Measures of Center: Mean

Below is the data on the number of people in a household for six students. You can see from the data that the six households vary in size.

|  |  |
| --- | --- |
| Student Name | Number of People  in Household |
| Ossie | 2 |
| Leon | 3 |
| Gary | 3 |
| Ruth | 4 |
| Paul | 6 |
| Arlene | 6 |

# Thinking About the Situation

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

Use cubes to make stacks representing each household. Use the stacks to answer the following questions.

What is the median of these data? 3.5

Make the stacks all the same height by moving the cubes. How many cubes are in each stack? 4

By leveling out the stacks to make them equal height, you have found the average, or mean, number of people in a household. What is the mean number of people per household? 4

# Investigation 1: Finding the Mean

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

Another group of students made the table below.

|  |  |
| --- | --- |
| Student Name | Number of People  in Household |
| Reggie | 6 |
| Tara | 4 |
| Brendan | 3 |
| Felix | 4 |
| Hector | 3 |
| Tonisha | 4 |

1. Make stacks of cubes to show the size of each household.
2. How many people are in the six households altogether? Explain. 24, answers may vary, but you would add the number of people in each household.
3. What is the mean number of people per household for this group? Explain how you got that number. 4, by leveling out the stacks, each stack would contain 4 cubes.
4. How does the mean for this group compare to the mean of the first group? It is the same.
5. What are some ways to determine the mean number of a set of data other than using cubes? How do these methods relate to the method of using the cubes? Students may mention the formula. Other ways are to think about the mean as a balance point or as a fair share. (see following slides on mean as fair share and mean as balance point)

# Thinking About the Situation

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

The dotplots below show two different distributions for number of people in a household with the same mean of 4 people per household.

**Number of People in a Household**

**Group A Group B**

1 2 3 4 5 6 7

mean

1 2 3 4 5 6 7

mean

How many households are there in each group? 6

What is the total number of people in each group? 24; 24

How do these facts relate to the mean in each case? The number of people divided by the number of households tells us the number of people per household, which is the mean.

# Investigation 2: Data with the Same Mean

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

1. Find two new data sets for six households that each have a mean of 4 people per household. Use cubes to show each data set. Then make dotplots from the cubes. . All should have 24 total people and for each dot plot, 4 is the “balance point.” If it doesn’t come up, show a dot plot where all values are 4 and another where 3 values are 2 and 3 values are 6.
2. Find two different data sets for **seven** households that each has a mean of 4 people per household. Use cubes to show each data set. Then make dotplots from the cubes. Same as above. All should have 28 total people.
3. A group of seven students find that they have a mean of 3 people per household. Find a data set that fits this description. Then make a dot plot for this data. There should be 21 total people represented.
4. A group of six students has a mean of 3.5 people per household. Find a data set that fits this description. Then make a dot plot for this data. There should be 21 total people.
5. How can the mean be 3 ½ people when “half” a person does not exist? Since we are dividing, its possible to get a value that is not a part of the data set. When we interpret, we need to take the context of the data into account. In this case ½ a person doesn’t make sense, but when we interpret this value, it tells us that the typical household for this group has 3-4 people in it.
6. How can you predict when the mean number of people per household will not be a a whole number? When the number of households is not a factor of the number of total people, it will not divide evenly to give us a whole number.

# Investigation 3: Using the Mean

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

A group of students answered the question “How many movies did you watch last month?” The table and histogram below show their data.

|  |  |
| --- | --- |
| Student | Number |
| Rachel | 3 |
| Min | 3 |
| James | 5 |
| Kara | 6 |
| Omar | 6 |
| Jamal | 7 |
| Jessica | 11 |
| Colton | 15 |
| Mary | 16 |
| Jerome | 18 |

1. Find the following:
   1. the total number of students 10
   2. the total number of movies watched 90
   3. the mean number of movies watched 9 movies per student
2. A new value is added for Carlos, who was home last month with a broken leg. He watched 31 movies.
   1. How does the new value change the distribution on the histogram? (Make the histogram in your calculator.) There would be an additional bar between 30 and 35 with a frequency of 1. This would make the distribution appear to be skewed to the right.
   2. Is this new value an outlier? Explain. Yes, there is a large gap between 31 and the rest of the data.
   3. What is the mean of the data now? 121/11 = 11 movies per student
   4. Compare the mean from question 1 to the new mean. What do you notice? Explain. It is higher than the previous mean by 2.
   5. Does this mean accurately describe the data? Explain. Take students opinions on this. Some may say yes, some no. Note during the class discussion that 5 of the 11 students have watched 11 movies or more. If time: let’s look at the median number of movies. What is the median number of movies watched both before Carlos is added (6.5) and after Carlos is added (7)? Which value seems to describe the data better in each case – the mean or the median? This discussion lays the groundwork for the next part of the lesson on mean vs. median.
3. Data for eight more students is added.

|  |  |
| --- | --- |
| Student | Number |
| Tommy | 3 |
| Alexandra | 5 |
| Trevor | 5 |
| Kirsten | 4 |
| Robbie | 4 |
| Ana | 4 |
| Alicia | 2 |
| Brian | 2 |

* 1. Add these values to the list in your calculator. How do these values change the distribution on the histogram? The distribution is more clustered to the left,

so it now appears skewed right.

* 1. Are any of these new values outliers? The new values are

not outliers – they all fall in the bottom cluster.

* 1. What is the mean of the data now? The mean is 7.9, or

approximately 8, movies per student.

# Investigation 4: Mean vs. Median

**Discuss the following with your partner or group. Write your answers on your own paper. Be prepared to share your answers with the class.**

The heights of Washington High School’s basketball players are: 5 ft 9in, 5 ft 4in, 5 ft 7 in, 5ft 6 in, 5 ft 5 in, 5 ft 3 in, and 5 ft 7 in. A student transfers to Washington High and joins the basketball team. Her height is 6 ft 10in.

1. What is the mean height of the team before the new player transfers in? What is the median height? 65.9; 66
2. What is the mean height after the new player transfers? What is the median height? 67.9; 66.5
3. What effect does her height have on the team’s height distribution and stats (center and spread)? The mean increased by 2 in. and the median increased by .5 in.
4. How many players are taller than the new mean team height? 2 How many players are taller than the new median team height? 4
5. Which measure of center more accurately describes the team’s typical height? Explain. The median gives a more accurate description of the team’s typical height. Half of the players are taller than the median (and half shorter) but only two players are taller than the mean. Using the mean would lead someone to conclude that the team is taller than they really are.