EDCI 786 Topics: Science Research in the Classroom
Lesson Plan

Project Title **Natural Selection of Sunflowers by Region**
Participant Name **Jennifer Taylor**

Instructional Overview and Timeline

Day 1

1. (10 minutes) Introduction of sunflowers and the difference between cultivated sunflowers and wild sunflowers. The class will see pictures of the wild sunflowers grown in Canada and the ones grown in Texas. The students will discuss the difference they see and brainstorm reasons for this difference. [If we have the plants to show the students, that would be better.] Description and the purpose of the lab activity. The purpose of the lab is to see if the difference is due to climate difference or a genetic difference. The students make their hypothesis and will test it. Since we do not have the time to grow the plants, we will test to see if there is a difference we can see in the short term. The size of the seed is one difference the students can see. We will record germination times and rate of growth of the stems and roots.
2. (50 minutes)
    a. The students are to take measurements on the average length of the seeds from each region and record that data. Is there a difference in the size of the seed coat?

Materials Needed per Group		
5 Petri dishes	25 90mm Filter Papers	
10+ seeds each from		
Manitoba	S. Dakota	Kansas
Oklahoma	Texas	
Distilled water w/bottle	Ruler	Metal Spatula
Optional		
Dissecting Microscope	2 Forceps	

    b. Each group needs to germinate their seeds.
        i. Place a filter paper in each Petri dish and wet with distilled water. The paper needs to be very wet without visible puddles.
        ii. Place one type of seeds on filter paper spreading them out.
        iii. Label Petri dish and replace cover.
        iv. Repeat for each set of seeds and place seeds in a cool dark place. [Inside a drawer or cabinet.]

Day 2

1. (10 minutes) Background information. What is a species? Are all the members of a species the same? How would members of a species be different if the climate they lived in was different? What is natural selection? Review Variation, Heritability, Overproduction and Reproductive Advantage.

2. (25 minutes) Using a web site, the students find data on the climate of all five regions from the seeds were taken. Rainfall, days of frost, average temperature, etc.
- http://www.iwmi.cgiar.org/index.htm (you may need to register)
- http://dw.iwmi.org/dataplatform/Home.aspx (use id: public, password: public)

Region North Latitude West longitude (hint: if they do not have West Longitude use (-) East.)

Manitoba	49.71	degrees	99.96	degrees
S. Dakota	44.38	degrees	99.55	degrees
Kansas	39.10	degrees	96.58	degrees
Oklahoma	35.25	degrees	97.54	degrees
Texas	30.20	degrees	98.18	degrees

3. (10 minutes) The students need to transfer the seeds to a new filter paper. [This is the optional part: Remove the seed coat from the seeds and look at the size of the embryo of the seeds from each region.] Carefully remove the filter paper from the Petri dish and rinse the Petri dish. Add a new filter paper and use the metal spatula to transfer the seeds to the new moist filter paper. Replace seeds to cool dark place.

Day 3

1. (10 minutes) Using the climate data, the students make inferences about length of growing season and why some regions might have plants that go from seed to flower faster than others.
2. (15 minutes) The students make observations of the seeds/embryos and record data. As soon as stems or roots appear, the length is measured daily.
3. (10 minutes) Transfer seeds/embryos to clean and moist filter paper and return to cool dark place.
4. (20 minutes) Students begin setting up graphs. Review of line graphs, XY scatter plots, bar graphs and slope.

Days 4-7(?)

1. (15 minutes) The students make observations of the seeds/embryos and record data. As soon as stems or roots appear, the length is measured daily.
2. (10 minutes) Transfer seeds/embryos to clean and moist filter paper and return to cool dark place.
3. (30 minutes) Students begin/continue to write up lab report.

Purpose The purpose is to demonstrate the effect of natural selection.

Grade Level(s) 9^{th}-12^{th} grades

Student Learning Outcomes (Instructional Objectives)
The student…

1. actively engages in asking and evaluating research questions.
2. actively engages in investigations, including developing questions, gathering and analyzing data, and designing and conducting research
3. actively engages in using technological tools and mathematics in their own scientific investigations.

4. actively engages in conducting an inquiry, formulating and revising his or her scientific explanations and models (physical, conceptual, or mathematical) using logic and evidence, and recognizing that potential alternative explanations and models should be considered.
5. actively engages in communicating and defending the design, results, and conclusion of his/her investigation.

1. understands biological evolution, descent with modification, is a scientific explanation for the history of the diversification of organisms from common ancestors
2. understands populations of organisms adapt to environmental challenges and changes as a result of natural selection, genetic drift, and various mechanisms of genetic change.
3. understands biological evolution is used to explain the earth's present day biodiversity: the number, variety and variability of organisms.
4. understands organisms vary widely within and between populations. Variation allows for natural selection to occur.
5. understands the primary mechanism acting on variation is natural selection.
6. understands biological evolution is used as a broad, unifying theoretical framework for biology.

Pertinent Sections of Science Standards

STANDARD 1: SCIENCE AS INQUIRY
Grades 8-12

SCIENCE AS INQUIRY – The student will develop the abilities necessary to do scientific inquiry and develop an understanding of scientific inquiry.

Benchmark 1: The student will demonstrate the abilities necessary to do scientific inquiry.

STANDARD 3: LIFE SCIENCE
Grades 8-12

LIFE SCIENCE – The student will develop an understanding of the cell, molecular basis of heredity, biological evolution, interdependence of organisms, matter, energy, and organization in living systems, and the behavior of organisms.

Benchmark 2: The student will demonstrate an understanding of chromosomes, genes, and the molecular basis of heredity.

Plan for Implementation

Biology I and II students in the 2007-2008 school year will participate in lesson.

Unit Assessment

The students write a lab report.

Introduction ¶

1. What is already known?
2. What is the purpose? What will be learned?

3. What is the hypothesis? (testable statement?)
4. What is your independent variable? What is your dependent variable?
5. What conditions are being held constant?

Materials/Procedure ¶

1. What materials were used? Give descriptions if necessary.
2. How were the materials used?
    a. How was the data taken?
    b. Describe what was done so that someone could reproduce your experiment.

Data Table

1. The data should be clearly recorded.
2. All appropriate units should be given.
3. Explain any data that does not seem reasonable.

Graph

1. The graph should have an appropriate title.
2. Each axis should have labels and have appropriate units.
3. The independent variable should be on the x-axis.
4. A key should be used if necessary to convey information.

***Analysis**

5. Any equations used should be explained and a sample calculation given.

Conclusion ¶

1. What was learned? What caused the difference in height, the difference in the seed germination rates and growth rates? Was it genetics or climate? Explain.
2. Was the hypothesis correct? What information was used to determine if hypothesis was correct? Explain.
3. What could be done in future experiments to learn more or improve procedure? Explain.

<u>Resources (Print and Websites)</u>

http://www.ars-grin.gov/npgs/

Manitoba	592333
South Dakota	586900

[We can see from the pictures that the sunflowers in Canada do not grow as tall as the ones in Texas and that flowers in the regions between those two extremes show a gradient. The question is why is this the case. Is it the climactic difference or is it genetic? If we grow these plants under similar conditions, if it were entirely climate, they'd all be the same size. We see that the seeds from Canada germinate faster than the other plants and grow faster as seen in the length of root and stem. The difference must be due to genetics. They are the same species which means that any two groups can reproduce offspring that are fertile. Natural selection must be the explanation. The plants in Canada that can grow to maturity in the shortened growing season produce more seeds that survive than the ones that took longer.]