

## Data About Us

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### Lesson Overview

In this lesson, students begin to understand the idea of a statistical question and explore three graphical displays: box plot, dot plot and histogram.

### Standards Addressed

CCSS 6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

CCSS 6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

### Disciplinary Literacy Best Practices

Focused List

Anticipation Guide

Verbal and Visual Word Association (VVWA)

Gallery Walk

### Lesson Plan

Time Required: One or two 60-minute class periods

Disciplinary Vocabulary: data, data analysis, data collection, statistical questions, graphical displays, dot plot, box plot (box and whisker plot), histogram

Materials Needed:

- Paper
- Pencil
- Markers, colored pencils or crayons
- chart paper
- Anticipation Guide (1 per student)

Assessment: Anticipation Guide, teacher questioning, Completed Graphical Displays

## Engage

- Determine a class survey questions around which to collect data. Survey questions should measure numerical data so that the results can be displayed in dot plots, histograms, or box plots.
- Engage students in dialogue to determine what they might like to explore. They must be questions that are statistical questions, that is: one that can be answered by collecting data and where there will be variability in data. Reference non-statistical questions as: “How old is your grandmother? How many days are there in a week? Do you like pizza?” These are non-statistical questions because they represent one response.
- Ask the students: how might you change some of those questions into statistical questions so that we could collect multiple points of data? Accept responses that are multiple data-collectable responses.
- Tell the students that you are going to explore statistical questions today and represent those in the form of graphical displays. What types of questions might they like answered today?
- Create a class **focused list** (on chart paper or other visual) of possible statistical questions they might like to collect data. (To create the focused list, each group of students could brainstorm questions. Have each group share out a question. If that is a statistical question, it could be added to the focused list. If it is not, have the class dialogue about the question and turn it into a statistical question. At the end, there should be one list for the class to refer to that is only statistical questions.)
- Possible statistical questions may be:
  - “What are the ages of people in our families?”
  - “How old are teachers in our school?”
  - “How many hours a week do students spend on the internet?”
  - “How many hours a week do students spend sleeping?”
  - “How many hours a week do you watch television?”
  - “How many pairs of shoes do you have?”
  - “How many songs do you have on your iPod?”
  - “How many minutes a day do you spend texting?”
  - “How many M&Ms are in a fun-size bag of M&Ms?”
  - “How many seconds can a typical 6th grader hold their breath?”
- Use one of the given questions or a class question that is measurable as described above. Collect a classroom set of data and organize data into chart or table format (or how they feel their data would best be organized).

## Explore

- Once data are collected, tell students that you will organize data into each of the three types of graphical displays (histogram, box plot and dot plot.)
- Before doing so, everyone will need to complete an **Anticipation Guide** in order to pre-assess what they might already know about dot plots, box plots, and histograms. To complete the Anticipation guide, students (individually) read each statement. If they believe the statement is true, they will check the agree column on the “before” side. If they believe the statement to be false, they will check the disagree column. Once students have completed the “before” side, they should discuss their current thinking with a partner. At this point, it is OKAY if students do not know or understand what these are and if the students disagree during their dialogue time. Instruct them that they will revisit this after the lesson to see if their thinking has changed. They are not to change their original answers because you (the teacher) would like to see what their thinking was before and after the lesson.
- Model, using the set of collected data, what each of the three graphical displays will look like and how to create them.
- As the teacher models each type of graphical display, students will take notes on each using **Verbal and Visual Word Association** for each of the three graphical displays: histogram, box plot and dot plot. This will help them delineate among the three by using a visual representation, a definition (in their own words), and associating the graphical representation with a personal characteristic and visual that they can relate to. *It is important that the teacher allow students time to complete the VVWA after modeling each graphical display. Students complete the parts of the VVWA using their own words and understanding, not by copying the words provided by the teacher.*

A Verbal and Visual Word Association (VVWA) is arranged in a large square, separated into four boxes:

Vocab Word	Visual Representation
Definition	Personal Association Or Characteristic

## Explain

- Once students have been exposed to the three types of graphical displays, groups of 2-3 students should now choose statistical questions from the class list earlier and create graphical displays. (If they choose, they may create a new statistical question that is not on the list. Reiterate that it must be a statistical question!)
- As a group, they will need to decide which of the displays would best be used to answer each statistical question they have chosen to collect data. Students should determine that different types of data displays provide different information and that the type of display used should be determined by the questions one hopes to answer with the data. They should also recognize the connections between the three types of displays and the similarities between data displayed in box plots, dot plots and histograms. Students may refer to their VVWA to assist with creating their graphical displays.
- Students post data and graphical representations for others to see, including a brief description of why the graphical representation was chosen for that particular data.
- Take the class on a **Gallery Walk** to view all representations. Have each group look for: was a statistical question answered? Was a correct graphical representation chosen? And was it properly displayed?
- Engage the whole class in dialogue afterwards to check for understanding of statistical questions and representing data correctly (choosing the right graphical representation).
- Revisit the **Anticipation Guide**. Instruct students to complete the “after” side. If their thinking changed from “before” have them right a note about how their thinking changed. What is it that they now know?

## Extend

- Connect data analysis with content outside mathematics – science and social studies guide students to the understanding that data analysis is a process that helps make sense of a situation. Opportunities will naturally arise in all subject areas. Use these opportunities to allow students to collect data related to what they are studying and represent the data in appropriate graphs.
- Try this NCTM lesson – “There is a Difference: Bar Graphs vs. Histograms” Lesson Plan using data about Presidents to explore the differences between bar graphs and histograms. <http://illuminations.nctm.org/LessonDetail.aspx?id=L812>

### Teacher Reflections and Biographical Information

Students use histograms as bar graphs in general. In fact they are special bar graphs where bars are used to display numerical data that have been organized into equal intervals. The entire range is covered in the interval with no overlapping. This is why a student is told not to put spaces between the bars unless the data represents zero. Some students may question the width of their bars when they make the histogram. Students need to understand that the width needs to be the same for all bars since the bars represent the same interval length. Some students have trouble with the height of the bars and the vertical scale for the bars. It is a good point for students to look at the data that they have grouped together prior to graphing to see what would be the largest value overall. They could then use this to set their scale prior to actually graphing the bars. Technology may be used to help students focus on the graph and its message. Graphing calculators produce histograms without much difficulty. They allow for the size of the interval to be specified and easily changed.

Lesson Author: Susie Teague, Education Specialist, S<sup>2</sup>TEM Centers SC

## “Data about Us” Anticipation Guide

Name \_\_\_\_\_ Date \_\_\_\_\_

Directions: Read each statement. If you believe the statement is true, put a check in the **AGREE** column on the “Before”. If you believe it is false, check the **DISAGREE** column. Turn to your partner and share your beliefs. Then, pay close attention to what you learn through the lesson “Data About Us”. We will complete the “After” column after today’s lesson.

Before		Statement	After	
Agree	Disagree		Agree	Disagree
_____	_____	1. A box plot displays the median of a set of data.	_____	_____
_____	_____	2. A dot plot is displayed on a number line beginning at 0.	_____	_____
_____	_____	3. A statistical question is “How Old Am I?”	_____	_____
_____	_____	4. Histograms are special bar graphs where the bars are at equal intervals.	_____	_____
_____	_____	5. Box plots show the range of a set of data.	_____	_____

How has your learning changed between “before” and “after”? Which ones changed? Why did they change? Talk about each number that changed and why in the space below.