

DELTA MATH SCIENCE PARTNERSHIP INITIATIVE

M³ Summer Institutes

(Math, Middle School, MS Common Core)

Mean, Median, and Mode

Hook Problem: To compare two shipments, five packages from each shipment were chosen at random and weighed. Which measure or measures of center would be best to use if you wanted to compare the weight of a typical package from each shipment?

Weights of packages (in pounds):

1 st shipment	2, 4, 6, 8, 10
2 nd shipment	3, 3, 5, 8, 50

- a. Median would be the best measure of center
- b. Mean would be the best measure of center
- c. Median and mean would both be equally good measures of center
- d. Neither the mean nor the median would be a good measure of center

M&M Math

Refer to handouts.

The Parade

Group	# of People Riding on Float	# of Animals Participating	Approx. Weight of Float (tons)	Throwing Candy?
4-H	8	24	1.5	yes
Larson's Drug	4	0	1.75	yes
ABC Day Care	12	2	1.5	yes
Central High Marching Band	6 (56 marching)	2	2.25	no
Bob's Feed and Grain	8	2	3	yes
Girl Scouts	24	4	1.5	yes
Boy Scouts	18	0	1.5	yes
Central Farm Co-op	6	2	2.25	yes
Acme Hardware	4	1	2	no

1. Helen wants to arrange the floats so that the smallest floats are at the front and the largest are at the back. Assume that the weight of the float and the number of people riding indicates its relative size. How would you order the floats?
2. The judges ask Helen to tell them the average number of animals participating. She thinks they really want to know the most common number of animals on the floats. Calculate the average; then calculate the mode. Then write a sentence telling why Helen thinks the mode will be more useful than the mean.
3. The parade committee has to pay a special tax to the city if the average weight of the floats is over 2 tons. Will they have to pay the tax this year?
4. What is the range for the number of people riding on the floats? (Do not include the 56 members of the marching band; only include the 6 members of the homecoming court riding with them.)

Mnemonic Poem

Hey diddle diddle,
The median's the middle;
You add and divide for the mean.
The mode is the one that appears the most,
and the range is the difference between.

Drop-off Problem:

Many middle-grades students are interested in roller coasters – often, the scarier the better. This activity deals with the maximum drop of fifty-five roller coasters in the United States. For this activity, students must be able to read the information in a histogram.

Refer to handouts.

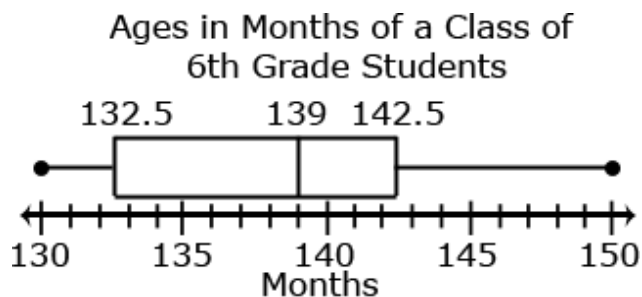
Navigating through Data Analysis

- Ms. Hancock asked each student in her class to write their age in months on a sticky note. The 28 students in the class brought their sticky note to the front of the room and posted them in order on the white board. The data set is listed below in order from least to greatest. Create a data display. What are some observations that can be made from the data display?

130	130	131	131	132	132	132	133	134	136
137	137	138	139	139	139	140	141	142	142
142	143	143	144	145	147	149	150		

Quartile 3 (Q3) – $(142+143) \div 2 = 142.5$ months

Maximum – 150 months



Five number summary

Minimum – 130 months

Quartile 1 (Q1) – $(132 + 133) \div 2 = 132.5$ months

Median (Q2) – 139 months

This box plot shows that

- 1/4 of the students in the class are from 130 to 132.5 months old
- 1/4 of the students in the class are from 142.5 months to 150 months old
- 1/2 of the class are from 132.5 to 142.5 months old
- the median class age is 139 months.

Stopping Distance

What are some things that car buyers consider as they make their choices of model?
Consider this for a moment.

What are some of the aspects of safety that a buyer might be concerned about?

Refer to handout after answering these questions.

Instructional Strategies: This cluster builds on the understandings developed in the Grade 6 cluster “Develop understanding of statistical variability.” Students have analyzed data displayed in various ways to see how data can be described in terms of variability. Additionally, in Grades 3-5 students have created scaled picture and bar graphs, as well as line plots. Now students learn to organize data in appropriate representations such as box plots (box-and-whisker plots), dot plots, and stem-and-leaf plots. Students need to display the same data using different representations. By comparing the different graphs of the same data, students develop understanding of the benefits of each type of representation. Further interpretation of the variability comes from the range and center-of-measure numbers. Prior to learning the computation procedures for finding mean and median, students will benefit from concrete experiences. To find the median visually and

kinesthetically, students should reorder the data in ascending or descending order, then place a finger on each end of the data and continue to move toward the center by the same increments until the fingers touch. This number is the median.

The concept of mean (concept of fair shares or “evening out”) can be demonstrated visually and kinesthetically by using stacks of linking cubes. The blocks are redistributed among the towers so that all towers have the same number of blocks. Students should not only determine the range and centers of measure, but also use these numbers to describe the variation of the data collected from the statistical question asked. The data should be described in terms of its shape, center, spread (range) and interquartile range or mean absolute deviation (the absolute value of each data point from the mean of the data set). Providing activities that require students to sketch a representation based upon given measures of center and spread and a context will help create connections between the measures and real-life situations.

Using graphing calculators to explore box plots (box-and-whisker plots) removes the time intensity from their creation and permits more time to be spent on the meaning. It is important to use the interquartile range in box plots when describing the variation of the data. The mean absolute deviation describes the distance each point is from the mean of that data set. Patterns in the graphical displays should be observed, as should any outliers in the data set.

Students should identify the attributes of the data and know the appropriate use of the attributes when describing the data. Pairing contextual situations with data and its box-and-whisker plot is essential.

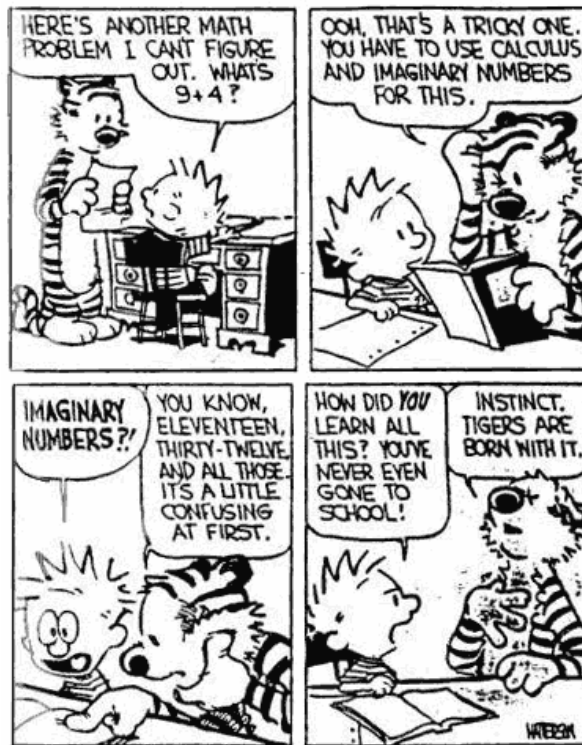
Continue to have students connect contextual situations to data to describe the data set in words prior to computation. Therefore, determining the measures of spread and measures of center mathematically need to follow the development of the conceptual understanding.

Students should experience data which reveals both different and identical values for each of the measures. Students need opportunities to explore how changing a part of the data may change the measures of center and measure of spread. Also, by discussing their findings, students will solidify understanding of the meanings of the measures of center and measures of variability, what each of the measures do and do not tell about a set of data, all leading to a better understanding of their usage.

Common Misconceptions:

Students often use words to help them recall how to determine the measures of center. However, student’s lack of understanding of what the measures of center actually represent tends to confuse them. Median is the number in the middle, but that middle number can only be determined after the data entries are arranged in ascending or descending order. Mode is remembered as the “most,” and often students think this means the largest value, not the “most frequent” entry in the set. Vocabulary is important in mathematics, but conceptual understanding

is equally as important. Usually the mean, mode, or median have different values, but sometimes those values are the same.



Homework

6. Carl had scores of 90, 95, 85, and 90 on his first four tests.
 - a. Find the median, mean, and mode.

 - b. Carl scored a 20 on his fifth exam. Which of the three averages would Carl want the instructor to use to compute his grade? Why?

 - c. Which measure is affected most by an extreme score? Which is least affected?

7. Sue drives 5 miles at 30 mph and then 5 miles at 50 mph. Is the mean speed for the trip 40 mph? Why or why not?

8. If 99 people had a mean income of \$12,000, how much is the mean income increased by the addition of a single income of \$200,000?

9. Maria filled her car's gas tank. The mileage odometer read 42,800 miles. When the odometer read 43,040, Maria filled the tank with 12 gallons. At the end of the trip, she filled the tank with 18 gallons and the odometer read 43,390 miles. How many miles per gallon did she get for the entire trip?

CALVIN AND HOBBS By Bill Watterson

