# Ecologists and Students Explore Plant Diversity in the Schoolyard: A Fourth Grade Introduction to Experimental Design

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## Introduction

While elementary school students are generally familiar with different areas of their schoolyard, few take the time to examine the plants around them in detail. We developed an inquiry-based lesson for elementary school students that allows students to explore and attempt to identify the plants in their schoolyard while learning important scientific processes such as hypothesis formation, random sampling and observation skills.

This lesson was designed to achieve the following objectives:

- Students will practice forming and testing hypotheses, collecting data, and graphically describing their results
- Students will learn the concept of plant diversity and observe that levels of diversity are not equal throughout the schoolyard
- Students will gain experience in basic plant identification, which can range from simple classification of “grass,” “weeds,” and “flowers” to detailed classification using field guides for older students.

By engaging in this lesson, students learn that science is not strictly a textbook-driven discipline, but provides many opportunities to work outdoors and explore nature. Teachers can also link this activity with mathematical concepts such as averaging, measuring, graphing, and surface area.

## Abstract

We present an inquiry-based lesson to demonstrate how schoolyard habitats can be used to teach the concepts of observation, hypothesis testing and data analysis. The investigation focuses on counting the number of plant species within multiple plots of the schoolyard. Two fourth grade classes were asked to hypothesize which area of the schoolyard contained the most types of plants, and which contained the fewest. Groups of students were then given hula hoops and instructed to collect one of each plant type falling within a hula hoop-sized area in their area of the schoolyard. The concepts of random sampling, replication and averaging of results were emphasized. The investigation culminated with students presenting their results to the class. Through this investigation, students began to appreciate their schoolyard from a scientific perspective, and learned that biodiversity across a landscape can be due to a number of habitat variables including microclimate, soil, and the use of herbicides.

## Inquiry Methods

1. Students are asked to describe different areas of the schoolyard. A map or aerial photo (figure 1) can be useful here. Students then hypothesize where they might find the most and fewest types of plants.
2. The class brainstorms the best way to test this hypothesis, and the teacher asks students to consider the importance of sampling plots of equal area.
3. The class discusses the importance of random sampling as opposed to “searching” for a location that looks like it has many or few plants. In order to sample randomly, the hula hoop should be thrown towards the schoolyard area of interest. Groups of students can sample different regions of the schoolyard.
4. Students collect one of each type of plant within the area of the hula hoop. Students then repeat the sampling procedure, placing their plants in a second bag.
5. After returning to the classroom, students count the total number of plant types from each throw. This number should be entered into the data sheet (figure 2).
6. As each group shares their results, the teacher compiles the data on the board, leading the class in averaging the results of each group’s multiple samples.
7. The final results of plant diversity throughout the schoolyard can then be graphed, and the teacher can lead a discussion on why different locations have different numbers of plants (i.e. microclimate differences, soil differences, use of fertilizer or herbicides).

For a complete description of this lesson, see: http://www.bioed.org/ecos/inquiries/TRPlantDiversityInquiry.pdf

**Fig 1. Satellite photo of our schoolyard (source: Google Earth).**

Making Hypotheses About Plant Diversity

Names of group members: _____

1. In what part of the schoolyard do you expect to find the most types of plants (what is your hypothesis)?

_____

_____

2. What area of the schoolyard will your group sample? _____

3. How many types of plants do you predict you will find in your schoolyard area (what is your hypothesis)? _____

Data Sheet:

Describe the area where you collected your plants. Was it dry, wet, cold, hot, hilly, flat?

_____

_____

Number of plants collected from the first hula hoop throw: _____

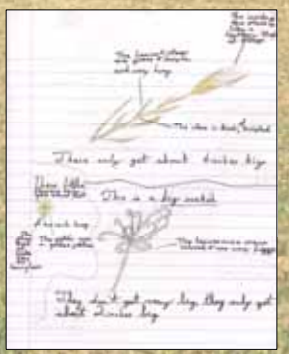
Number of plants collected from the second hula hoop throw: _____

**Fig 2. Data sheet used for recording habitat and plant information**

## Inquiry Questions

Students answered the following questions:

- What area of the schoolyard contains the most different types of plants?
- What is the average number of plants found in each area of the schoolyard?
- What kinds of plants are in the schoolyard?



**Examples of student journal entries describing some of the plants they have found in their schoolyard.**

**Plant diversity in the Target Range schoolyard.**

## Materials Needed

- Schoolyard map or aerial photo (figure 1)
- Hula hoops for defining study plots
- Plastic bags – one per student
- Data sheets (figure 2)

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