Investigation: Pollination in Texas

Objective: Each student will be able to collect data and construct a bar graph in order to explain how structures of plants attract various pollinators in Texas.

- "I can explain how structures on plants help them survive."
- Students collect and analyze data in a simulated comparative investigation to answer the research question: "How do different plant structures affect pollination?"
- Academic Terms: pollinators, structures, independent variable, dependent variable.

What is Happening?

Digital Student Journal Slides 3-4

Click slides to enlarge
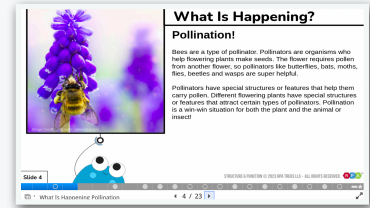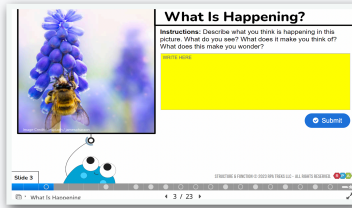
Description: Phenomenon-based approach for any classroom setting. This attention-getter can be used as either a cooperative learning strategy for engagement or as an individual reading opportunity to activate prior knowledge.

Slide 3

Be sure to provide time for students to make observations about the image before moving on to the description on the next slide.

Pollination is a great example of a symbiotic relationship in which both living factors are dependent on each other. Explain to students that it is the structures of both organisms that allow the relationship to exist.

Slide 3, Answer Key

> There is no correct or uniform answer for these connections. However, students should be able to relate information from 3rd, 4th, and possibly 5th grade to these terms using examples they have either directly observed or learned about previously. Be sure to provide time for students to make observations about the image before moving on to the description on previous slides. Encourage full sentences in the written descriptions.

Investigation: Pollination in Texas

Digital Student Journal Slide 5 - *Click slides to enlarge*
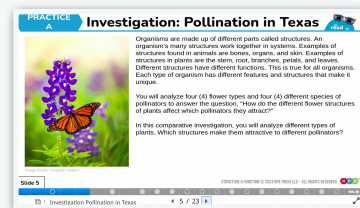
Description: Students collect and interpret data in a simulated comparative investigation about different pollinators. They construct a bar graph to compare results. They use the bar graph to compare the pollinators and help answer the research question, "How do the different flower structures of plants affect which pollinators they attract?"

During the Recall students identified structures and functions of organisms. In Practice A, students will analyze data to determine how plant structures affect pollination. They will also identify which plant structure is most appealing to pollinators based on the function of the structure that captures pollen for the pollinators. For example, pollen attaches to the legs and abdomen of bees, therefore shallow flowers are pollinated by bees more frequently.

Investigation: Planning

Digital Student Journal Slides 6 - *Click slides to enlarge*

Description: Students are introduced to the investigation. Terms: independent or manipulated variable, dependent or responding variable.
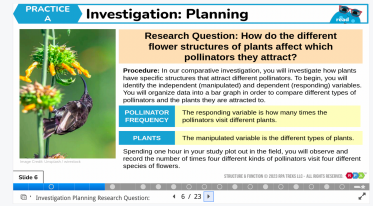
If students struggle to distinguish between the two types of variables and which axis each one belongs to, using the acronym DRY MIX can help. DRY - Dependent Responding variable on Y-axis and MIX - Manipulated Independent variable on X-axis.

Investigation: Design

Digital Student Journal Slides 7 - *Click slides to enlarge*

Description: Students use the independent/manipulated variable and dependent/response variables to sort statements.
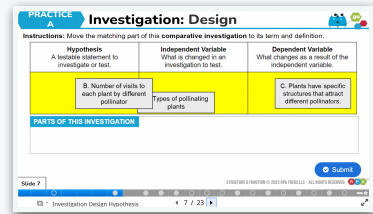
When discussing the answers with students, point out that the hypothesis includes what is being compared in the investigation - the structure of plants and the different pollinators. The independent variable is what can be manipulated, the different plants and the dependent variable is the response we are looking for - visits by different pollinators.

Answer Key

Hypothesis	Independent Variable	Dependent Variable
C. Plants have specific structures that attract different pollinators.	A. Types of pollinating plants	B. Number of visits to each plant by different pollinator

Investigation: Pollination

Digital Student Journal Slides 8 - *Click slides to enlarge*

Description: Students read about four different flowers - Bee Balm, Evening Primrose, Conflower, and Honeysuckle.
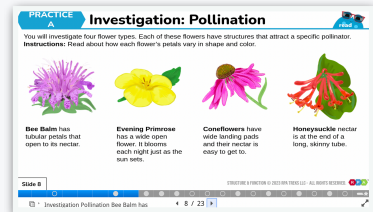
ELPS Spotlight

STRATEGY: Structured Academic Talk

Jigsaw: Students will be able to work collaboratively using the jigsaw strategy to share information about different flowers and compare the structure and function of nectar and pollen.

Instructions:

1. Introduce the concept of the jigsaw strategy and explain that it is a way for students to work together to learn and share information.
2. Divide students into small groups of four to six students, depending on class size. Each group should be heterogeneous in terms of language proficiency, so that students can support each other's learning.
3. Assign each group a specific topic related to the science content to be discussed. Provide jigsaw reading materials on each topic. The reading material should be at an appropriate reading level for each group.(Reading)
4. Have students read their jigsaw reading material individually, taking notes as they read.
5. Once all students have finished reading, have them meet with their "expert group," consisting of students who have read the same jigsaw reading material, to discuss what they have learned and share their notes. Encourage students to use academic language and support their ideas with evidence from the reading. (Listening and Speaking)
6. After expert groups have had a chance to discuss, have students return to their original small groups to share what they have learned with the rest of their group. Encourage students to use sentence frames to guide their discussions.(Listening and Speaking)
7. Finally, have each small group share with the class what they have learned about their topic. Use a graphic organizer to record information and connections between topics.(Writing)

ELPS Tips for Beginning EB students:

- Provide simplified reading material that is appropriate for their language level.
- Allow students to work with a partner or in a small group to practice using academic language and sentence frames before participating in the jigsaw reading and discussion.
- Provide sentence frames or other support tools to guide students in their discussions.

ELPS Tips for Intermediate and Advanced EB students:

- Encourage students to use more complex sentence structures and academic language to express their ideas.
- Allow students to create their own jigsaw reading materials, based on the science content, to encourage more personalized and creative expression.
- Provide challenge activities, such as having students research and present information on a related topic using academic language and sentence frames.

Skills Practice: Flowering Plants

Digital Student Journal Slides 9 - *Click slides to enlarge*

Description: Students compare the structure and function of nectar and pollen.
Answer Key

- Structures that hold pollen: Sticks to pollinator and is carried to other flowers.
- Structures that store nectar: Attracts and gives reward to pollinator.
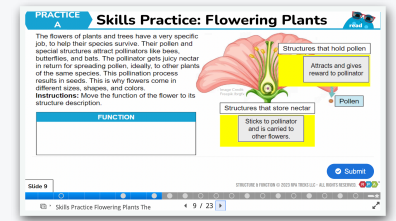
Investigation: Collect Data

Digital Student Journal Slides 10-13 - *Click slides to enlarge*

Description: Students practice entering data into a table using the information collected during observations and record the number of times four different kinds of pollinators visit four different species of flowers. As students complete the graphs emphasize that data is based on what is observed, not prior knowledge, what someone thinks, what was seen on television etc. For example, just because a student thinks that the bird would be more attracted to the pink flower, the data shows that it visited the red flower with long petals more often.
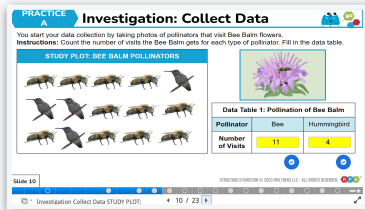
Slide 10
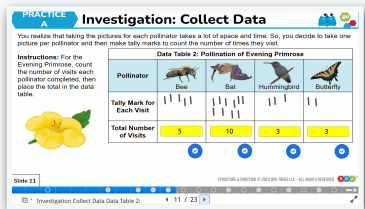
Slide 11
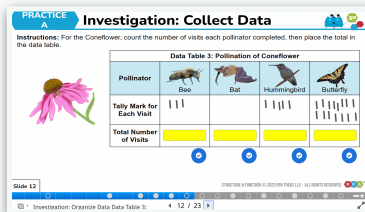
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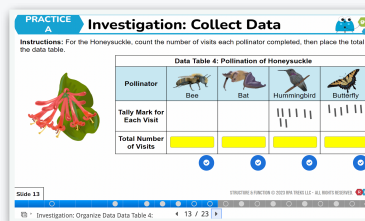
Slide 13

5.1E Collect observations as evidence

Students spend one hour in a study plot out in the field to observe different types of plants and to determine types of structures that make them attractive to different pollinators.

Slide 10, Answer Key

Pollination of Bee Balm	
Bee	Hummingbird
11	4

Slide 11, Answer Key

Pollination of Evening Primrose			
Bee	Bat	Hummingbird	Butterfly
5	10	*3*	2

Slide 12, Answer Key

Pollination of Coneflower			
Bee	Bat	Hummingbird	Butterfly
3	0	5	15

Slide 13, Answer Key

Pollination of Honeysuckle			
Bee	Bat	Hummingbird	Butterfly
0	0	8	6

Investigation: Organizing Data

Digital Student Journal Slides 14 - *Click slides to enlarge*

Answer Key

Butterfly

Skills Practice: Graphs

Digital Student Journal Slides 15 - *Click slides to enlarge*

Description: Students use the independent/manipulated variable and dependent/response variables to sort statements.

If students struggle to distinguish between the two types of variables and which axis each one belongs to, using the acronym DRY MIX can help. DRY - Dependent Responding variable on Y-axis and MIX - Manipulated Independent variable on X-axis.

Slide 15, Answer Key
1. X-Axis is Type of Flower. Y-axis is Number of Visits.
2. Bar Graph

Investigation: Graph Data

Digital Student Journal Slides 16-17 - *Click slides to enlarge*

Description: Students create a bar graph using the data they collected.

Slide 16, Answer Key
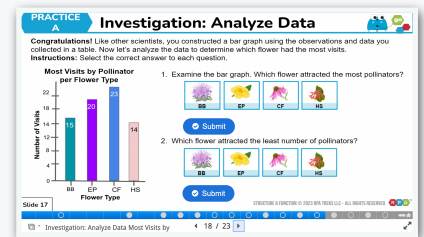BB 15, EP 20, CF 23, HS 14

Slide 17, Answer Key
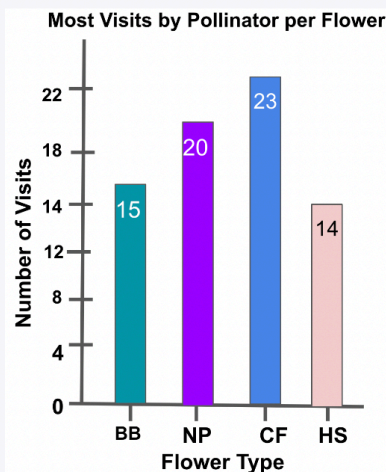
Investigation: Analyze Data

Digital Student Journal Slides 18 - *Click slides to enlarge*

Description: Students use the data they have collected to summarize their learning.

Inform students that they will write a conclusion next and the conclusion must be based on data. Analyzing the data in the graph will prepare them to write their conclusion.

Answer Key

   Student answers will vary based on the pollinator they choose, but should demonstrate understanding of the different structures that attracted the organism.

Investigation: Conclusion

Digital Student Journal Slides 19 - *Click slides to enlarge*

Description: Students synthesize the information they have learned to review the investigation question.

Answer Key

   Student answers will vary based on the pollinator they choose, but should demonstrate understanding of the different structures that attracted the organism.

   Different pollinators have different structures or features that help them carry pollen. For example, birds have long beaks to reach pollen in flowers with long petals.

Pulling It Together

Digital Student Journal Slides 20-21 - *Click slides to enlarge*

Description: Students use their learning of structures to answer the question.

Slide 20, Answer Key

1.   Uncoiling and extending the proboscis to sip food.

Slide 21, Answer Key

2. B and C