Marshall University Sustainability Department

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Pollination

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OBJECTIVES

Students will investigate pollination frequencies through a scientific experiment. They will draw conclusions from their data and make inferences relating their data to pollinator activities as a whole.

LESSON PARAMETERS

1. **Key Terms** - pollination, pollinators, monarchs
2. **Group Size** - groups of 3 to 5 students; applicable for a class ranging from 3 to 30 students
3. **Grade Levels** - 5^{th}- 9^{th}
4. **Duration** - one 45 minute session
5. **Setting** - outdoors and indoors (optional)
6. **Disciplines** - Science, Biology, Mathematics, Art, Environmental Education
7. **Learning Techniques -**
    a. Discussion
    b. Hands-On
    c. Group-based Collaboration
    d. Interdisciplinary
    e. Activity-based
    f. Real-world application
    g. Expeditions
    h. Nature-based
    i. Observation

GREEN CONNECTIONS

- **Connections to Home and Community -** Students understand the significance of pollinators within a community. They also will be able to attract pollinators to their own backyards or neighborhoods after creating homemade butterfly feeders.
- **Sustainable Perspectives -**
    - Gardening
    - Sustainable habitats
    - Sustainable food sources
    - Pollination

LESSON SUMMARY

Students will discuss the discussion questions as a whole class with the instructor mediating and contributing information when necessary. Students will receive handouts illustrating flowers that attract butterflies and bees from “Gardening for Butterflies: How to Attract Butterflies to Your Garden” (https://www.fix.com/blog/gardening-for-butterflies/) and “Bring Back the Bees: How to Increase your Garden’s Bee Population” (https://www.fix.com/blog/bring-back-the-bees/). The instructor will end the discussion with the question “How much pollinating can one little pollinator do?” This will transition the lesson into the next activity as students will find out the answer through their own observations at the butterfly garden. Before moving out into the field, if students have a smartphone, they will be encouraged to download the free app “LikeThat Garden”. This app allows them to scan a picture of a butterfly or flower and the app will quickly identify the species.
Students will be split into groups and assigned certain tasks that they will complete in two 10 minute segments of time. Some groups will focus on following individual pollinators to see how many flowers that one pollinator pollinates. They can use the app to identify the pollinator and the flowers that it pollinates. They will record all the data in a notebook. Other groups will be given colored twine to mark off a segment of the garden for them to focus on. They will use the app to identify the flowers within their segment then observe all the pollinators that visit the flowers. They must count how many flowers are pollinated, each time a flower is pollinated, and how many pollinators hit the flowers. They may want to assign each student in the group a specific task. All of the data will be recorded in their notebooks. After the twenty minutes of observing is complete, the groups will analyze their data collectively then report to the whole class. The students and instructor can discuss how this data may or may not be an accurate representation of hourly pollination. They should identify the dependent and independent variables, controls, and what could be done differently for future observations.

Upon completion of this pollination activity, students will return to the classroom to make butterfly feeders. They will follow the instructions from “Attract Butterflies By Making A DIY Feeder in 6 Simple Steps” (https://brightnest.com/posts/attract-butterflies-by-making-a-diy-feeder-in-6-simple-steps). This can be completed individually if enough materials are available so students can take it home to their own gardens or yards. If materials are scarce, they can make one feeder per group to hang in a community garden.

ACTIVATING STRATEGY

The students will discuss the discussion questions to activate prior knowledge from previous lessons. They should be able to relate this lesson to the lesson “Garden Wildlife” and “Plant Needs and Seeds”. This will allow them to quickly transition into deeper questioning and understanding, leading into the activity.

LESSON DEVELOPMENT

Exploration Lesson - Students will participate in active learning as they investigate the frequency of pollinators within a segmented section of a garden. This engages them in a scientific experiment with multiple variables, techniques, and observations involved.	**Explanation Lesson -** Information is presented in this lesson mainly through class and group discussions. The whole class receives the same information through an opening and closing discussion with the instructor. The groups will discuss the new information they found after their observations.	**Application Lesson -** The pollination activity also requires students to apply what they have learned previously about the scientific method. They also apply their new skill of pollinator and flower identifications.

LESSON WEATHER CONTINGENCY

If bad weather, off season, or unable to visit campus or any working garden, then students will not be able to perform the pollination activity. The groups will remain indoors and be assigned different types of pollinators to research. They must record pollinator habitats, life spans, and flowers that they pollinate. If time allows after completing the butterfly feeders, students may also participate in such research.

DISCUSSION QUESTIONS

- Why is pollination so important?
- What insects or animals are considered pollinators?
- Why plant flowers when all you really want to plant is tomatoes?
- Why plant Milkweed for Monarchs?
- What food would we have left if we had no more pollinators? (leaves, roots, bulbs)
- How much pollinating can one little pollinator do?

MATERIALS

- Handout from “Bring Back the Bees: How to Increase your Garden’s Bee Population” https://www.fix.com/blog/bring-back-the-bees/
- Handout from “Gardening for Butterflies: How to Attract Butterflies to Your Garden” https://www.fix.com/blog/gardening-for-butterflies/
- Twine
- Scissors
- Notebooks
- Smartphones/tablets with the app: “LikeThat Garden”
- Instructional handout from “Attract Butterflies By Making A DIY Feeder in 6 Simple Steps” https://brightnest.com/posts/attract-butterflies-by-making-a-diy-feeder-in-6-simple-steps
- Mason jar (or baby food jar, peanut butter jar, etc.)
- Kitchen sponges
- Hammer and nail (or anything that can poke a hole in a jar lid)
- Sugar water
- Red food coloring (optional)
- Decorative tape or stickers (optional)

RATIONALES

- Next Generation Science Standards
  - **MS-LS1-4 -** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
  - **MS-LS1-5 -** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
  - **MS-LS2-1-** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
  - **MS-LS2-2 -** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
  - **MS-LS2-5 -** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
  - **HS-LS2-2 -** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- 21st Century Science Content Standards and Objectives for WV Schools
  - **SC.O.6.2.05 -** examine how abiotic and biotic factors affect the interdependence among organisms.
  - **SC.O.6.2.08 -** predict changes in populations of organisms due to limiting environmental factors (e.g., food supply, predators, disease, or habitat).
  - **SC.O.7.2.07 -** evaluate how the different adaptations and life cycles of plants and animals help them to survive in different niches and environments (e.g., inherited and acquired adaptations).
  - **SC.O.7.2.11 -** predict the trends of interdependent populations if one of the limiting factors is changed
  - **SC.O.ENV.2.10 -** analyze biological diversity as it relates to the stability of an ecosystem.
  - **SC.O.6.1.01 -** realize that scientists formulate and test their explanations of nature using observation and experiments.
  - **SC.O.6.1.05 -** cooperate and collaborate to ask questions, design and conduct investigations to find answers and solve problems.
  - **SC.O.6.1.11 -** construct and use charts, graphs and tables to organize, display, interpret, analyze and explain data.