Visual Data Representation Lesson Plan

Modified from Cittlali Onate Lesson

Grades: K-12
Time: 45 minutes-1 hour
Lesson 2 of 3 in the STEM in the Garden Investigation

Objectives: Students will be able to display their collected data as a visual graph/chart and draw conclusions from their findings.

Standards: **1.MD.C.5, 2.MD.D.10, 3.MD.B.3, 6.SP.B.4, 7.SP.A.1, 7.SP.A.2, 7.SP.B.3, 7.SP.D.8, 8.SP.A.1, 8.SP.A.2, A1.N.Q.A.1a, A1.F.LE.A.2, A1.S.ID.A.1, A1.S.ID.A.2, A1.S.ID.B.4, A1.S.ID.C.6, A1.S.ID.C.7, A2.S.ID.A.1, A2.S.ID.B.4, A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.A.1**

Review: Review prior learning related to bar graphs, scatter plots, etc.

Hook: Part 2 of 3 in investigation & ask if they think representation of information matters (can present 2 things showing the same data but represented differently and ask how they would interpret the information)

Real World Connection: Scientists communicate their findings and how they do so matters.

Student reflection: Ask students to consider how the way they represented the data might affect the way someone answers their original question

Assignments require students to: Interpret – data on the bar graph to compare their findings with other students; Evaluate information – bar graph will determine what shapes occur the most/least in the garden; Produce arguments – why were some shapes easier to find than others? Life experiences – connects to data visualizations that they have seen in school or in life.

Assessment and Thinking: Presentation – Displaying their bar graphs to a partner to compare their findings; Analytical – students will look at their data results to make conclusions and generalizations from the overall data of the class.

Grouping:

- Pair students to set them up for success behaviorally and academically.
- Pairs will be the same as in the previous lesson.

Prior knowledge/skills needed:
- Basic counting, addition, and, for older students, multiplication
- Must have data sheets

Areas in which students may struggle:
- Students may only be able to complete the bar graphs.
- Students may have difficulty adding and multiplying.
- Students may have difficulty in selecting the appropriate scale for their bar graphs and/or scatter plots.

Behavior notes:
- Establish expectations clearly and early for best behavior outdoors.
- Students should be able to clearly restate all boundaries and task expectations.
- Prepare students for going outside by letting them know in advance that it will occur and model appropriate behaviors (ex: try not to scream or squeal too much if an insect flies by you and instead take a few deep breaths and calmly walk away).
- Students will practice respect and responsibility by being mindful of the materials they use and by keeping up with their materials throughout the lesson.
- This lesson can be done indoors or outdoors with the appropriate materials.

Materials needed:
- Completed frequency charts (1 for every 2 students)
- Bar graph worksheets (or large poster paper)
- Pie chart worksheets (or large poster paper)
- Markers (various colors for each group to use as desired)
- Pencils (1 for every 2 students)
- Pencil sharpeners (several)
- Erasers (several)
- White board & marker OR poster paper & marker for teacher writing
- Optional: clipboards (1 for every 2 students)
- Optional: calculators (1 for every 2 students)

- Optional: scatter plot and/or box-and-whisker plot worksheet(s)
- Optional: use only found materials outside to make bar graphs or scatter plots

Career connections: All scientists (from plant scientists to social scientists) rely on statistical analysis to understand their findings. Knowing which analysis to use and how to interpret it strengthens the research. Ethically presenting data involves consideration of who is affected by the research as well as knowing that how it is presented matters. Environmental educators may use this type of analysis to determine who attends their programs most frequently, where those people live, and the ages of those individuals to determine the audiences that are being served and to identify who is not being served by their programs. Biologists may use this to determine the relationship between a plant species and a particular animal (if one is present, is the other? Does the presence of a specific animal increase the likelihood of seeing a specific type of plant?), for example.

<u>Activities and Pacing</u>:

Introduction to class and lesson (10-15 min)

- Show students two different representations of the same data. Ask them to tell you how they feel about each one and what they gain from it. (Try showing one of them first and getting their responses then following up with the other example. Compare the two.)
- From this discussion, reintroduce them to the investigation and tell them that they will create visual representations of their data much like a scientist would when writing their journal publication.

Transition

Activity (~ 30 minutes)

- Be sure to hand out all the frequency charts, worksheets, and any materials needed. (Can do this activity outdoors using found materials, too.)
- Instruct students to make a bar graph that answers their original question (ex: what is the most common shape in the garden?)
    - The bar graph should have a title and labels for both the x- and y-axis.
    - There should be a bar for each shape found (or grouping of parallelograms, etc.).
    - The age/grade of students will impact how much more you do. Students may continue to create a pie chart, a scatter plot, and a box-and-whisker plot to represent the data. Ask them to consider how the different versions may influence someone's interpretation of the information presented.
    - Once they are finished, have the students present their graphs to one another on a gallery wall and/or show and tell.

Transition

Conclusion (10-15 minutes)

- Discuss how different groups presented the information and why they made certain decisions.
- Ask students to consider how these representations influence others.
- Explain bias and ethics in data collection/representation to older students.
- Be sure to ask them the answer to their statistical question!

Wrap up this lesson. Be sure to save all worksheets for upcoming lessons!

Possible changes for classes:

- Lower elementary may focus primarily on the bar graph and sharing their findings with one another.
- Middle grades may add the pie chart to the bar graph and discuss why someone would use one or the other.
- High school may do all the above and/or use this to discuss mean, median, and mode and create box-and-whisker plots or to introduce line of best fit in a scatter plot.
    - If doing line of best fit, use tech to find R and model the line.
    - For line of best fit, must have two values such that x predicts/explains y.
    - Basic example for line of best fit and scatter plot: Does the number of flowers with a circular, flat landing pad increase the number of butterflies present in a garden? Students would need to create a frequency chart that records the number of flowers with circular, flat landing pads AND, separately, the number of butterflies observed in the same garden. [You would need to survey multiple locations, which could simply be various quadrants or transects around the school campus.] This type of question relates to both the study of entomologists and plant scientists who are interested in pollinator syndromes, the characteristics about a flower that make them attractive to specific types of pollinators. Shape is one such characteristic that we know influences pollinator-plant relationships. For example, we know that butterflies do like flowers with either flat landing pads or tubular structures. This overlaps with hummingbirds preferring tubular flowers but large bees and beetles preferring the more circular, flat clusters of flowers. Pollinator.org has more detailed information about pollinator syndromes.
    - Box and whisker plot: You could simply use the shapes found and determine how likely it is that you would find a given shape. For this, you would also need to survey multiple locations. Each location would be associated with a particular number of, say, circles. Then,

each number of circles would be gathered and analyzed using the box and whisker plot. For example, say you had students survey 10 locations. At those 10 locations they found this many circles: 2, 3, 7, 10, 2, 8, 9, 8, 11, 4. Using this data set, you would then have them order the points from smallest to largest, then find the median, and so on to create the box and whisker plot. This visual representation of the data would tell us how likely it may be to find a circle in the school garden. (This could be useful for understanding how most natural landscapes tend to have curves rather than hard edges and begin to inform how we can design landscapes that mimic natural forms and structures through curvilinear designs and softer edges, which create clusters of flowers that are easier to see by pollinators flying high overhead. It could also lead to an indicator or metric by which we could, presumably, evaluate how naturalistic a garden is based on the presence of curves/circles.)

- All the graphs can be modeled outdoors using sticks, stones, and other natural objects to visually represent data.