Support your local bee life

Teacher Guide

In this unit students will use a Problem Based Learning model to help support the struggling bee population in their community. This unit will be approached in the What-Why-How format--*What is the problem? Why does it matter? How can we solve the problem?* During the "What" and "Why" stages of the unit, students are developing a fundamental understanding of pollination and bees. This approach can be done in many ways including whole class research, independent research, special guest speakers, and teacher lectures. Certain approaches will be better for certain grade levels.

During the "How" stage of the unit, students will use their knowledge from the "What" and "Why" stages to determine real solutions to the problem. Students' exact solutions to the problem will vary from school to school based on a variety of factors, most notably being the outdoor space they have to work with, but this adds to the richness of the unit as a whole when it is catered towards a school's unique space. Offered in this unit are **suggestions** on ways students could solve the problem, but authentic Problem Based Learning requires students come up with ways to solve the problem through the **support** and **guidance** of their teacher rather than being told what they are going to do next.

Note: Unless otherwise stated, all of the literature resources are non-fiction texts that can be accessed for free digitally via EPIC! Books for Kids if you are a librarian or educator. Teachers can make accounts for their students, then create and assign collections of books for their students to read. EPIC can be used on a laptop or Chromebook and also has a great iPad app.

What?

What is the problem?

Lesson 1: What is the problem?

1. Read (or listen) to pages 4-5 and 10-11 of *The Case of the Vanishing Honeybees: A Scientific Mystery* by Sandra Markle on EPIC which introduces the problem
    a. Focus question: Why do you think people care about bees dying? Should we care about bees dying?
        i. Set up a visual "tug of war" display around the focus question that students can add to throughout the "What" and "Why" stages of the unit. Don't be afraid to acknowledge possible reasons why we might not care, like how bees can sting, so that as students learn more, they can adjust their opinion.
2. If possible, have guest speaker (local beekeeper, bee researcher, or general expert on bees) come talk to the class about the causes of the bee decline.
    a. For elementary students, we recommend the primary focus be:
        i. Habitat loss
        ii. Limited access to food
        iii. Limited access to clean water
    b. *Note: The speaker might also touch upon Verroa mites (and other pests), pesticides, and disease. While these are factors that the students can learn about, addressing these problems lies in the hands of beekeepers and unless the school has a hive, there is a limited amount students can do to help at this point in current research.*
    c. Have students complete the graphic organizer (see Why is the bee population declining?) that outlines the three reasons the bee population is declining

3. If an outside speaker cannot come in, below is additional children's literature (which can be found on EPIC) that talks about the bee crisis
    i. *What is Pollination?* by Bobbie Kalman
    ii. *Bees Matter* by Erika Wassall
    iii. *The Case of the Vanishing Honeybees* by Sandra Markle

Why?

Why does it matter?

Lesson 2: What is Pollination?

1. Remind the students what you have heard earlier about bees dying. Pose the question: *If we don't have bees and other pollinators, what might happen?* Tell students they are going to work to answer that question today.
    a. Read pg. 4-9 in *What is Pollination?* by Bobbie Kalman on EPIC
    b. Stop the read aloud to complete a pollination game/simulation (link:http://www.teachers-going-green.com/teachers-going-green/clean-and-green/3rd-grade)
        i. Possible Modifications to the Simulation:
            1. Instead of pretending they're different kinds of flowers, students will pretend to be different kinds of common fruit or vegetable plants grown in their area
            2. Add several more beach balls to illustrate having more pollinators, and then take all of them away to illustrate Colony Collapse Disorder.
            3. During one round, have students who are not pollinated in a certain number of seconds (such as 15) sit down to represent the plant being unable to grow seeds/fruit/vegetables
            4. Make some students plants that are self-pollinators, such as soybeans. They can self-pollinate, so stick sticky notes all over their back. They are only allowed to reach them with one hand, get them one at a time, and once they get a sticky note they have to count to 5 before they can reach for another (so they aren't taking them all off at once!). They can also pollinate from the beach ball if it comes to them. Draw the connection that while crops like soybean don't need bees to pollinate, they do benefit from them being around
        ii. Discuss reflection questions from simulation, highlighting that as more beach balls (pollinators) were introduced to the ecosystem, the greater the plants' chances were of being pollinated.

Lesson 3: How do pollinators affect what we eat?

1. Have a discussion during lunchtime (after the simulation has taken place) to connect what was learned from the simulation to how it would affect their lunches. Teachers could have this discussion in the lunchroom, but it will likely be more beneficial if students bring their lunches back to the classroom.
    c. During lunchtime have students keep all of their food on their tray or in their lunch boxes. Tell the students that they are going to imagine a world where there are little to no pollinators. Remind the students what it was like when there was only one beach ball during the simulation. If we don't have bees and other pollinators, what might happen to our fruit plants?
        i. Tell the students that any food you list right now is one pollinated by bees. If you

mention a food they have on their tray or in their lunchbox, have them remove it.

1. List of foods pollinated by bees that could be mentioned

ii. At the end of the list, have students look at their trays. What do they notice?

iii. What is left on your trays? Discuss what foods are left on their trays (likely processed foods and meats). Trace back down the food chain what foods the meat on their plates eat, demonstrating that while the animal itself doesn't need pollination, they depend on foods that need or benefit from pollination.

2. After students eat and clean up their lunches read pg. 12-13 in *What is Pollination?* by Bobbie Kalman on EPIC
3. Show students image from this article (image on right) and discuss how grocery stores/school lunches/meals might be different if the bee population continues to decline
    a. Introduce or refresh students about the social studies concept of scarcity.
4. Reflect back on Tug of War board. We know that bees are dying. Should we care? Allow students to change opinions and/or reasons if needed.

How?

How can we solve the problem?

Lesson 4: Brainstorming and Selecting Ideas Help the Bees

1. Have students pull out their "Why is the bee population declining?" graphic organizer to refresh themselves as to the causes of the bee decline
2. Give students the brainstorming graphic organizer (see attached) and have them independently brainstorm, based on the problems bees are facing, how we could help them
3. Reconvene as a whole group and have students share their ideas. Document **all** ideas on chart paper, and once sharing is done, go back through and talk about ones that are most realistic and helpful to the bees
    a. Below are possible **suggestions** that students might come up with and how one might go about executing them. If students come up with better ideas, especially ones more specific to your school and community, follow their thought process.
        i. To address lack of food, provide the bees with food by planting a pollinator garden at our school
        ii. To address lack of food/overall bee education, find ways to communicate to the students in the school (via signs, announcements, speaking to classes) why they shouldn't pick the dandelions on the playground and why they shouldn't be afraid of bees
        iii. To address lack of habitat, provide bees with homes by making bee hotels
        iv. To address lack of clean water, provide bees with clean water by making bee baths

Lesson 5: Where should we plant our pollinator garden?

1. As a class, brainstorm potential locations for the pollinator garden. Consider things like the amount of sunlight it will get and if it will be close to a feature like a garden or farm (where it could support the crops growing)
    a. If you have multiple classes or grades participating in the creation of the garden, multiple

gardens could be grown, each class/grade focusing on a certain location

2. Narrow down the possibilities to 3-5 locations based on the number of classes/grades participating.
3. On a sunny day, use the Sunlight Tracking Chart (see attached) to determine if your location overall receives "Sun", "Partial Sun", or "Shade". Every hour, determine whether the location has sun, partial sun, or shade, and then categorize based on the description on the bottom of the page.
    a. This categorization will help students determine what plants can or cannot be grown in the garden

Lesson 6: What should we plant in our pollinator garden?

1. Place students in groups of two or three. In groups, students should use the BeeSmart app and/or Internet to research local plants that will help bees. They will then select one (as a group) that they think we should plant in the pollinator garden
    a. The BeeSmart app (available on Apple and Android devices, but not via the Internet) has students enter their zip code and will give them a list of native pollinator friendly plants for their area. They can select which pollinator they are hoping to help, the color of the flower, the amount of sunlight, type of soil, and plant type and a list of plants that fit those criteria will appear.
        i. *Note: If students select too many criteria, no results will come up*
        ii. Some possible plants for a pollinator garden include:
            1. Black Eyed Susans
            2. Menarda (bee balm)
            3. Grey headed coneflower
            4. Purple coneflower
            5. Maximillian sunflowers
            6. Milkweed
            7. Partridge Pea
            8. Any type of clover (red, white, alsike, yellow sweet, etc)
        iii. *Note: It is important that the plant students choose is available for purchase--educators might want to check with local businesses and provide a master list for the students to choose from so they don't research a plant that cannot be purchased in the area*
2. Students will complete the All About My Plant page (see attached) which will require them to provide basic information about their plant choice as well as provide rationale for where they think the plant should be planted (perhaps based on sunlight, proximity to playground, road, farms, gardens, etc.)
3. Using this research, reflect back on the budget. If each group planted the flower they chose, how much would it cost? Do we have enough money? Could we plant more than one flower?

Lesson 7: How can we provide bees with a habitat to combat their habitat loss?

1. As a whole class, research DIY **bee hotels**
    a. There is also a how-to in *The Bee Book* by Charlotte Milner (**not** available on EPIC, but a fantastic resource)
2. Ask *How should we get the materials?*

i. Students will determine a way/ways to communicate to the school a need for the materials (announcement over intercom, at weekly assembly, posters in the hallway, emails to parents)

ii. Have students create the announcements, posters, and emails (or whatever other ideas they have) in order to collect the supplies

b. Create bee homes as a class.

i. Some can be used to hang up around the school (about 3 in or around the garden)

ii. Others can be given away or sold for money for the pollinator garden

Lesson 8: How can we provide bees with clean water?

1. Provide bees with clean water by making bee baths
    a. Ask *How could we get some of the materials?*
        i. Students could collect rocks from the playground or space where the garden will be planted
    b. Students will paint clay saucers (such as these) for the bee baths to be put out by our pollinator garden
        i. Extra bee baths can be given away or sold for money for the pollinator garden

Lesson 9: How should we raise money for the plants and other gardening materials for our pollinator garden?

1. Teacher could look into various local gardening grants
2. Have a class discussion about potential fundraisers
    a. For a bee-related fundraiser that doubles as a way to extend the effort to help the bees to the community, students could create and sell
        i. Bee balls - to provide bees with food
        ii. Bee hotels-to provide bees with shelter
        iii. Bee baths- to provide bees with clean water
        iv. Pet bee rocks- just for fun, but these could be a way to put the rocks in the space where you plan to plant the garden to use
            1. By using this type of fundraiser, students are not only raising money for the pollinator garden, but they are specifically addressing the 3 bee problems they are focusing on in this unit and giving the community a method to solve them as well. For this reason, if schools already have the money for a pollinator garden (via grant money, school funding, PTO support), it would still be beneficial to create and give away (rather than sell) the above products for community involvement!
3. As a class, walk students through developing a budget
    a. Every school's budget plan will look different based on the funds available, fundraising goals, and plants students decide they want to purchase
    b. Important elements to consider and decide as a class:
        i. How much money will our plants cost?

ii. How much will our gardening supplies cost?

iii. How much money might our fundraiser raise?

iv. What should we charge for each product?

v. How much will our fundraiser supplies cost? Will we make enough money to pay for our garden?

vi. Should we spend all of our money or set some aside in case we have an expense we don't expect?

Lesson 10: What specific crops in our community will benefit from the bees we are helping?

1. As a whole class, research what farms or gardens are within a 2 mile radius of the school (since 2 miles is the average distance bees will travel from their hives) to find out what crops are grown nearby that will benefit from helping the bees around the school
    a. Example: We have a soybean farm across the street from our school. By helping the bee population, they will help the soybean crop
2. Pick one crop (soybean is a particularly fascinating one, if there is a crop nearby) and have students look at their food labels at breakfast, lunch, and at home. When they find a food label that contains your crop, add the label to a bulletin board/wall display. Watch as the board fills up with more and more labels and talk about the impact this crop plays in your food and how it is important that the bees are able to help this crop.
    a. You can even take this one step further and talk about the animals that eat that crop (with soy you can mention poultry, livestock, and fish) and add a separate part of the display for animals that benefit from that crops production

Lesson 11: How can we educate our community about how they can help the bees?

1. Students will choose one factor that is negatively impacting the local bee population--lack of food, lack of shelter, or lack of clean water.
    a. They will then focus on educating the community (in the spirit of a Public Service Announcement) on what the problem is, why it matters, and how they can do so (using the "What, Why, How" model). (see attached)
        i. Basic possible outline:
            1. <u>What is the problem?</u> Bees don't have access to enough food
            2. <u>Why does it matter?</u> If bees are dying, they are not able to pollinate our crops
            3. <u>How can we fix it?</u> By using our bee balls to plant more flowers for bees
    b. Possible formats include:
        i. Video announcement
        ii. Radio announcement
        iii. Poster/billboard
        iv. Brochure
        v. Other (if they can think of something else, don't limit their options)
2. Host an event where families and community members are invited to hear students' Public Service Announcements

a. At this event, students will share their Public Service Announcements and either sell or give away bee balls, bee hotels, and bee baths so that people can go out and improve the conditions for bees in their community
b. Consider having a Pollinator Potluck where families celebrate the success of the unit by bringing in and sharing only foods that are brought to us with the help of pollinators

Next Gen Science Standards

Crosscutting Concepts

- Patterns
- Cause and effect
- Energy and matter: Flows, cycles, and conservation

Disciplinary core ideas/content

LS1.B Growth and development of organisms

LS1.C Organization for matter and energy flow in organisms

LS2.A Interdependent relationships in ecosystems

LS2.B Cycles of matter and energy transfer in ecosystems

LS2.C Ecosystem dynamics, functioning, and resilience

LS4.D Biodiversity and humans

Science and Engineering Practices

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information