EXPLORATIONS

Activity 2

Measures of Central Tendency

Teacher Notes

Concepts

- Median
- Mode
- Mean

Calculator Skills

- Statistics mode: 2nd [STAT], DATA, STATVAR
- Frequency

Materials

- TI-30X IIS
- Student Activity pages (p. 18-20)

Objective

- Students will learn to make sense of data by using the three measures of central tendency mean, median, and mode. They will use the calculator to find the mean of a set of data.

Topics Covered

- Modeling mathematics in real-world problem situations
- Relating procedures in equivalent representations in different contexts
- Understanding and applying the measures of central tendency

Introduction

One of the characteristics of young adolescents is their ability to consume fast foods—particularly burgers. If you eat a hamburger, you consume more than just bun, beef, and trimmings. While enjoying the delicious taste of a hamburger, generous amounts of fat, calories, and cholesterol are being consumed as well. What is the "typical" amount of cholesterol in a burger?

Investigation

The cholesterol levels (in mg) are given for 11 different fast food burgers: 65, 50, 55, 60, 80, 50, 65, 60, 60, 90, and 99.

A quick scan of the data suggests that the amounts of cholesterol vary somewhat in the different burgers. When asked to find a "typical" amount of cholesterol in a burger, you could use the three measures of central tendency: median, mode, and mean.

1. Find the median. Arrange the numbers in order from lowest to highest, and find the number in the middle of the set.

   50, 50, 55, 60, 60, 60, 65, 65, 80, 90, and 99

   The median, or middle, value is 60 mg.

2. Find the Mode. The number that appears the most is the mode. Therefore, the mode is 60 mg.

3. Find the Mean. The average of the data is the mean. The mean is calculated as the sum of all the data elements divided by the number of elements. That is, 734 ÷ 11 = 66.73 mg.

4. Use the overhead calculator and have the students use the TI-30X IIS to calculate the mean two ways.

5. First, simply enter the data as follows:

Press:	The calculator shows:
50 [+] 50 [+] 55 [+] 60 [+] 60 [+] 60 [+] 65 [+] 65 [+] 80 [+] 90 [+] 99 [ENTER]	50 + 50 + 55 + 60 → 734 DEG
[÷] 11 [ENTER]	Ans/11 66.72727273 DEG

   (This rounds to 66.73 mg.)

6. The second way to calculate the mean is particularly useful when you want to enter the data in memory for editing purposes.

Press:	The calculator shows:
2nd [STAT]	1-VAR 2-VAR→ DEG
ENTER	(to select 1-VAR) STAT DEG
DATA	X_1 = STAT DEG
50 ⊙	FRQ = 1 STAT DEG
2 ⊙	X_2= STAT DEG
55 ⊙	FRQ = 1 STAT DEG
⊙	X_3= STAT DEG
Continue this procedure until all data elements and their frequencies are entered.	X_8= STAT DEG
STATVAR	n $\bar{x}$ Sx σx 11. STAT DEG (n = 11 since you entered 11 cholesterol data elements)
⊙	n $\bar{x}$ Sx σx 66.72727273. STAT DEG (The mean is 66.72727273 as calculated in step 5.)
⊙ ⊙ ⊙	Σx Σx^2 734. STAT DEG (The sum of the x-values - the 11 data elements - is 734.)

7. Clear the data from the calculator so that you are ready to enter a new set of data.

Press:	The calculator shows:
2nd [STAT]	1-VAR 2-VAR→ DEG
▶ ▶	CLRDATA STAT DEG
ENTER	STAT DEG (The data elements and frequencies have been cleared.)

8. Be sure to exit from STAT mode when you complete this activity.

Press:	The calculator shows:
2nd [EXIT STAT]	EXIT ST: Y N→ STAT DEG
ENTER	DEG (STAT is no longer displayed on the screen.)

Wrap-Up

Other statistical features of the TI-30X IIS will be explored in Student Activities 13, 14, and 15.

Have the students continue this activity by completing the Student Activity pages. You may want to have students work in small groups as they complete the activity pages. Be sure to use CLRDATA before beginning work on a new problem.

Extension

Students can use the Internet to find data sets and then find the three measures of central tendency using these data sets.

Solutions Part 1

Kendall is a recent high school graduate and is seeking employment at a local manufacturing company. He is told that "the average individual earnings amount is over $21,000 per year." Upon investigation, he obtains the following information about the number of employees at various earning levels:

Job category	*Number employed*	*Individual earnings*
President/Owner	1	$200,000
Business Manager	1	$ 60,000
Supervisor	2	$ 45,000
Foreman	5	$ 26,000
Lathe & Drill Operator	50	$ 16,000
Clerk	2	$ 14,000
Custodian	1	$ 9,000

1. How many employees earn $45,000 or more?

   4

2. How many people does this company employ?

   62

3. To compute the mean salary, how many individual earnings would have to be totaled?

   You could use 7 individual earnings, with a frequency computation, or you could add all 62 individual earnings.

4. Is the reported average annual earnings amount correct? What is it?

   Yes. The mean is actually $21,241.94.

5. Which measure of central tendency—mean, median, or mode—would be the most important for Kendall to know?

   Mode.

   Why?

   The majority of the employees (50) are in this category ($16,000); therefore, this is a "typical" measure for Kendall to know.

6. Suppose the president of the company receives an annual salary increase of $5,000. What is the new mean annual earnings for the whole company?

   The new mean is $21,322.58.

7. Suppose the lathe and drill operators all received a $1000 raise in pay. What is the new mean annual earnings for the whole company?

   The new mean is $22,048.39. (Do not include the $5,000 raise given the president of the company in #6.)

8. Which had more impact on the company's average wage—a $5,000 raise for the president or the $1,000 raises for the lathe and drill operators?

   The $1,000 raise for the lathe and drill operators.

9. The Kwality Komfort company has 54 employees on the payroll. The median annual earnings are $24,000, the mode is $18,000, and the mean is $26,000. What is the total annual payroll for the company?

   The total is $26,000 X 54 employees = $1,404,000.

Solutions Part 2

1. Use this list of data for the following problems,
   23, 20, 14, 13, 17, 21, 29, 31, 10, 12, 11, 21, 5, 36,19

   The median of the set is 19, and the mean is 18.8.

   Now create a new data set from the one above by adding or deleting just one number so that the new data set will have:

   - A mean larger than the median — *Delete 5 or add any number 39 or higher (answers will vary)*
   - A median of 20.5 — *Add any three numbers 21 or greater (answers will vary)*
   - No mode — *Delete 21*
   - A median of 20 — *Add any two numbers 21 or greater (answers will vary)*
   - A mean of 25 — *Add 118*

2. Find five whole numbers between 10 and 20, inclusive, that will illustrate each situation given below. Numbers may be repeated in each set.

   - The mean and median of the set are the same. — *11, 13, 15, 17, 19 or 10, 12, 13, 14, 16 (answers will vary)*
   - The mean is less than the median of the set. — *10, 17, 18, 19, 19 will give a mean of 16.6 (answers will vary)*
   - The set has the largest possible mean. — *20, 20, 20, 20, 20*
   - What is the median of this set? — *20*
   - What is the mode of this set? — *20*

3. A mode exists, and the mean, median, and mode are all the same, but the distribution is different from that in #2 above.

   14, 17, 17, 18, 19 or 13, 17, 17, 18, 20 (answers will vary)

4. Jason earns an 80 and an 85 on his first two history tests this semester.

   If a grade of B requires a mean of at least 85, what must he get on his next test to have at least a B average?

   90 or above

   Suppose, on the other hand, that in order to earn a B, Jason must have a median score of at least 85. What would he need to get on his next test to have a B average?

   85 or above

Student Activity 2

Name _____

Date _____

Making Sense of Data - Measures of Central Tendency

Objective: *You will use the three measures of central tendency — mean, median, and mode — in problem solving and in reasoning.*

Part 1: Evaluating Data

Kendall is a recent high school graduate and is seeking employment at a local manufacturing company. He is told that "the average individual earnings amount is over $21,000 per year." Upon investigation, he obtains the following information about the number of employees at various earning levels.

Job category	Number employed	Individual earnings
President/Owner	1	$200,000
Business Manager	1	$ 60,000
Supervisor	2	$ 45,000
Foreman	5	$ 26,000
Lathe & Drill Operator	50	$ 16,000
Clerk	2	$ 14,000
Custodian	1	$ 9,000

1. How many employees earn $45,000 or more?

2. How many people does this company employ?

3. To compute the mean salary, how many individual earnings would have to be totaled?

4. Is the reported average annual earnings amount correct? What is it?

5. Which measure of central tendency—mean, median, or mode—would be the most important for Kendall to know? Why?

6. Suppose the president of the company receives an annual salary increase of $5,000. What is the new mean annual earnings for the whole company?

7. Suppose the lathe and drill operators all received a $1000 raise in pay. What is the new mean annual earnings for the whole company? (Do not include the $5,000 raise given to the president of the company in #6.)

8. Which had more impact on the company average wage—a $5,000 raise for the president or the $1,000 raises for the lathe and drill operators?

9. The Kwality Komfort company has 54 employees on the payroll. The median annual earnings are $24,000, the mode is $18,000, and the mean is $26,000. What is the total annual payroll for the company?

Part 2: Working with Data Sets

1. Use this list of data for the following problems.

   23, 20, 14, 13, 17, 21, 29, 31, 10, 12, 11, 21, 5, 36, 19

   Now create a new data set from the one above by adding or deleting just one number so that the new data set will have:

   - A mean larger than the median
   - A median of 20.5
   - No mode
   - A median of 20
   - A mean of 25

2. Find five whole numbers between 10 and 20, inclusive, that will illustrate each situation given below. Numbers may be repeated in each set.

   - The mean and median of the set are the same.
   - The mean is less than the median of the set.
   - The set has the largest possible mean.
   - What is the median of this set?
   - What is the mode of this set?

3. A mode exists, and the mean, median, and mode are all the same, but the distribution is different from that in #2 above.

4. Jason earns an 80 and an 85 on his first two history tests this semester. If a grade of B requires a mean of at least 85, what must he get on his next test to have at least a B average?

   Suppose, on the other hand, that in order to earn a B, Jason must have a median score of at least 85. What would he need to get on his next test to have a B average?