Save the Bees!

Teacher's Guide

Interdependent Relationships in Ecosystems

BOCES 4 Science

Teacher's Guide

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Written by teachers and administrators from public school districts within the borders of the NYS Midwest Joint Management Team in conjunction with the BOCES 4 Science Educators
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12/17

Foreword

BOCES 4 Science is a collaboration between four New York State BOCES (Board of Cooperative Educational Services) with in the Midwest Region. This collaborative of science educators came together to respond to the need for instructional resources based on the New York State pK-12 Science Learning Standards (NYSSLS). The research behind the Next Generation Science Standards (NGSS) and the National Research Council (NRC) publication, A Framework for K-12 Science Education is the basis for the NYSSLS and the BOCES 4 science units.

We believe that the future health and well-being of our world depends on scientifically literate people making informed decisions. The development of scientific literacy begins at the earliest grades. Elementary children must have concrete experiences upon which to hook their understanding and new vocabulary – this is especially true in the discipline of science. We embrace the notion that students should experience phenomena and solve real problems to learn about the world. We strive to present lessons and materials that will make high quality science instruction available for all students through cost-effective resources for teachers.

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About this Unit

Overview

The Interdependent Relationships in Ecosystems unit is designed for 2nd grade. The main topics included in this unit are needs of plants and animals, how plants and animals depend on each other for survival, the diversity of life in different habitats, seed dispersal, and pollination. The issue of global loss of the bee population is the phenomenon that is a central focus of the unit. An engineering design project involving the design of a hand pollinator allows students to devise a solution to the decline in bee population.

Scheduling

This unit is scheduled to be in the classroom for 12 weeks. There are approximately 35 science instructional sessions in this unit, based on 30-40 minutes each. Adjust your schedule accordingly. Please return the unit promptly or to request an extension, call 585-352-1140.

Materials to Obtain Locally

Some lessons require materials that are NOT supplied in the kit. These materials can be easily obtained by the teacher or the students. Materials that will need to be provided are indicated with an asterisk in the lesson materials list and are also listed below:

- Astroemeria flowers (one per each pair of students) (L11)
- Cardboard tubes (L2)
- Chart paper (All)
- Clipboards (optional) (L2, L9)
- Computers or iPads (L2, L3, L12)
- Construction paper- 11"x17" (L7)
- Crayons/colored pencils (L4, L5)
- Envelopes (L2)
- Google Earth or Google Maps software (L2)
- Glue stick (L12)
- Green construction paper - 11" x 17" (L10)
- Hole punch (L2)
- Index cards or 8 ½ x 11 white paper (L4)
- Interactive whiteboard or projector (All)
- Margarine or whipped topping containers (optional) (L4)
- Markers (All)
- Masking tape (L10)
- Old newspaper (L4)
- Pencils (All)
- Permanent black markers (L4, L11)
- Post-it notes (optional)
- Resource books on bees (L3, L11)
- Resources on betta fish (L6)
- Resource books on plants (L7)
- Resources on different habitats, plants and animals (L8)
- Scissors (L8, L12)
- Scotch tape (L6, L8, L10)
- Stopwatch (L6, L10)
- Table cloth, garbage bag or towel (L6)
- Water (L4, L5, L10)
- White glue (L11)

Three Dimensions

Each of the BOCES 4 Science lessons includes at least one element from each of the three dimensions identified in the NYSSLS. The lesson page identifies the specific elements targeted; the NYSSLS topic page is included after the Features that Support 3-D Learning page.

Science and Engineering Practices (SEP) – These are the major practices that scientists employ as they investigate and build models of their understanding of the world. They also include key practices used by engineers as they design and build systems.

Disciplinary Core Ideas (DCI) – Selected to represent four major domains: the physical sciences; the life sciences; the earth and space sciences: and engineering technology, and the applications of sciences.

Crosscutting Concepts (CCC) – These big ideas have application across all domains of science and provide one way of linking across the domains of the DCI's. In addition, they link to ideas that are parts of other elementary subjects.

NYSSLS Shifts in Instruction

It is the intention of BOCES 4 Science that this unit provides lessons that demonstrate the following shifts in instruction:

- **Explaining Phenomena or Designing Solutions to Problems:** The unit focuses on supporting students to make sense of a phenomenon or design solutions to a problem.
- **Three Dimensions:** The unit helps students develop and use multiple grade-appropriate elements of the SEPs, CCCs, and DCIs which are deliberately selected to make sense of phenomena or design a solution to a problem.
- **Integrating the Three Dimensions for Instruction and Assessment:** The unit will elicit student artifacts that show direct, observable evidence of three dimensional learning.
- **Relevance and Authenticity:** By taking advantage of student questions and experiences in the context of their homes, neighborhood and community, the lessons in this unit will motivate student sense-making or problem-solving.
- **Student Ideas:** This unit provides opportunities for students to express clarify, justify, interpret or represent their ideas and to respond to peer and teacher feedback.
- **Building on Students' Prior Knowledge:** Since student understanding grows over time, this unit identifies and builds on students' prior learning in three dimensions in such a way as it is explicit to both students and teachers.

Assessment:

Providing opportunities for assessment of learning and feedback to students is an important step in the educational process. This unit includes formative assessments and summative assessments. The teacher is encouraged to use a variety of informal or anecdotal assessment strategies.

Additional Features of this Unit

The Interdependent Relationships in Ecosystems: Save the Bees! unit also includes a Student Science Journal. A digital version of the Student Science Journal is available online at the BOCES 4 Science website. (A web address and password are located on a color insert in the Teacher's Guide.)

Additional resources for the teacher, such as the specific assessments, ELA and/or ELL supports, direct links to videos or websites mentioned in the teacher's guide, etc. can also be found on the BOCES 4 Science website.

Features that Support 3-D Learning

Look for these features in the Teacher's Guide:

NYS pK – 12 Science Learning Standards within each lesson provide the teacher with specific information about the Performance Expectation and the 3-Dimensions that are targeted by the instruction in this lesson.

Performance Expectations:

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.

Science and Engineering Practices

Developing and Using Models

Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models, These representations are useful in communicating ideas for a problem's solutions to other people.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

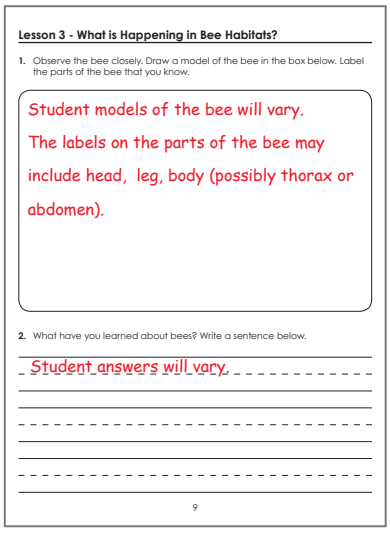
ELA/Math/Social Studies Connections:

ELA: 2R1

Math: NY-2.MD

Social Studies:

Throughout the Teacher's Guide, the 3-Dimensional Domains are color coded within the text so that teachers know to emphasize or explicitly point out to students this connection to either the **Science and Engineering Practices (SEPs)** and the **Crosscutting Concepts (CCCs)**. In addition, small boxes on the right hand side of the Procedure pages (see box in the green column to the right) serve as a visual reminder, as well.



Lesson 3 - What is Happening in Bee Habitats?

1. Observe the bee closely. Draw a model of the bee in the box below. Label the parts of the bee that you know.

Student models of the bee will vary. The labels on the parts of the bee may include head, leg, body (possibly thorax or abdomen).

2. What have you learned about bees? Write a sentence below.

Student answers will vary.

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In addition, a small picture of the page(s) of the Student Science Journal (with answers) that students are using for each lesson has been included on the appropriate pages in the Teacher's Guide (see box to the right). This keeps the teacher from needing to go back and forth between various documents pertaining to a particular lesson.

CCC: Crosscutting Concept(s):

Cause and Effect:

Events have causes that generate observable patterns.

New York State P-12 Science Learning Standards

Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment Boundary: Assessment is limited to testing one variable at a time.]

2-LS2-2. Develop a simple model that illustrates how plants and animals depend on each other for survival.* [Clarification Statement: Examples could include animals dispersing seeds or pollinating plants, and plants providing food, shelter, and other materials for animals.]

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education:*

Science and Engineering Practices

Developing and Using Models

Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1)
- Make observations (firsthand or from media) to collect data that can be used to make comparisons. (2-LS4-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world. (2-LS4-1)

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Animals depend on plants or other animals for food. (2-LS2-2)
- (NYSED) Plants depend on water, light and air to grow. (2-LS2-1)
- (NYSED) Some plants depend on animals for pollination and for dispersal of seeds from one location to another. (2-LS2-2)

LS4.D: Biodiversity and Humans

- There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

ETS1.B: Developing Possible Solutions

- (NYSED) Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas to other people (secondary to 2-LS2-2)

Crosscutting Concepts

Cause and Effect

- Events have causes that generate observable patterns. (2-LS2-1)

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2)

Patterns

- Similarities and differences in patterns can be used to sort and classify organisms. (2-LS4-1)

New York State P-12 Science Learning Standards

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels: **K.LS1.C** (2-LS2-1); **K-ESS3.A** (2-LS2-1); **K.ETS1.A** (2-LS2-2); **3.LS4.C** (2-LS4-1); **3.LS4.D** (2-LS4-1); **5.LS1.C** (2-LS2-1); **5.LS2.A** (2-LS22),(2-LS4-1)

Common Core State Standards Connections:

ELA/Literacy –

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1),(2-LS4-1)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(2-LS4-1)

SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. *(2-LS2-2)*

Mathematics –

MP.2 Reason abstractly and quantitatively. *(2-LS2-1),(2-LS4-1)*

MP.4 Model with mathematics. *(2-LS2-1),(2-LS2-2),(2-LS4-1)*

MP.5 Use appropriate tools strategically. *(2-LS2-1)*

2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems. *(2-LS2-2),(2-LS4-1)*

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The text in the "Disciplinary Core Ideas" section is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas unless it is preceded by (NYSED).

Flowers, Bees, and Pollination

Vocabulary:
flower
nectar
petal
pollen
pollen basket
pollen duster
pollination
stamen
stigma
thorax

Focus Question:
Why do plants have flowers?

Lesson Synopsis

Learning Target:
I can identify the structures of a flower and describe their function in pollination.
I can pollinate Fast Plants with the bee sticks.

Lesson Description:
This lesson will take 3-4 days to complete. In the previous lesson, students discovered one way plants depend on animals for survival. Animals help in plants' seed dispersal. Students investigated how plants disperse seeds. In this lesson, students will focus on another way animals help plants – pollination. Students identify the parts of the flower of the Wisconsin Fast Plant and how these parts are important in the pollination process. Students will learn about the process of pollination by pollinating their Fast Plants using their bee sticks and what they know about the parts of the flower. A plant's seeds form as a result of the successful pollination of the female flower.

The learning in this lesson will be expanded on in 5th grade when students focus on the balance within an ecosystem. If a new species is introduced to an ecosystem, it can damage the balance within an ecosystem. Also, if a species, like the bee, is disappearing, the balance in an ecosystem can be greatly affected.

Management

Materials

For the class:

- Alstroemeria or Lily Flower interactive whiteboard file (BOCES 4 Science website)
- Lesson 11 - Lorax Letter (BOCES 4 Science website)
- Bee Picture interactive whiteboard file (BOCES 4 Science website)
- Making Bee Sticks interactive whiteboard file (BOCES 4 Science website)
- Video – Bees Pollinating a Flower (BOCES 4 Science website)
- Video – Bees Pollinating a Flower 2 (BOCES 4 Science website)
- Video – Flower and Pollen (BOCES 4 Science website)
- Video - Pollinating Wisconsin Fast Plants and Harvesting Seeds (Links to Resources page, BOCES 4 Science website)
- Chart paper*
- Markers*
- Resource books on bees*

For each pair of students:

- 1 quad with flowering Fast Plants
- Magnifiers
- Paper towel
- 1 alstroemeria or lily flower*

*provided by teacher/student

Materials continued

For each student:

1 bee
1 toothpick
1 paper towel
Article – What is Pollination? (BOCES 4 Science website)

Flowers and Pollination Student Science Journal pages
Pencils*
White glue*

*provided by teacher/student

Preparation:
This lesson can be started once the Fast Plants have flowered.

Have sufficient alstroemeria or lily flowers so each pair of students has one.

Make sufficient copies of the Article - What is Pollination? found on the BOCES 4 website for this unit/Lesson 11.

Gather white glue needed to attach the bee to the toothpick to make bee sticks.

Create a structure/function chart on chart paper or interactive whiteboard (see sample in right column of the page).

Structure	Function

Teacher Background:
Animals can move around a habitat and plants cannot. Therefore, plants depend on animals for pollination and to move their seeds.

Pollination is a vital process for reproduction in flowing plants. It allows for the genetic diversity necessary for a species of plant to adapt to changes in environmental conditions. The new plant growing from the seed produced has half of its genetic make-up from the fruit producing parent and half from the **pollen** producing parent. Pollen contains sperm and when pollen lands on the stigma of the **flower** the eggs within the ovary of the flower become fertilized and develop into seed while the walls of the ovary become the fruit. For second graders, their learning should center on pollination causing seeds and the fruit around the seed to form. No pollination = no fruit and no seeds.

The two most common agents moving pollen from one flower to another are wind and insects. The vast majority of flowering plants will not produce fruits containing seeds without pollination. This lesson will give students a better understanding and appreciation for insects, especially bees, in their role in pollination.

The bee is a very effective pollinator. The worker bees which gather pollen are all sterile female bees. The worker bee learns the details of one kind of flower, where the **nectar** and pollen are located, and collect from this kind of flower as long as it can be found. As a result, pollen is not wasted by being delivered to other kinds of flowers. The bee's anatomy is well developed for pollen gathering. The bee's body, especially the **thorax**, is covered with hairs to which sticky pollen will cling. The rear legs of the bee have pollen combs and pollen baskets. They allow the bee to carry much of the pollen on its body and move it from flower to flower.

Standards

Performance Expectations:

2-LS2-2 – Develop a simple model that illustrates how plants and animals depend on each other for survival. [*Clarification Statement: Examples could include animals dispersing seeds or pollinating plants, and plants providing food, shelter, and other materials for animals.*]

Science and Engineering Practices

Developing and Using Models

- Develop a simple model based on evidence to represent a proposed object or tool.

Obtaining, Evaluating, and Communicating Information

- Read grade-appropriate text and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural world.

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Some plants depend on animals for pollination.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural objects are related to their function(s).

ELA/Math/Social Studies Connections:

ELA: 2R2, 2W4, 2SL1, 2SL2, 2SL4

Social Studies: 2.5d (Cross-Discipline Extension)

Vocabulary:

- **flower** - the part of the plant that makes fruit with one or more seeds
- **nectar** - a sweet liquid made by plants and used by bees in making honey
- **petal** - soft, colorful parts of a flower
- **pollen** - very tiny grains made by the plant that is carried to other plants of the same kind so that the plants can produce seeds.
- **pollen basket** - a smooth area on the back legs of a bee that has a fringe of stiff hairs that collect and transport pollen.
- **pollen duster** - the top part of the stamen that "dusts" pollen on to the stigma
- **pollination** - to give a plant the pollen from another plant of the same kind so that seeds will be produced
- **stamen** - the part of a flower that makes pollen
- **stigma** - the part of a flower that receives the pollen
- **thorax** - the middle part of the body of an insect between the head and abdomen

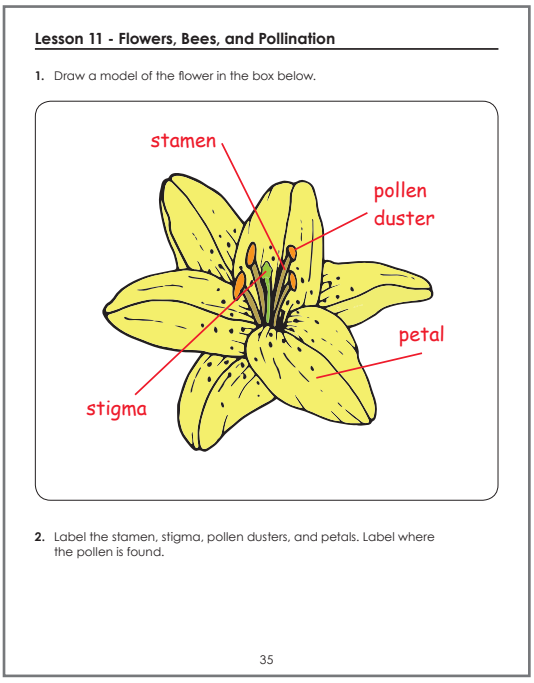
Misconceptions:
Students may have the misconception that fruit automatically grows on a plant. They may not make the connection that pollination is the cause of plants making fruit/seeds.

Procedure

Phenomenon:
Provide student pairs with an alstroemeria or lily flower, a paper towel, and a magnifier. Ask students to observe the flower carefully and draw a **model** of the flower on page 35 of the Student Science Journal. Discuss observations.

Discussion Questions:

- What **structures** of the flower do you know? (Answers vary but may include petals, pollen, etc.)
- What do you think is the **function** of each part of the flower we know? (Answers vary.)



Use the **structure/function** chart on chart paper or interactive whiteboard to write student responses to questions. Students may not have correct answers at this point in the lesson. Answers written on the chart can be revised later in the lesson.

Ask students to label the **petals** on the **model** of their flower. An interactive whiteboard file titled Alstroemeria Flower or Lily Flower found on the BOCES 4 Science website for this unit can be used to help students label their **model**. Then students can remove the petals of the alstroemeria or lily flower and lay them on their paper towel. Students can now take a closer look at the middle **structures** of the flower. Explain that you want them to focus in on the pollen of the flower.

Discussion Questions:

- Where do you think the pollen is located on the alstroemeria or lily flower? (See picture below)

Structure	Function
petal	
pollen	
stem	
stigma	
stamen	
pollen duster	

SEP: Science and Engineering Practice(s):

Developing and Using Models:
Develop a simple model based on evidence to represent a proposed object.

CCC: Crosscutting Concept(s):

Structure and Function:
The shape and stability of structures of natural objects are related to their function.

Tell students you want them to watch a short video, Flower Pollen, that can be found on the BOCES 4 Science website for this unit/Lesson 11. This video shows a close-up of a flower and the **structures** that carry the pollen of the flower. As students watch the video, ask them to verify where the pollen is located on their alstroemeria or lily flower. Students can use their magnifiers to look closely at the pollen. Pictures of the pollen and **pollen dusters** on the alstroemeria or lily can be seen on the Alstroemeria Flower or Lily Flower interactive whiteboard file.

Discussion Questions:

- What do you think the pollen is used for **(function)** in the flower? (Answers vary)
- Why do you think the pollen is important to the flower? (Answers vary)

Again, write student responses to questions on the chart.

Students may not have correct answers to questions at this point in the lesson. Answers written on the chart paper can be revised later in the lesson.

Now ask students to remove the **structures** of their flower that contain the pollen. Place these parts of the flower on the paper towel. Students may notice the pollen getting on their hands. The center section of the flower is still attached to the flower. Discuss this part of the flower with students.

Discussion Questions:

- Why do you think this **structure** of the flower is important **(function)**? (Answers vary)

Write final student responses to questions on chart paper. This information will be revisited later in the lesson.

1. Ask students to **read** the first two paragraphs of the article, What is Pollination?, with a partner. Then have students use the diagram included in the article to label their **model** of the flower in their Student Science Journal. Students should include the labels: **stigma, stamen**, pollen duster, pollen and petal. Students should also indicate on their model where the pollen is found on the flower.

   Discussion Questions:

   - What does the article tell us about the other important **structures** of a flower? (The **structures** it mentions are the stigma, stamen, pollen duster, and petal.)
   - What does the article tell us about how pollen moves among flowers? (The pollen of the flower moves from the stamen on one flower to the stigma of another flower.)
   - Why is pollen important to the flower? (When the pollen moves from the stamen of one flower to the stigma of another flower, new seeds can form.)

2. Revisit student answers to the questions asked previously in the lesson. Compare them to what was learned about the flower. Look for answers that are correct and/or answers that need to be revised

CCC: Crosscutting Concept(s):

Structure and Function:
The shape and stability of structures of natural objects are related to their function.

SEP: Science and Engineering Practice(s):

Obtaining, Evaluating, and Communicating Information
Read grade-appropriate texts and/or use media to obtain scientific and/or technical information to determine patterns in and/or evidence about the natural world.

SEP: Science and Engineering Practice(s):

Developing and Using Models:
Develop a simple model based on evidence to represent a proposed object.

on the chart. Any information that is incorrect can be crossed out and rewritten in different color marker. Add any additional parts of the flower to the **structure/function** chart to complete it.

Part 2

3. Review the information on chart paper that students added about the pollen of the flower. Now ask students to watch two short videos, Bee Pollinating a Flower and Bee Pollinating a Flower 2, found on the BOCES 4 website for this unit/Lesson 11. The videos show a bee in the pollination process. Discuss what they are observing on the video. Students should notice the bee is climbing around the flower and trying to make its way into the flower, and there appears to be a "powder" on the bee's body.

   Discussion Questions

   - What did you observe in the pollination video? (Answers vary but may include that they saw a bee trying to get into a flower, crawl on a flower, something that looks like powder on its body, etc.)
   - How do you think the bee (an animal) helps carry the pollen from one flower to another? (Answers vary.)

4. Ask students to read the last two paragraphs of the article, What is Pollination?, with their partner. Discuss their learning.

   Discussion Questions

   - What did you see in the video that you read about in the article? (Bee is picking up pollen from the flower, when the bee flies away the pollen will go with him, the bee may be looking for nectar, flower is a bright color to attract the bee, etc.)
   - How does the bee (an animal) help carry the pollen from one flower to another? (The pollen sticks to the bee's body. When the bee visits another flower, the pollen from the first flower sticks to the sticky stigma of the other flower. This results in the pollination of the flower.)
   - How is the plant helping the animal (bee)? (The flower has nectar for the bee to eat.)
   - What is the **function** of the petals of the flower? (The flowers attract the insects to the flower.)

5. Ask students to go back to page 9 in their Student Science Journal on which they drew a **model** of a bee they observed with a magnifier in Lesson 3 of this unit. Ask students to work with a partner to label as many **structures** of the bee as they know based on background knowledge, videos watched, and the articles. Students can also use any books on bees provided in the classroom or websites to help them identify the **structures** of this insect.

6. Show students the picture of a bee on the interactive whiteboard file titled Bee Picture found on the BOCES 4 website for this unit/Lesson 11. Have students help identify the **structures** on the bee's body using the first slide. Discuss how each part of the bee **functions** to help the bee survive.

SEP: Science and Engineering Practice(s):

Developing and Using Models:

Develop a simple model based on evidence to represent a proposed object.

CCC: Crosscutting Concept(s):

Structure and Function:

The shape and stability of structures of natural objects are related to their function.

7. Show students the picture on slide 2 of the interactive whiteboard file. This picture shows the parts of the bee where pollen often collects. The bee's back legs are covered with hair; therefore, pollen sticks to them and is collected into a special area on the leg called a **pollen basket**.

Part 3

On a paper towel, place a bee, a toothpick, and white glue on students' desks. Place the Fast Plants in view of students so they can see the flowers developing on the plants.

Discussion Questions

- What do you notice about the Fast Plants? (The flowers have grown on the Fast Plants.)
- How do bees help plants? (They pollinate the plants.)
- How do plants help the bees? (The bees eat the nectar from the flowers on the plant.)
- What do you think we are going to do with the items placed on the paper towel on your desk? (Answers vary but may include using the bees to pollinate the flowers.)

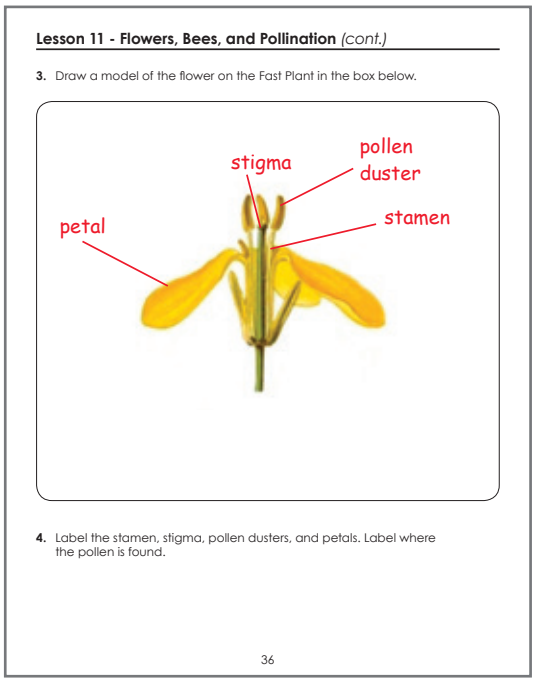
8. Explain to students that the bees are going to help us pollinate the Fast Plants. Use the Making Bee Sticks interactive whiteboard file found on the BOCES 4 Science website for unit/Lesson 11 to take students through the steps of creating the bee stick. The bee sticks should be placed on the paper towel to allow the glue to dry.

SEP: Science and Engineering Practice(s):

Developing and Using Models:

Develop a simple model based on evidence to represent a proposed object.

9. While the glue dries, ask students to draw a **model** of the Fast Plants flower on page 36 of their Student Science Journal. Students should apply what was learned earlier in the lesson with the alstroemeria or lily flower and the article to label the similar parts of the Fast Plants flower – stamen, stigma, pollen dusters, pollen, and petals. Students should also indicate on their model where the pollen is found on the flower.


Lesson 11 - Flowers, Bees, and Pollination *(cont.)*

3. Draw a model of the flower on the Fast Plant in the box below.

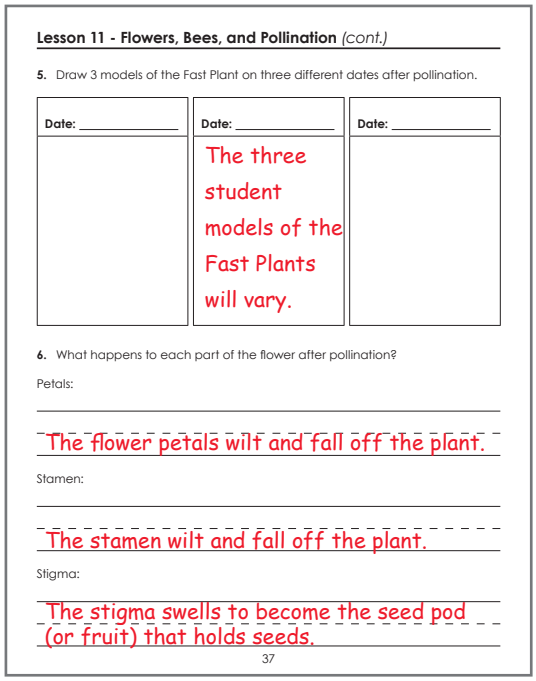
4. Label the stamen, stigma, pollen dusters, and petals. Label where the pollen is found.

36

Part 4

10. Once the glue on the bee sticks has dried, provide each pair of students with their quad of Fast Plants and their bees on a stick. Explain to students that they will be pollinating their Wisconsin Fast Plants growing in their quad. Now that the plant has flowers, it is ready for pollination. The bees will help us pollinate the flowers.
11. Review with students the parts of the bee and the parts of the flower.
12. Have students touch their bee to the pollen dusters (with the pollen) of a number of flowers.

13. Then students should touch the center of a number of flowers with their bees. It is important that pollen be moved from one plant to another. In other words, a Fast Plant flower must receive pollen from another Fast Plant flower in order to produce a fruit with viable seeds. A video showing how to pollinate the Fast Plants can be found on the Links to Resources file on the BOCES 4 Science website. Look for the Pollinating Wisconsin Fast Plants® and Harvesting Seeds video under Lesson 11.
14. Pollinating should be completed on at least three different days. Any flower buds appearing after pollination should be removed by pinching the flower off with fingernails. This allows the plant to put all its energy into the ripening fruit.
15. Students should continue to observe the plants to see what happens to the flowers after pollination. Students can draw **models** of the plants for at least three days on page 37 of the Student Science Journal.
16. Also, students should document in their Student Science Journal page what happens to the parts of the flower after pollination.
17. Seeds in the fruit pods will mature three weeks after pollination. Remove the quads from the water source and let them dry out for a week. Students should then remove the dry pods from the plants. Pods can be threshed by rolling them between thumb and forefinger over a paper towel until all the seeds are removed. Place the seeds in a petri dish and count them. (Again, a video showing how to harvest the seeds of the Fast Plants can be found on the Links to Resources file on the BOCES 4 Science website. Look for the Pollinating Wisconsin Fast Plants® and Harvesting Seeds video under Lesson 11).
18. On page 38 of the Student Science Journal, ask student to record the data of the number of fruit pods and seeds their quad of plants developed.



Lesson 11 - Flowers, Bees, and Pollination *(cont.)*

5. Draw 3 models of the Fast Plant on three different dates after pollination.

Date: _____	Date: _____	Date: _____
	The three student models of the Fast Plants will vary.	

6. What happens to each part of the flower after pollination?

Petals:

The flower petals wilt and fall off the plant.

Stamen:

The stamen wilt and fall off the plant.

Stigma:

The stigma swells to become the seed pod (or fruit) that holds seeds.

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SEP: Science and Engineering Practice(s):

Developing and Using Models:

Develop a simple model based on evidence to represent a proposed object.

Discussion Questions

- How many seeds did the class plant altogether? (Each pair of students planted 2 seeds in each quad.)
- How many seeds were harvested by the entire class? (Answers vary)
- How does that compare? (Answers vary)

Closing the Lesson

Go back to the class Structure/Function chart. Confirm or revise any entries not yet revised based on their learning from this lesson. Then ask students to answer question 9 on page 38 of the Student Science Journal that asks students to address why pollination is important.

Read the letter from the Lorax addressing the importance of pollination.

Assessment

Student contribution to the Structure/Function chart on pollination can be a formative assessment tool to determine what students understand as they begin to learn about pollination and what they have learned throughout the lesson.

The answer to question 9 on page 38 of the Student Science Journal can be a formative assessment tool to determine what students understand about the importance of pollination.

Connections

Differentiation:

For those students who are not able to write their answer to question 11, ask them to dictate their answer to the teacher or provide sentence stems to assist with writing.

Students who have difficulty with fine motor skills may need assistance in making their bee sticks.

Cross-Discipline Extension:

Science: Bees are not the only way flowers are pollinated. Other animals pollinate flowers, as well. A PowerPoint of the other animals that pollinate plants can be found on the BOCES 4 Science website for this unit/Lesson 11.

Wind-pollinated flowers do not produce scents or nectar; instead, they usually have small or no petals and make a large amount of lightweight pollen. Research pictures of the grasses and other plants that are pollinated primarily by the wind and compare those plants to the showy plants pollinated by insects and other animals. A link to an online resource titled Plants Pollinated by Wind vs. Insects shows pictures of the various plants and can be found on the Links to Resources page on the BOCES 4 Science website for this unit/ Lesson 11.

ELA: If your class is using the Engage NY Core Knowledge Domains, Domain 8 discusses bees and the waggle dance done by bees to communicate the location of the hive. If the modules are not being used research information about the bee's waggle dance.

Social Studies: Research information on where pollinators like butterflies and bats migrate in the winter. Follow their journey online or on a map.

Next Lesson Preparation

In the next lesson, students will use the engineering design process to design a hand pollinator that can be used to pollinate a plant. Additional materials may need to be gathered for students' hand pollinator designs. Various materials to design a hand pollinator are provided in the kit.

At the conclusion of the lesson/unit, students will present the problem occurring with bees in our world to an audience, and demonstrate how their hand pollinator functions. A template for a PowerPoint presentation is provided; however, another digital presentation software can be used.