LESSON PLAN

Pollinators
Problem-Based Lesson

Ask

Place several items from the list below on a cafeteria tray.

Be sure to include some unusual items like dairy (cows eat alfalfa) and chocolate.

No food? No problem - use pictures instead.

These are foods that require a pollinator:

Apples
Mangos
Kiwi Fruit
Plums
Peaches
Nectarines
Guava
Pomegranates
Pears
Black & Red Currants
Alfalfa
Okra
Strawberries
Cashews
Apricots
Allspice
Avocados
Passion Fruit
Lima Beans
Kidney Beans
Green Beans

Cherries
Coffee
Walnut
Flax
Macadamia Nuts
Sunflower Oil
Lemons
Figs
Fennel
Limes
Quince
Persimmons
Cucumber
Hazelnut
Cantaloupe
Tangelos
Watermelon
Coconut
Tangerines
Starfruit
Brazil Nuts

Mustard Seed
Brussels Sprouts
Bok Choy
Peppers
Papaya
Eggplant
Raspberries
Elderberries
Blackberries
Cocoa
Vanilla
Cranberries
Tomatoes
Sugarcane
Grapes

Grade Level: 2

Subject Area: ELA / Engineering / Math / Health / Science / Social Studies

Materials:
Food items (or pictures of them)
White board or chart paper

Additional Resources:
Engineering Design Process diagram
Standards descriptions

Standards:
ELA: RI.2, RI.3, RI.4, RI.5, RI.6, RI.7, RI.8, RI.9, RI.10, W.2, W.5, W.6, W.7, W.8, SL.1, SL.2, SL.3, L.1, L.2
Math: 2.OA, 2.MD, 2.G
Health: 2.NPA.1
Science: 2.L.1
Social Studies: 2.H.1.1, 2.G.2.1, 2.G.2.2

Also include a few of the following items. These foods do not require a pollinator; in most cases, the edible part is not a fruit (botannically speaking) or the plant is able to self-pollinate.

Leafy greens
Brassicas (broccoli, cauliflower, cabbage, kohlrabi)
Root veggies: carrots, parsnips, potatoes, sweet potatoes, horseradish, beets, turnips, rutabagas
Peas and beans
Corn
Celery
Onions and leeks

Ask students, "If you could pick three items from the tray to have as a snack, which items would you include?" Have the students write down their top three. Call on students to share their list and record on the whiteboard or chart paper.

Now ask students "What if you could only have food that did not require a pollinator to be produced?" One by one remove all the foods from the tray that require a pollinator. Erase or mark out any food listed that requires a pollinator.

***Fascinating Facts**: Pollinators are responsible for 1/3 of the food we eat. Pollinators include bees, bugs, butterflies, bats and birds.*

Optional activities:

1. To help students understand the different types of pollinators and how they have "coevolved"

   Life Lab Growing Classroom Flower Power, Part One
   Students match pollinators to the flowers they like to pollinate based on clues

2. To help students understand how flowers are pollinated by bees and other pollinators

   Pollination demonstration with fuzzy bees by Amy Bowman, Plants for Human Health Institute

   Cheese Puff Pollination Activity

   https://www.makingsciencemakesense.com/static/documents/Experiment-Busy-as-a-Bee.pdf

   http://teach-from-the-heart.blogspot.com/2012/03/flashback-to-fourth-pollination.html

   https://www.pinterest.com.au/pin/408560997421369098/

Primary Problem: Pollinators are on the decline. Discuss the decline of pollinators.

https://www.usda.gov/media/blog/2016/06/24/reversing-pollinator-decline-key-feeding-future

https://ento.psu.edu/pollinators/resources-and-outreach/globally-pollinators-are-in-decline

https://www.nytimes.com/2016/02/27/science/decline-of-species-that-pollinate-poses-a-threat-to-global-food-supply-report-warns.html

Burning Question: Can we survive without pollinators?

Allow students a few minutes to digest this question, then have them answer yes or no and why they think so. Discuss their answers.

Students may either choose to research their particular viewpoint or the class can be divided into two groups (yes, no) and assigned a viewpoint.

Imagine

If students said "yes, we can live without pollinators," then their task will be to figure out how to artificially replace pollinators.

- Hand pollination
  - Q-tips
  - Paint brushes
  - Electric toothbrushes
- Mechanical pollination
  - Fan
  - Sprayer
  - Drone
- Automated pollination
  - Hands-off pollination

If students said, "no, we cannot live without pollinators", then their task will be to figure out how to attract and protect pollinators.

- Attraction
  - Pollinator gardens
  - Incorporating pollinator crops into landscape
  - Cover crops
- Education
  - Pesticides
  - Herbicides
  - Disease
  - Habitat loss
- Create Artificial Habitats
  - Beekeeping
  - Butterfly houses

Plan

Allow students to research their viewpoint and gather information. Explore this collection of online resources.

General Bee and Pollination Resources

https://www.perfectbee.com/learn-about-bees/the-science-of-bees/exploring-the-process-of-pollination/

http://pollinator.org/pollination

https://www.fs.fed.us/wildflowers/pollinators/index.shtml

https://ento.psu.edu/pollinators/resources-and-outreach/what-are-pollinators-and-why-do-we-need-them

https://www.fws.gov/pollinators/

https://www.epa.gov/sites/production/files/2016-08/documents/vicki_wojcik_6-23-16.pdf

Artificial pollination Resources

https://www.goodfruit.com/no-bees-but-a-lot-of-buzz-about-artificial-pollination-video/

www.nosoilsolutions.com/3-methods-hand-pollination/

https://study.com/academy/lesson/artificial-pollination-definition-examples-risks.html

https://www.npr.org/sections/thesalt/2017/03/03/517785082/rise-of-the-robot-bees-tiny-drones-turned-into-artificial-pollinators

https://www.youtube.com/watch?v=JDGqK67FYIQ

https://www.youtube.com/watch?v=YTaBVR-YrQc

https://www.youtube.com/watch?v=Hd4MmbWks2E

https://bonnieplants.com/2012/07/pollination-problems-give-hand-pollination-a-try/

http://vegibee.com/index.php/hand-pollination

https://www.sciencelearn.org.nz/videos/19-artificial-pollination

Bee Conservation Resources

https://www.bumblebeewatch.org/

http://xerces.org/bumblebeeguidelines/

http://xerces.org/pollinator-resource-center/

https://www.epa.gov/pollinator-protection/colony-collapse-disorder

https://thehoneybeeconservancy.org/

https://thehoneybeeconservancy.org/our-work-2/educators-kit/

https://thehoneybeeconservancy.org/bee-lesson-plans/

http://pollinator.org/learning-center/bee-issues

Create

Students/groups will create a product/prototype that supports their viewpoint OR students/groups will present their research and as a class determine which product/prototype the class will create.

- Pollinator Habitat
  - Pollinator garden
  - Butterfly house
  - Beekeeping
  - Bug hotel
  - Bee house
  - Bee bath
- Awareness Education Product
  - Poster
  - Brochure
  - PSA
  - Video
  - Educational signs for the garden
- Artificial Means of Pollination
  - Hand pollinator
  - Wind pollinator
  - Drone for pollination

Test and Evaluate

Rubric (develop a rubric that meets your needs, below are some criteria to be considered)

- Pollinator Habitat
  - Plants designed to attract multiple types of pollinators
  - Flowers blooming throughout the active season
  - Sustainable

- Awareness Education
  - Message clear and concise
  - Realistic steps audience can take
  - Eye catching
  - Grammatically correct
- Artificial Pollination
  - Does it effectively transfer pollen?
  - Cost considerations
  - Is it feasible on a larger scale than the school garden?

Improve

After students have tested their product and evaluated with the rubric, allow them time to improve their product.

OR

Reflect on the following questions to find ways to improve the plan or product:

- Were there barriers that you did not anticipate?
- Were you able to carry out your job? If not, what might help you next time?
- Was your product successful?
- What changes would you make in order to make this more successful?
- What did you learn from this experience?

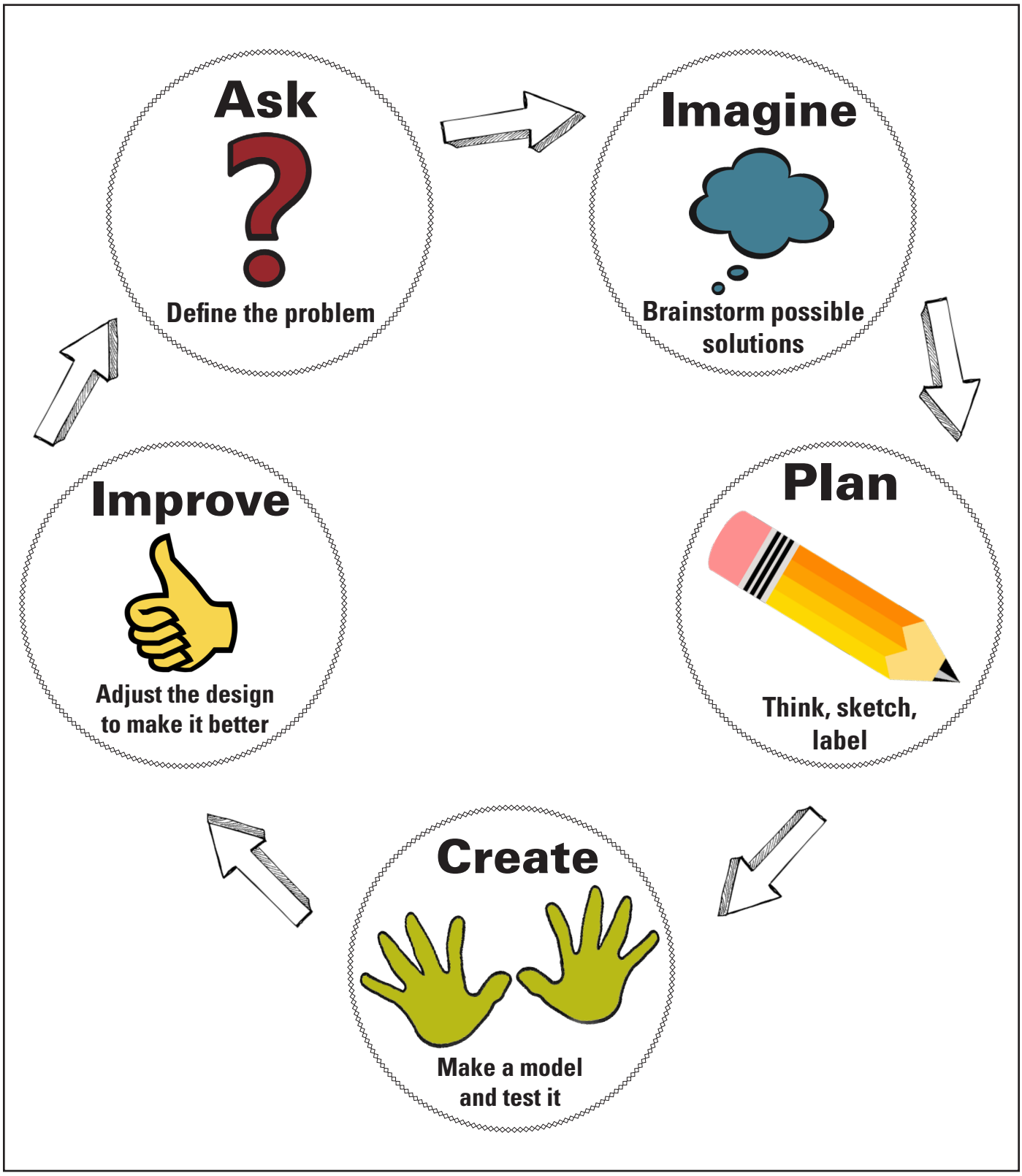
Communicate

Students/groups will present their products in a creative way.

- Skit
- Multimedia
- Event (Pollinator Tea)
- Press Release
- School News Story
- Live Demonstration

Your Notes & Ideas

The Engineering Design Process



Standards Descriptions

English Language Arts

RI.2 Identify the main topic of a multiparagraph text as well as the focus of specific paragraphs with the text.
RI.3 Describe the connection between a series of historical events, scientific ideas or concepts, or step in technical procedures in a test.
RI.4 Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.
RI.5 Know and use various text features to locate key facts or information in a text efficiently.
RI.6 Identify the main purpose of a text, including what the author wants to answer, explain, or describe.
RI.7 Explain how specific images contribute to and clarify a text.
RI.8 Describe how reasons support specific points the author makes in a text.
RI.9 Compare and contrast the most important points presented by two texts on the same topic.
RI.10 By the end of the year, read and comprehend informational text, including history/social studies, science, and technical texts, in the grades 2-3 complexity band proficiently, with scaffolding as needed at the high end of the range.
W.2 Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points and provided a concluding statement or sections.
W.5 With guidance and support from adults and peers, focus on a topic and strengthen writing as needed by revising and editing.
W.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
W.7 Participate in shared research and writing projects
W.8 Recall information from experiences or gather information from provided sources to answer a question.
SL.1 Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
SL.2 Recount or describe key ideas or details from a test read aloud or information presented orally or through other media.
SL.3 Ask and answer question about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.
L.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
L.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Engineering

Students will be using the engineering design process throughout this PBL:
Ask, Imagine, Plan, Create, Improve

Standards Descriptions

Math

Math Standards will vary depending on the engineering task but may include the following clusters:

2.OA	Represent and solve problems involving addition and subtraction
2.MD	Measure and estimate lengths in standard units
2.G	Reason with shapes and their attributes

Health

Health standards can be incorporated by examining how pollinators/pollinator decline may affect MyPlate recommendations.

2.NPA.1	Understand MyPlate as a tool for selecting nutritious foods

Science

2.L.1	Understand animal life cycles

Social Studies

2.H.1.1	Use timelines to show sequencing of events
2.G.2.1	Give examples of ways in which people depend on the physical environment and natural resources to meet basic needs.
2.G.2.2	Explain how people positively and negatively affect the environment.