

# MEAN, MEDIAN, MODE, AND RANGE by Debbie Mauk

## OVERVIEW

Students will be able to determine the mean, median, mode, and range of a set of data.

## BENCHMARKS

3 - 4<sup>th</sup> Grade

Data Analysis and Probability

- A. Gather and organize data from surveys and classroom experiments, including data collected over a period of time.
- E. Describe data using mode, median and range.

5 - 7<sup>th</sup> Grade

Data Analysis and Probability

- A. Read, create and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate.
- B. Interpret data by looking for patterns and relationships, draw and justify conclusions, and answer related questions.
- E. Collect, organize, display and interpret data for a specific purpose or need.
- F. Determine and use the range, mean, median and mode to analyze and compare data, and explain what each indicates.

8 - 10<sup>th</sup> Grade

Data Analysis and Probability

- A.. Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.
  - C. Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data.
1. Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.

## Vocabulary

mean, median, mode, range

## Materials

ruler, paper, pencil, calculator

## Procedure

1. I'm going to give you a word recall test. I will read 20 words, then I'll say, "OK, now write down the words". We will see how many you can get right. I will tell you ahead of time, that the typical 80 year old, gets 4 right. Can you guess how many the typical 20 year old

gets right? The answer is 7. Memory worsens with age. So let's see if you can match or beat the typical 20-year old.

2. Put pencils down and just listen only. Read the list slowly and loudly. 1. guitar 2. piano 3. clipper 4. boat 5. soap 6. potato 7. rice 8. roster 9. couch 10. purse 11. tree 12. daisy 13. soil 14. highway 15. rug 16. basketball 17. bush 18. club 19. lake 20. country
3. Now tell the class to write down every word they can remember. After a few minutes, instruct them to count how many words they got.
4. Ask each student for the number of words they got right and put it on the board in a vertical column. Students are curious as to which words they missed so be sure to read the entire list again slowly. Be sure to remind them that a typical 20 year old only gets 7 right.
5. Now we are going to do the same thing but with a twist. I'm going to read another list of 20 different words, but this time I'm going to show you the object as I say it, so you will have a visual picture of the object. Also, the object may be in a weird place somewhere out of the ordinary. After I have finished the list, I will again ask you to write down all the words you can remember.
6. 1. baby 2. glasses 3. crayon 4. calculator 5. bag 6. worm 7. turtle 8. pony 9. tape 10. apple 11. q-tip 12. tissue 13. pencil 14. fork 15. paper wad 16. dollar 17. hat 18. twinkie 19. hair 20. feather Now write them down.
7. Again, ask each student for the number of words they got right and put it on the board in a vertical column.
8. Ask the students to prepare a paper for you with the information on it that you are putting on the board. Their paper should look something like this:

word recall	word recall with objects
Jessica      6	13
Aaron        3	11
Sarah        7	18
Chris        5	16
Seth         6	11
mean	mean
median	median
mode	mode
range	range

9. Ask students to find the mean, median, mode, and range of the data for each column. You can now discuss individual scores and compare them to the average. Remind them that the average score for a typical 20 year old is 7 (without the benefit of seeing the object) and that for an 80 year old it is 4.

10. In the book CAN'T REMEMBER WHAT I FORGOT, Sue Halpern did this study with brain-injured patients that had their memory somewhat compromised. In the first word recall, the patients did horribly. When she retested them showing them the objects, 16 out of 20 patients remembered all 20 words!!

11. Discuss how this is evidence that doing a math activity with manipulatives can increase

learning greatly. It is comparable to giving a 3-D object to connect with a concept just as in the word recall test.

12. If you were trying to convince a group of math teachers that using manipulatives increases learning greatly, what kind of graph would you use to organize this data? Would you use a line graph, bar graph, or circle graph? Construct a bar graph on the board to demonstrate how this is impressive. Discuss how to determine what numbers go on this graph.

13. You can now continue this activity by creating a box and whisker plot for both sets of data and comparing them. Discuss how statisticians use graphs like this to apply meaning to sets of data. Since my students will be getting their driving permits in a few years, I discuss how statisticians have determined through data analysis that teenage boys are the highest risks. This is how insurance companies justify charging higher rates for teenage boys. Government statisticians make about \$85,000 a year.

#### 14. HOW TO CONSTRUCT A BOX-AND-WHISKER PLOT STEP BY STEP INSTRUCTIONS

##### STEPS:

- 1) Arrange data in order from least to greatest.
- 2) Draw a line with divisions that count by 2's, 5's, 10's, 20's, etc. whatever is appropriate.
- 3) You will make 5 dots:
  - one at the median
  - one at the upper quartile (the median of the upper half)
  - one at the lower quartile (the median of the lower half)
  - one at the greatest number
  - one at the lowest number
- 4) Draw a box around the 3 middle dots.
- 5) Draw whiskers from the box to each end dot.
- 6) Determine the outliers, if any.

##### HOW TO DETERMINE THE OUTLIERS

- Step 1: Determine the interquartile range (subtract the lower quartile from the upper quartile)
- Step 2: Multiply that by 1.5.
- Step 3: Add that number to the upper quartile. Any number greater than this number is considered an outlier (an extreme).
- Step 4: Subtract the number that you got when you multiplied by 1.5 from the lower quartile. Any number less than this number is considered an outlier.

If you have outliers, the whisker cannot be connected to them! Erase the whisker back until the end of the whisker lies at the next data back from the outlier.