubes • Natural string or twine • Optional: dried leaves, bark, or other natural nesting materials	• Hand saw or pruning shears (teacher use, if needed) • Scissors • Hot glue gun or wood glue • Masking tape or clamps (optional) • Rulers or measuring tapes • Pencils and paper for planning • Observation sheet or science notebook • Optional: magnifying glasses for observing insects during follow-up

Important note about natural materials:
Whenever possible, use recycled, reclaimed, or sustainably sourced materials when building pollinator hotels. Avoid collecting bamboo, wood, bark, twigs, or other natural materials from parks, forests, or protected areas, where they provide important habitat for wildlife and contribute to healthy ecosystems. If collecting natural materials, only gather small amounts of fallen branches, twigs, or other loose materials from places where their removal will not cause ecological damage, and never remove materials from living plants or disturb existing insect habitats. This is an opportunity to discuss how sustainable engineering begins with responsible material selection and thoughtful use of natural resources.

Lesson & Activity

Lesson Stages	Learning Activities

Introduction	Begin with questions such as:
	
	• What is a pollinator?
	• Why are pollinators important?
	  ○ https://youtu.be/eDxZojp9yNg
	
	 
	
	• Which pollinators live in British Columbia?
	  ○ Common Pollinators of British Columbia-2nd-Edition
	  ○ Pollinators — Habitat Acquisition Trust
	  ○ Creating a Pollinator-Friendly Space — Habitat Acquisition Trust
	  ○ Native Bee Society
	• Do all pollinators live in hives?
	
	Introduce the idea that many native pollinators, such as mason bees and leafcutter bees, are solitary and nest in hollow stems, wood cavities, or underground rather than large colonies.

	Explain that habitat loss, pesticide use, and urban development have reduced nesting opportunities for many native pollinators.
	
	Present the **engineering challenge**: Design and build a pollinator hotel that provides safe nesting habitat for native pollinators using sustainable materials.
	• What is a Bee/ pollinator hotel?
	  ○ A Bee Hotel Overview: How to Build, Maintain, and Attract Native Pollinators to Them
	  ○ A bee hotel is a human-made structure designed to provide nesting spaces for solitary bees and wasps. These hotels simulate natural environments by offering hollow tubes or blocks where bees can nest and lay their eggs. They are crucial for supporting bee populations. Bee hotels can be made from materials like bamboo, wood, or even recycled plastic, and they help create safe habitats for solitary bees that typically do not form colonies.

Activity	**Part 1: Research Local Pollinators** Students begin by learning about pollinators found in British Columbia. Working individually or in small groups, students research questions such as: • Which pollinators live in our area? • Which species are native? • What are their characteristics? • Where do they nest? • What threats do they face? **Part 2: Imagine & Plan**

	Students brainstorm possible designs for their pollinator hotel. Encourage them to use what they learned during their research to make design decisions. Ask guiding questions such as: • What do pollinators need to survive and nest successfully? • Which features from natural habitats could you incorporate into your design? • How can your design provide shelter while protecting pollinators from rain and predators? • What types of nesting spaces should your hotel include? • Which sustainable or recycled materials would work best, and why? • Where would be the best location to install your pollinator hotel? • How could your design support a variety of native pollinators rather than just one species? Students then create a labelled sketch of their design, identify the materials they plan to use, and explain how their design meets the needs of local pollinators while using sustainable design principles. **Part 3: Create** Using their design plans, students build their pollinator hotel using recycled, reclaimed, and natural materials. As they build, encourage students to continually compare their prototype with the needs identified during their research. Remind them that engineers often make changes throughout the construction process as new challenges arise. Students should consider:

- Creating a sturdy structure that can withstand outdoor conditions.
- Including a variety of nesting spaces using materials such as bamboo stems, cardboard tubes, untreated wood, pinecones, or twigs.
- Designing a roof or cover to help protect the nesting areas from rain.
- Using materials that are safe for wildlife and environmentally responsible.

Encourage students to make thoughtful design decisions rather than simply decorating the hotel. Every feature should have a purpose that supports pollinators or improves the durability of the structure.

Example:

Part 4: Test, Share & Improve (Optional Long-Term Investigation)

Once the hotels are complete, have students evaluate their designs before installation. Invite students to present their pollinator hotels and explain how their research informed their design decisions.

	If possible, install the hotels in an appropriate outdoor location around the school or community. Over the following weeks, students can monitor their designs by keeping a Pollinator Observation Log. They might record: • Date and weather conditions • Pollinators or other insects observed • Number of visits • Evidence of nesting activity • Photographs or sketches of observations
Closure	After collecting observations, encourage students to reflect on the effectiveness of their designs: • Did the hotel attract pollinators? • Which design features seemed to work well? • What changes would improve the habitat? • How could the design support a greater diversity of native pollinators? This optional follow-up allows students to revisit the Improve stage of the Engineering Design Process by using real observations to refine their designs and better support local biodiversity. .
Step Ups & Step Downs	**Step Downs** • Provide students with a simple pollinator hotel template or example to guide their design. • Focus on one or two common local pollinators instead of researching multiple species. • Build one large pollinator hotel as a whole class rather than individual or small-group projects.

	Step Ups • Install the pollinator hotels outdoors and conduct a long-term monitoring study using observation logs, photographs, or citizen science platforms such as iNaturalist. • Redesign the hotel after collecting field observations and explain how the changes improve the habitat. • Compare the effectiveness of different designs by analyzing which hotels attract the greatest diversity or number of pollinators. • Investigate how factors such as location, sunlight, weather, or building materials influence pollinator activity and use the results to make evidence-based design improvements.

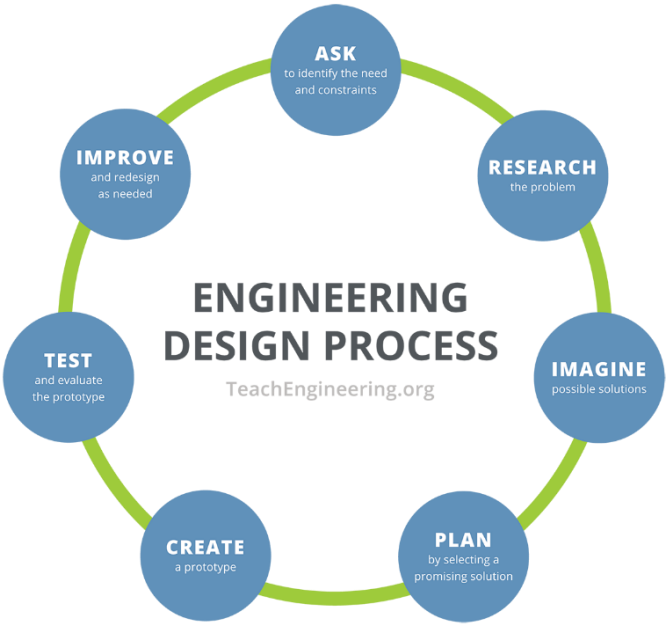
Background Knowledge

Pollinators are animals that transfer pollen from one flower to another, allowing many plants to reproduce and produce fruits and seeds. While bees are among the best-known pollinators, butterflies, moths, beetles, flies, hummingbirds, and other animals can also contribute to pollination. Approximately one-third of the food we eat depends, at least in part, on animal pollination.

Many native bee species, including mason bees and leafcutter bees, are solitary pollinators. Unlike honey bees, they do not live in large colonies or produce honey. Instead, they nest individually in hollow stems, small cavities in wood, or other protected spaces. Because natural nesting habitats are becoming less common due to urban development, habitat loss, and changes in land use, providing suitable nesting spaces can help support local pollinator populations.

A pollinator hotel is an artificial nesting structure designed to provide shelter for cavity-nesting pollinators. An effective pollinator hotel should use untreated, natural materials, include a variety of cavity sizes, protect nesting areas from excessive moisture, and be placed in an appropriate outdoor location with access to flowering

plants. It is important to recognize that pollinator hotels support only some pollinator species and should be considered one part of a broader strategy that includes planting native flowers, reducing pesticide use, and protecting natural habitats.



The Engineering Design Cycle:

- Ask
  - What is the problem we're trying to solve?
  - What are the limits that our solution needs to follow?

- Research
  - Has someone already created something like this?
  - Who are the experts in this field?

- Imagine
  - Brainstorm a large quantity and variety of ideas before narrowing the options.
- Plan
  - What criteria should we use to narrow down our ideas?
  - Which ideas need to be screened based on the original constraints we identified?

- Create
    - What kind of prototypes can we create? A sketch, scale model, CAD model, computer simulation, etc
- Test
    - What does our final design need to accomplish? Can we test this with the prototype we made?
    - Run an experiment
    - Create a computer simulation
    - What information are we looking to gain from these tests?

- Improve
    - Based on the results from the testing, what can we improve on our design?
    - Are there certain aspects we found too difficult to create?

Additional Resources

Pollinators

- https://curiositysavestheplanet.com/native-bees-and-pollinators-of-british-columbia/
- https://borderfreebees.com/wp-content/uploads/2017/02/common-pollinaotrs-of-bc-v40.pdf
- https://borderfreebees.com/wp-content/uploads/2017/11/Common-Pollinators-of-British-Columbia-2nd-Edition.pdf
- https://hat.bc.ca/pollinators
- https://hat.bc.ca/pollinatorfriendlyspace
- https://www.bcnativebees.org/

How to Build A Pollinator Hotel

- https://www.youtube.com/watch?v=PNxrkr9T0A4
- https://www.youtube.com/watch?v=TklME77Ow-A
- https://youtu.be/IiR_jYZKQPE
- https://youtu.be/VoQJ1DbttDg