INQUIRY ACTIVITY ON BIODIVERSITY

By
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I. Title: MEASURING SPECIES DIVERSITY

II. Lesson Summary: In this activity students will inventory species diversity in two different areas on the property of Midpark High School.

III. General Goal: To introduce students to the concept of biological diversity; showing that differing habitats have different characteristics, and the ways the differences can be studied and measured.

IV. Duration: Three periods (52 minutes each), two periods for collection of data and one for class discussion.

V. Specific Learning Objectives:

A. Content Objectives

1. Show in a data table that differing habitats have different communities of organisms.
2. Indicate in a data table that lawn sites have less species than woods sites.
3. Indicate on a table that lawn sites have greater density of species than woods sites**.**

B. Process Objectives

1. Identify some difficulties involved in measuring biological diversity.
2. Identify the relationship between biological diversity of environments and the organisms that live in those environments.
3. Apply the methods of science to observed differences in environments and organisms.
4. Understand that debates about classification of organisms are an example of the nature of scientific inquiry.

A. Standards: The above objectives are included in the Berea City School District grades 9-12 science curriculum. The curriculum has been developed using benchmark guidelines written by Project 2061 for the American Association for the Advancement of Science.

VI. Prerequisite Knowledge/Skills for Students: Students will be familiar with the methods of science and the concepts of species, habitat, and niche. They will have an evolving definition of biological diversity. A functional knowledge of graphing skills is required.

Background Information:

A. Students are introduced both to the content concept of diversity and the process of inquiry in science in **Chapter One** of their textbook, *BSCS Biology: A Human Approach.* The focus of the curriculum at this point is on similarities and differences between humans and other animals.

Chapter Two discusses types of evidence for evolution and a mechanism for the process of evolution.

This inquiry is designed to review previous concepts and to introduce **Chapter Three**, titled, "Products of Evolution: Unity and Diversity" which more fully develops the concepts of diversity and evolution and begins building the concept of the role of adaptation in relationship to biological diversity.

B. The following vocabulary terms will occur in the content of Chapter 3. The teacher may find an opportunity to introduce them during this inquiry.

1. **Biological diversity** is the totality of diversity in nature, including the variety of plants and animals, the ecological roles they perform, and the genetic variance they contain.
2. Diversity exists and can be measured from the **genetic**, **species**, and **ecosystem** levels.
3. **Genetic diversity** includes the variations in genes that result in inherited differences between organisms.
4. **Species diversity** can be determined by counting the number of different species that live in a given area. This is not an easy task, as will be illustrated by this inquiry.
5. **Ecosystem diversity** considers the differences in habitat and its interactions with the living components of the system. This is the level fundamental to the shaping and diversification of all biological diversity.

D. In Data Table 3, Number of Total Species: Plant, Animal, Other, will not be graphed. These columns will be used to indicate possible sampling errors or other "weird" things happening with the collection teams and/or sites.

VII. Preparation for Lesson:

A. Materials for the students:

1. Paper, pencils or pens, meter sticks, rulers, boundary markers (any of a variety of items used to denote the area of a site), markers (for reporting data on transparency), graph paper, colored pencils or markers, tape.
2. Activity Worksheets. Divide the handouts into three groups.
    a) Day One: Activity Pages 1 and 2.
    b) Day Two: Activity Pages 3 and 4
    c) Day Three: Activity Page 5 and Data Table 3

B. Materials for the teacher:

1. Overhead projector
2. Transparency of Data Table 3
3. Marking pens

Instructional Strategy:

A. Period One:

1. Students will be divided into 7 teams of 4 (assume class of 28). Members of the teams will "count off" and be assigned roles according to their number:
   - **#1)** Taskmaster – keeps the team on task and directs the team's discussion.
   - **#2)** Recorder – writes down the important information and transfers team data to the class.
   - **#3 and #4)** Field Surveyors – understands technique for and accomplishes collection of data.

B. Everyone will be given pages 1 and 2 of the MEASURING SPECIES DIVERSITY Activity Sheets. Students will be introduced to the activity through class discussion. They will form their hypothesis before leaving the classroom to gather data.

2. Each team will select and mark the boundaries of a square three meters on a side in the woods area. The Field Surveyors will count the numbers of different species present in the plot. Each species should be named using common or descriptive terms. Teams should group the different species with those that are similar according to the Site Inventory (Plants, Animals, Others).

B. Period Two:

1. Students will continue in the same team, but with different roles. Each team member will rotate two positions from the previous day's job description. (e.g., Taskmaster and Recorder become Field Surveyors).
2. Each team will select and mark the boundaries of a square three meters on a side in the lawn area. The Field Surveyors will count the numbers of different species present in the plot. Each species should be named using common or descriptive terms. Teams should try to group the different species with those that are similar according to the Site Inventory (Plants, Animals, Others).
3. Each team needs to report their team's data on the table provided on the overhead. All students need to complete their own DATA TABLE 3.
4. **Homework**: Each student will make two graphs using their team's data (woods and lawn). The X-axis will include a list of all species found according to group (Plants, Animals, Others). The Y-axis will include the number of individuals within the species. Students may choose to construct any type of graph.

C. Period Three:

1. All graphs will be taped to the wall/blackboard.
2. Students will continue in the same team. Teams need to work together to complete the Study Questions (Allow 20 minutes). Part of this activity will include comparison of the posted graphs.
3. The class will convene as a whole to discuss the results of the inquiry. The teacher will review the class data and responses of the teams to the Study Questions.

VIII. Assessment:

A. During the Activity

1. The student will display a graph during period three that accurately displays the team data.
2. The student will complete the Study Questions with 90% accuracy.
3. Students will form additional hypotheses regarding the causes of differences in the two sites and they will propose methods for testing their hypothesis.

B. On a Chapter Test

1. The student will indicate the effect on biodiversity of reducing or expanding ecosystems, when responding to the following question on test:

   The Nature Conservancy is an example of a conservation organization that seeks to protect woods. How could the activities of an organization such as this have an effect on biological diversity? Give specific examples using this organization or a similar one.

2. The student will indicate that debates about classification of organisms are an example of the nature of scientific inquiry when responding to the following scenario on the test.

   Scientists have hypothesized that modern whales are descended from land mammals that moved into the water environment approximately 50 to 60 million years ago. In 1994 scientists found two exciting fossil discoveries, both whale-like creatures with legs. Not all scientists accept this data as evidence supporting the hypothesis. What do you know about the nature of scientific inquiry that would indicate this type of disagreement is not an uncommon phenomenon?