# **Elementary Science Learning Experience**

# **Integrated with a Reading and Writing Instructional Resource**

Grade 2 Example 2

## **Science Experience Overview**

Anchoring Phenomenon: Different amounts of blueberries were produced on two different groups of plants. The blueberry plants were grown in the same location and with the same amount of water and sunlight.

Driving Question: Why might some blueberry plants yield more fruit than others?

Lesson Focus Questions:

1. How do animals interact with flowers?
2. What must happen for plants to produce seeds?
3. In what ways are the changes in blueberry plants like the changes in the fireweed plants?
4. How can plants without flowers be pollinated?
5. How might you design, build, and test a solution to pollinate flowers?

Open Educational Resource: [PHD Science Level 2 Plants](https://greatminds.org/science/open-educational-resource) and [Phenomenal Science 2nd Grade-Bloom Where You’re Planted](http://phenomscience.weebly.com/2nd-unit-3.html)

*KAS for Science* alignment:

* **2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. \***
* **K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
* **K-2- ETS1-3: Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

|  |  |  |
| --- | --- | --- |
| **Science and Engineering Practices** | **Disciplinary Core Idea** | **Cross Cutting Concepts** |
| Developing and Using Models  Analyzing and Interpreting Data  Planning and Carrying Out Investigations | LS2.A: Interdependent Relationships in Ecosystems  ETS1.B: Developing Possible Solutions  ETS1.C: Optimizing the Design Solution | Cause and Effect  Structure and Function  Systems and System Models |

*Educators may have to engage with a standard multiple times throughout a year to meet the full intent of the standard. As a result, the following example may not encompass the entire scope of the standards identified*. *Below are the performance expectations and a list of the three dimensions this learning experience aligns with.*

## **Reading and Writing Connection**

Vibrant student experiences in Science differ from those in Reading and Writing.  However, intentionally aligning the topics enhances learning in both.  The following green-rated High-Quality Instructional Resource (HQIR) is used in Reading and Writing during the same time period as this Science learning experience:

HQIR: EL Education

Knowledge-Building Topic: The Secret World of Pollination

Grade-Level Complex Text(s): *What is Pollination* by Bobbie Kalman

The following Reading and Writing standards and tasks, along with Interdisciplinary Literacy Practices, play a supporting role and are integrated in this vibrant Science Learning Experience:

Text-Dependent Tasks: Writing to Learn, Writing to Demonstrate Learning

*Kentucky Academic Standards for Reading and Writing*: RI.2.1, RI.2.3, RI.2.4, RI.2.5, RI.2.7, RI.2.9, RI.2.10, C.2.4, C.3.5, C.2.6, L.2.4, L.2.5

*Interdisciplinary Literacy Practices*: 1, 2, 3, 4, 6, 7, 8, 9

|  |
| --- |
| **Setting the Stage: Introducing the Phenomena** |

| **Phenomenon**: Different amounts of blueberries were produced on two different groups of plants. The blueberry plants were grown in the same location and with the same amount of water and sunlight.  **Focus Question:** Why might some blueberry plants yield more fruit than others?  **Learning Objective:** Analyze data from a blueberry plant investigation. |
| --- |

Firsthand investigations about pollination should occur prior to reading about pollination to provide the students with a compelling context for the reading. Beginning the ELA unit consecutively with the Science learning experience will allow for development of the context on pollination.

In science instruction, anchoring student learning in phenomena can help educators align their teaching to the vision for science education in the *KAS for Science*. Phenomena are observable events that occur in the universe we can use our science knowledge to explain or predict. The goal of building knowledge in science is to develop general ideas, based on evidence, which can explain and predict phenomena. (Definition from Achieve, Next Generation Science Storylines & STEM Teaching Tools). For guidance in a process for selecting phenomena that can anchor a unit of instruction that supports three-dimensional student learning, visit the KDE’s [Phenomena for Instruction](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Selecting_Anchoring_Phenomena_for_Equitable_Three-Dimensional_Teaching_Module.pptx) professional learning module.

Each of the science learning experiences will help prepare students to develop a simple model that mimics the function of an animal in pollinating plants and will allow them to design a solution in the event of a decrease in the population of pollinators.

To set the stage for the learning, present students with a phenomenon regarding one group of blueberry plants yielding more fruit than the other group. The students will analyze the results of an investigation scientists conducted at a blueberry farm in Florida. During this initial exploration of the phenomenon, the students will use the [Notice and Wonder strategy](https://sadlerscience.com/notice-and-wonder/) to elicit student thinking and encourage students to ask relevant questions about what they see in the three pieces of data shared with the class. Below is a sample Notice and Wonder chart you may use with students.

|  |  |
| --- | --- |
| What do you ***NOTICE***?  (What do you see, What do you hear?) | What do you ***WONDER*** about?  (What questions do you have about what you saw in the video?) |
|  |  |

Display the [blueberry comparison image](https://drive.google.com/file/d/1-b1FjramOFG9IrmNEsifUDpkpNEXhTve/view?usp=share_link). Tell students that both drawings in the diagram represent blueberry plants and invite students to observe the diagram independently. After a few moments, ask students what they notice and wonder and have them record them in the notice and wonder chart. Ask, *“Why might these blueberry plants have different numbers of blueberries?”* Acknowledge that the blueberry plants might have different numbers of blueberries for several reasons. Reveal that the drawings represent the results of an investigation scientists conducted at a blueberry farm in Florida. Tell students that they will learn more about this investigation and its results before they try to explain the difference they noticed between the plants in the diagram.

Next, display [data from a blueberry plant investigation](https://drive.google.com/file/d/1D8CfsRCf-uwhPfIysNewgNHSYbmmyz8L/view?usp=share_link), which compared how much fruit blueberry plants produced on the two different groups of plants. Tell students that the graph shows the total number of blueberries that grew on two groups of plants throughout the investigation. Invite students to observe the graph for a moment and record their noticing and wonderings in their chart. Work with students to interpret the data on the graph. Ask, *“How can we explain the difference in height between the Group A and Group B bars?”* and *“Does the graph help us understand why Group B plants had more blueberries? Why or why not?”* Reveal that the scientists grew both groups of plants in the same location and with the same amount of water and sunlight.

Display the [blueberry plant investigation photo](https://drive.google.com/file/d/1fjgfltRAOV2hWVKUM54O6XrwSIhU_fed/view?usp=share_link). Tell students that the photograph shows the blueberry plants from the investigation. Give students a few moments to observe the photograph, and then ask what they notice and wonder about that could explain the height difference between the bars on the graph and record them in their chart.

Explain to students that some of the blueberry plants had nets over them throughout the investigation, whereas other blueberry plants did not. In the photograph, point out the covered plants and the plants next to them that are out in the open. Return to the graph and point to the Group A bar. Tell students that this bar represents the covered blueberry plants. Then point to the Group B bar. Tell students that this bar represents the open blueberry plants, which did not have nets over them throughout the investigation. Ask, *“Which group of blueberry plants had more blueberries? How do you know?”* and *“Why do you think the number of blueberries in each group was so different?”* Highlight student responses that mention that the nets kept something away from the covered blueberry plants. Invite students to consider what a net might keep away from the plants. Reveal that in the investigation the nets kept out animals such as bumble bees, honeybees, and birds. Explain that animals could not interact with the covered blueberry plants in Group A, whereas animals could interact with the open blueberry plants in Group B.

Introduce the Phenomenon Question, *“How can the actions of animals affect the number of blueberries on blueberry plants?”* Probe the students in their thinking by asking*, “What are some examples of animal interaction with plants?* *How do you think animal interaction helps blueberry plants produce more blueberries? What questions do you have about how animals interact with plants?”* Invite students to share their initial ideas about the question. As they share their questions, record them on sticky notes, and add them to the driving question board. Tell students that they will look more closely at blueberry plants and interactions between animals and plants in the next lesson.

This learning experience calls for student led discussion facilitated by the teacher. For guidance in Establishing the Learning Environment and the KAS for Science to enable effective communication and discourse, visit the KDE’s [Evidence Based Instructional Practice 1: Establishing the Learning Environment in Science](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/EPIB_1_Science.pdf).

|  |
| --- |
| **Learning Experience #1:** **How do animals interact with flowers?** |

| **Learning Objective**: Observe and demonstrate animal interaction with flowers to determine that pollen sticks to animals. |
| --- |

Provide the students with an [image of a bee on blueberry flowers](https://drive.google.com/file/d/19J29peikE1jYO2aRXgzxQAq95nPldE8J/view?usp=share_link). The students will again continue with the notice and wonder strategy as they make observations of the bee on the blueberry flower. Share with students that they will learn about flowers and explore new questions they have about flowers to help them answer the Phenomenon Question, “How can the actions of animals affect the number of blueberries on blueberry plants?” Play the [video](https://greatminds.smartplayer.video/play.php?vid=1658777341greatminds_5b345ef8009a49d9) of a bumble bee flying to multiple flowers. Tell students to pay close attention to what the bee is doing. Facilitate class discussion using the following questions: *What is the bee doing in the video? Why do you think the bee is landing on the flowers?*

Display an [illustration of pollinators](https://drive.google.com/file/d/1-k7ViC5OPYeRSYegdcMlC7NWDBUHZcpZ/view?usp=share_link) and explain that honey bees are not the only animals that interact with flowers. Give students a few moments to observe the illustration. Facilitate the class discussion by asking the following questions: *What animals do you see? How are they interacting with the flowers? Think about how the bee interacted with the flowers in the video and in the reading passage. How do you think that interaction compares with the interactions in this picture?*

Demonstrate Animal and Flower Interaction: Display a bouquet of fresh flowers. Explain that although these flowers do not come from a blueberry plant, they have the same parts as blueberry flowers. Divide the class into pairs. Hold up a chenille stem and explain that students will use a chenille stem to show how an animal interacts with a flower as it searches the flower for nectar. Point to the bent end of the chenille stem and tell students to use this end to interact with the flower so that they do not damage the flower. Distribute one chenille stem and one flower to each student pair. Instruct students to take turns holding the flower and using the chenille stem. While one student uses the chenille stem, the other should hold the flower and observe. Circulate to ensure that students are reaching the chenille stem down into the flower where the nectar is located. After each student has had a turn with both the flower and the chenille stem, bring the class back together to discuss students’ observations.

Distribute a magnifier to each student. Invite students to take turns using their magnifiers to examine the pollen on the chenille stem. Then ask students to share what they observed about the shape of the pollen.

Display a [photograph of different kinds of pollen](https://drive.google.com/file/d/1TwMry227CZ6st74QQpu_CUKPquUC8V5W/view?usp=share_link) and complete a [Think, Pair, Share](http://www.pz.harvard.edu/resources/think-pair-share) about what they notice in the photograph.

Have the students summarize this interaction between animals and flowers. Add their ideas to the [anchor chart](https://www.differentiatedteaching.com/anchor-charts-101/), “Student ideas”.

|  |
| --- |
| **Learning Experience #2: What must happen for plants to produce seeds?** |

| **Learning Objective:** View photographs of a plant before and after pollination to notice that plants can produce seeds after pollination. |
| --- |

Begin this experience with a [slow motion video of a honeybee on a flower](http://phdsci.link/1643). Pause the video at 11 seconds, when the bee is hovering above the flower. Ask the students, *“What do you notice about the bee?”* Play the rest of the video focusing on the bee. Have the students record their observations in their science notebook. Discuss the observations and reveal that pollen sticks to animals and can fall off them later. Ask the students what they predict the bee will do next after it drinks nectar from the flower. Highlight student responses that mention the bee traveling to other flowers.

Research around science instruction encourages us to wait until we develop a conceptual understanding prior to introducing vocabulary. For more information regarding teaching vocabulary in science, read [Stem Teaching Tool: Why you should stop pre-teaching science vocabulary and focus on students developing conceptual meaning first](https://stemteachingtools.org/brief/66). Now that the students have some concrete understanding of pollen, introduce the vocabulary term pollination (the transfer or movement of pollen from one plant to another). Also explain that a bee is a pollinator (an animal that moves pollen from one plant to another). As pollinators visit flower after flower, some pollen sticks to their bodies and some pollen falls off, so bees and other animals end up transferring pollen between different plants. Ask, *“What are some examples of pollination you have observed?”* and *“What questions do you have about pollination?”* We still need more information to determine what happens after pollination.

Display the [Fireweed Pollination images](https://docs.google.com/document/d/1tywgFfsvKgOCldhrBDGxXYs_xbuR7IgL/edit?usp=share_link&ouid=109757796690831094553&rtpof=true&sd=true). Give students a few moments to observe the three photographs, and then ask students what they notice and wonder. Tell students that all three photographs show fireweed, which is a kind of plant. Then show students the photograph on the back of the poster. Ask, *“What do you think is happening in this picture?”* Confirm that the hummingbird is visiting a fireweed flower to drink nectar. Ask, *“What might happen because of the hummingbird’s visit to the fireweed flower?”* Agree that the interaction between the hummingbird and the fireweed flower could lead to pollination. Tell students that the plants in the second and third photographs show how fireweed changes after pollinators such as hummingbirds visit their flowers. Ask, *“What do you think is happening to the fireweed plant in the third picture?”*

Invite students to share what they think is happening to the fireweed plants in the photographs. Highlight student responses about the plant making seeds. Point to the first photograph and review with students that pollinators such as hummingbirds move pollen from flower to flower. In the second photograph, point out the thin seed pods sticking out from the stem beneath both clusters of flowers. Finally, point to the third photograph and tell students that the seed pods opened, revealing fireweed seeds.

Display the [photograph of fireweed seeds](https://drive.google.com/file/d/1I51umDGNeBpUJ4b23hVjEbFUFJoEy5_Q/view?usp=share_link). Tell students the photograph shows a closer view of an open fireweed seed pod. Allow students a few moments to observe the photograph. Then ask students to point to where they think the seeds are in the picture. Work together as a class to identify the small brown seeds. Prompt students to summarize their learning by asking, *“What must happen for the fireweed plant to produce seeds?”* Add their ideas to the anchor chart, “Student ideas.”

Remind students of the Phenomenon Question. How can the actions of animals affect the number of blueberries on blueberry plants? Ask students to share their thoughts on this question. Tell students that in the next lesson they will answer the Phenomenon Question by applying their learning about pollination to the blueberry plant investigation.

|  |
| --- |
| **Learning Experience #3: In what ways are the changes in the blueberry plants like the changes in the**  **fireweed plants?** |

| **Learning Objective:** Use a model to communicate the process of pollination. |
| --- |

Display the [photograph of ripening blueberries](https://drive.google.com/file/d/15XUal48dv8DNrEd_RIdEZkqPiDqh3OkZ/view?usp=share_link). Tell students that the photograph shows a blueberry plant after animals have pollinated some of its flowers. Ask, *“What do you notice about this picture?”* Discuss as a class. Highlight student responses about the green berries. Tell students that the berries are young blueberries that will turn blue as they ripen. Point to the white flowers, and then to the shriveled brown flower, and finally to the green berries that no longer have flower petals on top of them. Tell students that this blueberry plant shows many stages of change. Point to the white flowers again, and explain that after each flower is pollinated, a berry can form in its place. Remind students about the fireweed plants they observed. Ask, *“In what ways are the changes in this blueberry plant similar to the changes in the fireweed plants?”* Recall with students how the fireweed plant changed after its flowers were pollinated and produced seeds. Ask, *“Where do you think the seeds are on the blueberry plant?”*

Distribute a magnifier, a blueberry half, and a paper towel to each student. Instruct students to look inside their blueberry halves. Then ask students to share their observations with the class. Confirm that blueberries contain small seeds. Revisit the [photograph of ripening blueberries](https://drive.google.com/file/d/15XUal48dv8DNrEd_RIdEZkqPiDqh3OkZ/view?usp=share_link). Ask, *“After the flowers were pollinated, what happened to the blueberry plant?”* Confirm that after a blueberry plant’s flowers are pollinated, the plant produces seeds inside

blueberries. Remind students that they observed a similar pattern with fireweed in the previous lesson: The hummingbird pollinated the fireweed flowers, and then the fireweed plant produced seeds.

Tell students they will now look at photographs that show the steps in the pollination of a blueberry flower. Direct students to the [pollination model](https://drive.google.com/file/d/1ltvlEoNf-SDQFZmrf1_mBEycWBkpoaFA/view?usp=share_link) provided. Have students work with a partner to write a description beside the photograph for each step in the pollination process. After they complete their models, have students Think–Pair–Share about the descriptions they wrote for each step in the pollination process. Then bring the class back together to discuss.

Revisit the [blueberry plant comparison diagram](https://drive.google.com/file/d/1-b1FjramOFG9IrmNEsifUDpkpNEXhTve/view?usp=share_link). Remind students that the plant on the left represents the blueberry plants that the scientists covered, whereas the plant on the right represents the blueberry plants that remained open. Ask students to use their learning about pollination to answer the Phenomenon Question, *“How can the actions of animals affect the number of blueberries on blueberry plants?”* Point to the blueberry plant on the left and acknowledge that even though the scientists kept pollinators away from its flowers, some blueberries still formed. Tell students they will explore why blueberries formed in an upcoming lesson. Ask students to summarize the effect of pollination on the blueberry plants that the scientists investigated. Agree that the blueberry plants that were open to animals produced many more berries and seeds.

Have students reflect on their new knowledge about pollination and share what they have learned. Add or update their ideas on the anchor chart, “Student ideas.”

Tell students that in the next lesson they will apply their learning about pollination to a new plant and a different kind of pollinator.

At this point, students have a good understanding of pollination and will be better able to comprehend the text in the book: Bees by Laura Marsh pp. 4 – 13. You can introduce this text from the ELA curriculum after this lesson. Following the reading, students will use the discussion questions about key details from the book provided along with a prompt asking students to use at least two examples from the text to explain the impacts bees have on the natural world. We will revisit this idea of the impact bees have on the natural world.

|  |
| --- |
| **Learning Experience #4: How can plants without flowers be pollinated?** |

|  |
| --- |
| **Learning Objective:** Analyze photographs to determine that wind can pollinate plants. |

Display [Shōson’s Tiger Lilies and Butterfly](https://drive.google.com/file/d/1mlEiWja1rwF6OXbcvSRq1-1gen-pyLmH/view?usp=share_link). Tell students to take a few moments to observe the print, and then ask what they notice and wonder about it. Ask, *“What do you think the picture shows?”* Highlight student responses that mention the butterfly pollinating the flowers. Inform students that the plant in the picture is a tiger lily. Ask students to look closely at the artwork and to Think–Pair–Share about how different parts of the print show movement. After student pairs finish, ask them to share their ideas with the class. Summarize that the butterfly in the print could be flying to the tiger lily flowers to drink nectar.

Tell students they will now apply what they know about pollination to a different kind of plant. Display the [photograph of a juniper tree](https://drive.google.com/file/d/1kHBcoZTmHVaV47BhWkUbediQYPrCmNkf/view?usp=share_link). Wonder aloud whether the juniper tree is pollinated in the same way as the tiger lily plant. Have

students share questions they could ask to find out. Reveal that junipers do not produce flowers or nectar but that they still produce seeds. Remind students that plants must be pollinated to produce seeds. Then introduce the question, *“**How can plants without flowers be pollinated?”* Highlight responses that mention pollination without animals or junipers producing pollen with other parts. Then show students the [photograph of juniper pollen cones](https://drive.google.com/file/d/1QzciXFNg3l69O-VS9TWm_KD7NW8JO4qr/view?usp=share_link). Inform students that—instead of flowers—some kinds of plants, such as junipers, have cones that produce pollen. Tell students that plants with cones can also use some of their cones to produce seeds. Then display the [photograph of juniper pollen](https://drive.google.com/file/d/1x-p0KSd-byuStZMW_nPIJLR6Hz6Kwxq3/view?usp=share_link), and invite students to share what they notice and wonder about it. Confirm that the white material in the air is juniper pollen. Then tell students that the photograph shows wind blowing pollen from a juniper tree’s cones into the air. Explain that wind can pollinate juniper trees by transferring pollen from one juniper tree to another. Clarify that many plants that do not have flowers and those plants depend on wind for pollination.

Revisit the blueberry plant investigation, and display the [blueberry plant comparison diagram](https://drive.google.com/file/d/1-b1FjramOFG9IrmNEsifUDpkpNEXhTve/view?usp=share_link). Remind students that the blueberry plant on the left represents the covered blueberry plants from the investigation and the blueberry plant on the right represents the open blueberry plants. Point out that the covered plants still produced some berries with seeds inside. Wonder aloud what could have pollinated these plants. Invite students to Think–Pair–Share in response to the following question, *“How do the results of the blueberry plant investigation support what we know about pollination?”* Bring the class back together. Then confirm that although both groups contained blueberry plants that were pollinated, the plants that were open to pollinators produced many more berries. Emphasize that most plants with flowers, such as blueberry plants, depend on pollinators to help move their pollen. Then explain that many plants without flowers, such as junipers, depend on wind—instead of animal interactions—to move their pollen. Finally, explain that some plants can be pollinated by both animals and wind.

Share out their new learning about pollination. Summarize students’ responses to replacing flowers with plants in the Pollination section of the anchor chart, clarifying that pollination can happen in plants that do not have flowers. Also record students’ new learning about wind pollination and add it to the anchor chart, “Student ideas.”

Explain that in upcoming learning they will use what they know now about pollination to solve a problem in an Engineering Challenge.

|  |
| --- |
| **Culminating Task** |

|  |
| --- |
| **Learning Objective:** Apply the engineering design process to design, build, and test a solution to pollinate flowers. |

What impacts do bees have on the natural world? What would happen if there were no bees to pollinate plants?

Students design a solution to the problem of a lack of pollinators while investigating the [Rent-a-Bee phenomenon](https://wsbt.com/news/local/for-rent-bees). Read the students the Rent-a-Bee blurb. Ask students to share what questions they have. How does this connect to what we have already learned? Engage students in a discussion: What fruits do you eat? Is it a problem if the fruit trees are not getting pollinated? What is the current solution? How might we solve this problem in another way?

Conduct the [Pollinator Simulator](https://drive.google.com/open?id=1q9WHdgvcm9ms9Y6ZpSYUeyWKUE-AFyV0) with the class in teams. Prepare several “flowers.” Have students explore several types of pollinators: chenille stem, paint brush, toothpick, Q-tip, cotton ball, etc. In groups, students investigate the efficiency of each type of pollinator. Have a class discussion about which pollinator worked the most efficiently. In their notebooks, students draw and label their two favorite pollinators and explain how they work.

Make a table or class chart of this process and complete what students know and have already worked on:

* Problem→ trees are not being pollinated.
* Brainstorm ideas → they tested different pollinators using materials.

Next step is to take the information from the pollinator simulation to plan and make a model using their findings from the simulation. Then students should test their new model using the same flower simulator. Students should make a poster that details their model (material used, structure of model and how that helps it) and the testing results. Students participate in a gallery walk for feedback on their solutions.

Students will reflect on feedback from the gallery walk and revise their models to incorporate the feedback. Students will re-test their model and collect data on the new model to share with the class. Students should make another poster that details their model (material used, structure of model and how that helps it, where improvements were made and why) and the testing results.

Students will complete another gallery walk to compare all models. Have them think about these two questions: What is the same in the models? What is the difference? Have a class discussion around which solution was the best and why. Encourage students to use evidence to support their claim. Consider using talk stems such as:

I agree…. I disagree …….