Graphing Nature with the TI-Nspire

by – Peggy Welch

Activity overview

Evolution through natural selection accounts for the diversity of species developed through gradual processes over many generations. Biological adaptations include changes in structures, behaviors or physiology that enhance survival and reproductive success in a particular environment.

Concepts

In this activity, students will graphically display variations of leaf blade sizes of deciduous trees within a species and between closely related species.

Teacher preparation

To prepare your own set of leaves, randomly collect 10 leaves from the same tree on a day that is not real humid or after a rain.
Place the leaves between layers of newspaper, and then cover the top with a heavy book. Keep in a dry place.
After 2-3 days, the pressed leaves are ready to be mounted.
Use clear contact paper and poster board for mounting. Write the name of the species and the number of the specimen on each card.
Students can also be required to make their own sets.

Inquiry graphing: If your students need to be prompted before they draw their predicted box plots, it might be necessary for you to explain the general shape and qualities of the box plot and how it relates to statistical data.

Classroom management tips

Students will need sets of leaves and a metric ruler.
Suggested specimens include:
Acer saccharum and Acer saccharinum
Quercus alba and Quercus macrocarpa

TI-Nspire Applications

In this activity, students will use Lists & Spreadsheet application on the TI-Nspire ™ learning technology.

Step-by-step directions

1. Have students measure the blade of 10 leaves at the widest point to the nearest mm and record in the chart below.

Species name _____

Leaf #	Blade Width (mm)
1	
2	
3	
4	
5	

6	
7	
8	
9	
10	

2. Insert a new page with the Lists & Spreadsheet application.
3. Enter the width data in Column A.
4. Arrow up to the top of the Column and label it width.
5. Press **MENU > Statistics > Stat Calculations > One-Variable Statistics**
6. For X list, choose width.
7. Copy the statistics from column C that are necessary for the box plot.
   (Min, Q1X, Med, Q3X, Max) Arrow down to find these values.
8. At this point, students will compare this data from step 7 with their inquiry graph.
   You may want to omit this step.
9. Arrow back to column A and press **MENU > Data > Quick Graph > Menu > Plot Type > Box Plot**
10. Use the NavPad to locate the values you recorded in step 7. Draw the box plot with its values.
11. Repeat steps 1-10 with another set of leaves.

Assessment and evaluation

Analysis and Conclusions:

1. How did your predicted box plots compare with the TI-Nspire generated box plots? (Answers will vary)

2. Describe the variations you observed within each species. Was there more variation within a species or between the two species? Why?
(There should be more variation between species because of their different genotypes (genetic makeup)

3. Describe variation in your own words. (Students should write something about physical differences within a species, i.e., height, color, width, etc.)

4. What are the three (3) main causes of variations in genotype?

(1)Mutations: results from flawed copies of individual genes. Mistakes that occur in the DNA genetic code.

(2) Recombination: results in reassociation of genes in a diploid individual. Recombination occurs during meiosis (gamete production) by the independent assortment of genes on nonhomologous chromosomes and by crossing over between genes located on homologous chromosomes.

(3) Random fusion of gametes: There are hundreds of millions of sperm, yet just one sperm fertilizes the egg by a matter of chance. This ensures that the offspring are not carbon copies of their parents.

5. What factors besides genotype result in variations? Specifically, what factors determined variations in the size of the leaf blades you measured?
(Environment: location of the leaf on the tree, amount of sunlight, moisture, space. Disease and insect concentrations (damage). Air quality.)
6. How do variations relate to evolution by natural selection? (Variations increase the chance that organisms will survive, reproduce and produce viable offspring in a changing environment.)

Activity extensions

1. Choose a third closely related species, i.e., *Acer rubrum* and compare the data among the three species.
2. Choose a cultivar, a closely related species that horticulturists have artificially selected and compare its data to its native species. Discuss the traits that horticulturists choose when designing cultivars. Then continue your discussion with genetic engineering. What traits would genetic engineers choose to incorporate into the tree's genome?
3. Predict if any relationship exits between leaf blade width and height, or between leaf blade height/width and petiole (stem) length. Graph the data on a scattergram and perform a regression to determine which relationship if any exists.