

The Dog Days of Data

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Grade Level: 5-8

Time Allotment: two 45-minute class periods or one 90-minute block

Overview: This lesson is designed to be used as either an introductory or review on organizing data using stem and leaf plots. The purpose of this lesson is to show students an alternative form of data presentation and may follow other lessons on statistics such as histograms, scatterplots, etc. Students should have a general understanding of data, place value, and measures of central tendency (mean, median, mode, range). Students will get practice in sequencing data, identifying the stem-and-leaf, creating stem-and-leaf plots, and drawing inferences from the data by viewing the plots.

Subject Matter: Mathematics, Statistics

Learning Objectives:

The students will be able to:

- sequentially organize data
- organize and display data sets in a stem and leaf plot
- read and draw conclusions about data sets
- identify trends in data by reading a stem and leaf plot

Standards:

This lesson addresses the Virginia SOL's which can be found at:

<http://www.pen.k12.va.us/VDOE/Superintendent/Sols/home.shtml>

- 5.18 The student will, given a problem situation, collect, organize, and display a set of numerical data in a variety of forms, using bar graphs, stem-and-leaf plots, and line graphs, to draw conclusions and make predictions.
- 6.18 The student, given a problem situation, will collect, analyze, display, and interpret data in a variety of graphical methods, including
- a) line, bar, and circle graphs;
 - b) stem-and-leaf plots; and
 - c) box-and-whisker plots.
- Circle graphs will be limited to halves, fourths, and eighths.
- 7.17 The student, given a problem situation, will collect, analyze, display, and interpret data, using a variety of graphical methods, including
- a) frequency distributions;
 - b) line plots;
 - c) histograms;

- d) stem-and-leaf plots;
- e) box-and-whisker plots; and
- f) scattergrams

7.18 The student will make inferences, conjectures, and predictions based on analysis of a set of data.

8.13 The student will use a matrix to organize and describe data.

Media Components:

Video:

Discovering Math: Statistics and Data Analysis (Grades 6-8): “Example 1: Stem-and-Leaf Plots – Dog Weights”

This video can be obtained from United Streaming: www.unitedstreaming.com

Website:

http://www.wisc-online.com/objects/index_tj.asp?objid=TMH1101

Materials:

Students:

- Paper and pencil
- **Optional but highly preferable:** Personal Response System (PRS)
- Optional: Computer with internet access

Teachers:

- Dog data (see list of numbers found in Introductory Activity)
- Video listed above
- PRS software and receiver
- Computer with internet access and display capabilities

Prep for Teachers:

Introductory Activity:

- Provide students with data set, either on a display board, computer screen or individual printouts.

Learning Activity:

- Preview video several times and rehearse pause and stop points.

Culminating Activity:

- Bookmark website on student computers (optional) and teacher computer.
- Prepare PRS software with student transmitter numbers, class roster and survey questions.
- Connect instructor’s computer to a display device for presentation.

Introductory Activity:

Step 1: Provide students with the following set of data.

70, 68, 26, 7, 13, 26, 5, 85, 65, 33

This is what's referred to as "Dog Data" in the preparation list. At this point, do not title this data and don't tell the students what the data represents.

Say "This is a *data* set. Can anyone tell me what I mean by using the word *data*?" Allow students to provide answers. (Answers may include: a set of numbers, numbers that mean something about people, information about things, a collection of facts about things or people)

Step 2: Say "I need for you to look at the data written on the board. I would like for you to figure out a way to organize this data so it makes sense to you. Also, try to determine what the data mean and what it could possibly represent. When you are finished, I'm going to ask you to explain the data and tell us what you think is represented, so be prepared to share your answers."

Allows students time to work individually or in pairs. Have several students share their answers and discuss responses. [Students may organize in several different ways. Some examples may include putting in sequential order, making a histogram or line plot (if this is a previous skill), etc. Students may draw many different conclusions about the data and could respond with thoughts such as: the number that appears the most, most numbers are high, the lowest number is far from the highest number, etc. They may also have many different explanations for what the data represents. Allow all answers from students and encourage them to explain their choices.] After students make their guess about what the data represents, tell them it represents weights of different breeds of dogs.

Learning Activity:

Step 1: Say "Now we're going to watch a very short video clip. You'll be presented with some data that may look familiar and will answer some of our questions." **Provide a Focus for Media Interaction** by saying, "In this first clip, I want you to pay attention to when the narrator presents what's called a stem-and-leaf plot. Be able to describe for what purpose he mentions this type of plot?" **Play** the video until the counter reaches 0:00:47 and **Pause** when the narrator says "...represent the variation within a data set while maintaining the detailed data itself".

Ask: "What type of issue did the narrator introduce?" (There are a lot of different dog breeds and it's hard to compare them.)

Ask: "What solution to this problem did the narrator suggest?" (Place the data in a stem-and-leaf plot.)

Ask: "What does a stem-and-leaf plot allow us to do?" (Allows us to represent all the variation within a data set while retaining the detail of the data itself) This question may allow for some brief discussion about measures of central tendency and how they don't allow us to see all of the data rather just a summary of the data. Students

who are familiar with histograms may also comment on not being able to view every data value in this type of graph. Questions and comments may vary.

Step 2: Say, “In this next clip, the narrator will describe the data we are looking at.” **Provide a Focus for Media Interaction** by saying, “I want you to pay attention to his description of the data. At the end of the clip, be able to tell us what the data represent.” **Play** the video until the counter reaches 0:00:53 and **Pause** when the narrator says “...top ten dog breeds as an example”.

Ask: “What does the data represent?” (the average or typical weights of several different dog breeds.) If students did not respond with the word *average*, **ask** “What special term did the narrator use to describe the data?” (Average; if students miss this, rewind the video to 0:00:45 and replay the clip.)

Ask: “What does the word *mean* describe?” (The average weight for each of the dog breeds.) Make sure students understand exactly what the data represent. If they are still unsure, **rewind** the video to repeat the narrator description. Conduct a brief class discussion or review on *mean* if necessary.

Step 3: Say “The next clip will give us a little more information about stem-and-leaf plots. The narrator will tell us exactly what the plot shows.” **Provide a Focus for Media Interaction** by saying, “After this next brief clip, I want you to be able to tell what kind of data a stem-and-leaf plot shows. More specifically, how is the data represented?” **Play** the video until the counter reaches 0:00:59 and **pause** when the narrator says “...in an organized chart”.

Ask: “What does a stem-and-leaf plot show us?” (Numerical data in an organized chart.)

At this point, you may want to ask the students why it would be important to organize the data. Allow for some very brief discussion of this topic.

Step 4: Say “In the next clip we are watching, the narrator will tell us what the stem and leaf represent.” **Provide a Focus for Media Interaction** by saying, “I need you to pay attention to his brief description. Following the clip, be able to tell what the stem and leaf both represent.” **Play** the video until the counter reaches 0:01:22 and **pause** when the narrator says “...the beagle averages out at 26 pounds”.

Ask: “What does the stem represent?” (The tens place)

Ask: “What does the leaf represent?” (The ones place)

Ask: “He mentioned the beagle weighs 26 pounds. How would you place this number on a stem-and-leaf plot?” (The 2 would go in the stem and the 6 would go in the leaf)

At this point, place the completed stem-and-leaf plot on the board for all students to see.

Ask: “What do you notice about the numbers in the plot?” (Accept several answers, but probe for the numbers being placed in order.)

Ask: “Notice there is a 0 in the stem column. What does this represent?” (0 means there is no tens place and would be used for one-digit numbers.)

Ask: “If you had the number 105, how would you place this on the plot?” (The 10 would go in the stem column and 5 would go in the leaf column.)

Say: “It’s very important that we keep all numbers in a data set on the stem-and-leaf plot and to make sure they are in order. If we do this, it will help us to easily make some conclusions about the data, as you’ll see soon.”

Step 5: Say “We will continue to watch the remainder of the video. The narrator will place the other dog weight values on the chart. Watch for the pink values to highlight as he mentions each dog.” **Provide a Focus for Media Interaction** by saying, “Toward the end of the video the narrator will begin making some statements about the data. I need you to pay attention to what he says and be able to mention at least one conclusion about the data.” **Play** the video until the counter reaches 0:02:09 and **stop** (this is the end of the video clip).

Ask: “What is one statement the narrator made about the data?” (The number of dog breeds under 10 pounds, the number of dog breeds over 70 pounds, lots of data in the middle, etc.)

Ask: “What do stem-and-leaf plots do with our data?” (Keeps them all intact and organized.)

Ask: “If we wanted to show all of the numbers in our data set, would stem-and-leaf plot be a good way to do this? Why?” (Yes, because it shows every number in our data set without eliminating values.)

Say: “It’s easy to see how stem-and-leaf plots are used with one and two-digit numbers, but let’s see how we can use this with other numbers.”

Ask: “What other numbers might we need to use?” (Three-digit and above, decimals, etc.).

Say: “Let’s see an example and collect some data!”

Culminating Activity:

Step 1: Say “We are going to go to a website that shows us how to create a stem-and-leaf plot. It will lead us through the most important steps for creating a plot and practice making some conclusions. After the demonstration, you will create your own plots and make your own conclusions.”

Step 2: Take students to the website.

http://www.wisc-online.com/objects/index_tj.asp?objid=TMH1101

It is optional to work as a class or have students work individually. The website will lead students through the steps such as putting the data in order, creating the stem and inserting the leaf. Following the web activity, ask students the following questions.

Write responses where the entire class can see them clearly.

- What is the purpose of a stem-and-leaf plot? (A quick way to organize data)
- What is the first step to creating a stem-and-leaf plot? (Identify the stems and list them vertically from least to greatest)
- What is the next step in creating the plot? (Place leaves in their corresponding row)
- After the leaves are placed, what is next? (Place leaves in order from least to greatest)

- What conclusions can you make about the data? (Allow them to reenact the introductory activity where they make statements about what the data could represent and what they can conclude from the numbers.)

Since the website introduces decimals to use in the stem-and-leaf plot, it may be necessary to conduct a class discussion on types of numbers to be used in the plot and how to identify the stem and leaf.

Step 3: Say “Let’s collect some of our own data.”

Note: This activity could easily be done with or without a PRS. To complete this activity without a PRS, simply follow the instructions on each step labeled “Without using the Personal Response System”.

Using the Personal Response System (PRS), students will contribute data to be transferred to stem-and-leaf plots. Launch the PRS program and begin with the first question. Students will respond using their transmitters. Depending on the system you use, locate the function where all data can be displayed at the same time so students are able to see all of the data at once.

Without using the Personal Response System, students will contribute data to be transferred to stem-and-leaf plots by taking polls or surveys on the board, individually at their seats, by walking around the room, etc.

Say “Now that we know what a stem-and-leaf plot is and what it looks like, we will collect some data as a class using our PRS. Let’s look at the first question. Using your clicker, submit your answer.” Allow students to give answers.

Continue collecting data with the remaining questions. Questions may vary, but could include the following:

- On what day of the month were you born (1-31)?
- What grade did you receive on the last test?
- What size shoe do you wear?
- How many books have you read in the last year?
- How many hours do you spend on the Internet each week?

If you create your own questions, responses should vary by decimal or by factors of ten or more. For example, it would not be beneficial to ask the students their age because most students would be the same age, which wouldn’t result in a helpful plot.

Step 4: Say “Now that we have some data, let’s make some plots of our own. Using the data from the first question, work with a partner to create a stem-and-leaf plot. After you make your graph, make two conclusion statements based on what you see in the graph.” Allow students time to work together to graph the first set of data. After a few minutes, ask groups to share their statements and conclusions based on the plot.

Step 5: Say “Let’s do a few more. I will display the data from the next question. This time, work on your own to create a graph and make two conclusion statements.” Allow students time to work on their own. Ask several students to create their graphs on the board or overhead. Discuss responses and conclusions as a class.

Continue making plots based on the class data. For some extension, give students an example with decimals or higher values (such as in the hundreds). For assessment, collect student plots and conclusion statements. Assessment will depend on accuracy of graphs and conclusion statements.

Cross-curricular Extensions:

Language Arts: Students can use the data found in stem-and-leaf plots to verbally describe the trends they notice. Based on their conclusions, have students engage in a creative writing activity to create a story about what they see in the data.

Health/Physical Education: Have students gather data on nutritional habits, weights, heights, etc. of classmates. They can organize the data using a stem-and-leaf plot and draw conclusions and make comparisons among all sets of data. For example, look at a correlation between how much sugar is taken in and the weight/height of students.

Students can gather data on physical activities, such as mile run times, and organize them using plots to draw conclusions about classmates.

Science: Through conducting experiments, students can gather data, organize and present data and conclusions using a stem-and-leaf plot. They may also transfer their data to other types of familiar graphs, such as scatterplots, bar graphs, etc. Data may be obtained from any experiment. An example may be measuring the distance of flying a paper airplane – each student creates and flies their own plane and data is gathered from all students.

Civics: In looking at topics such as populations, census data, etc., students can organize and display data to learn more about the make up of the country and how it may relate to things such a voting, taxes, etc.

Community Connections:

- Invite a member of the Census Bureau to present and discuss statistics of the national and/or local census. They could describe the data through using a stem-and-leaf plot and discuss the importance of this type of data display.
- Visit a local police station or invite officers to present statistics regarding local crimes involving a stem-and-leaf plot. Have them discuss the data and identify important perspectives.