# Using Measures of Central Tendency

Introduction

**Objective** → Students will be able to use measures of central tendency (mean, median, and mode) as tools to analyze real-world data.

**Context** → Students can find the mean, median, and mode. Students will go on to further differentiate the measures and make other statistics representations. In this lesson students will determine which measure is the best for representing data in a given situation.

**NCTM Standards Focus**

Understanding how people use data to communicate is very important in today's society. Often, however, students are just told how to find the measures of central tendency and directed when to use each one. In this standards-based lesson, students look at situations and determine which of these measures best communicates information in the given situation. Experiences like this one will prepare them both to express their own views and intelligently judge the views of others.

**Reasoning and Proof** Students interpret real-world data by referencing measures of central tendency. They apply reasoning skills to determine which measure or measures best represent(s) the data with respect to the context in which it is presented.

**Communication** Students see that the measure of central tendency they choose to use to represent data greatly affects the information they communicate. Throughout the lesson students communicate their reasoning both orally and in writing.

**Teaching Plan**

**Materials** → Student pages A.86-87a

Begin the lesson by conducting a quick review of mean, median, and mode and how to determine them. Ask students to talk about times they have seen or used averages. Most of the time students have probably heard the mean reported. Ask them to think of times when the median or mode may have been a useful piece of information to report or know.

You may want to take a few minutes to point out to students that these measures are referred to as *measures of central tendency* and discuss the term with them.

[Source: Connect to NCTM Standards 2000 - Seventh Grade, Creative Publications, Inc., pages 122-127]

Tell students that today the focus of the lesson will be not just on finding the mean, median, and mode, but on determining which measure might be the best one to convey information about a particular situation.

Give each student a copy of student page A.87. Because it may be helpful for students to discuss various ideas, you may wish to have them work with a partner or in groups. Review the problem situations with students to make sure they understand them. Tell them to find the mean, median, and mode for each set of data and then decide which of those measures would be the best one to describe the information. They also need to state why they chose a particular measure.

As students work in their groups you may wish to ask them some of these questions or give them these suggestions to help them reach a decision.

- *How do the measures of central tendency compare with each other?*
- *If you looked at a measure by itself, would it give you a good picture of what happened? Why or why not?*
- *Are there any "outliers" or pieces of data that don't follow the pattern of the rest of the data? How do these affect each measure of central tendency?*

One technique that might help students focus on the advantages and limitations of using a particular measure is to have members of the groups take a different measure of central tendency and try to convince the group that theirs is the best one to communicate the information. If the group agrees that this particular measure does not do a good job of describing the information they can take it out of consideration. This method of reasoning will help students not only in this exercise but also in looking at other situations.

**f.y.i.**

**An interesting point for students to note is that there is a *mode*, it is actually part of the data set, while the *mean* and *median* may or may not be in the data set.**

**f.y.i.**

**Encourage students to reach consensus rather than vote in their groups to make decisions about which measure of central tendency to use. This will help students develop their reasoning skills as they try to understand and respond to other opinions and reasoning.**

[Source: Connect to NCTM Standards 2000 - Seventh Grade, Creative Publications, Inc., pages 122-127]

Once students are finished, assemble them to present their opinions and their reasons for them. You may wish to ask what each group decided and have that group try to convince the class that their decision is the best one. While it may be difficult for a class to reach consensus, take the time to try for it. Striving for consensus will help students develop communication and their reasoning skills.

In the first problem, one of the important points is to make sure students understand what they are being asked to do. Some may think that since the player has been stealing a lot of bases lately, they are to tell about his recent stolen base productivity. The question is to tell about his stolen base productivity over his career. The mean would be a logical choice and is often used in sports averages. It reflects both the more productive and less productive years. The median would give you the midpoint of his stolen bases. In this case it is also a fair representation of his productivity. Because he had some very lean years and some very good years, the median is in line with the mean. The mode, while close to the mean and median, is not as meaningful, since it really represents only two of the eleven data points.

In the second problem, the median is probably the best indicator. The mean is skewed slightly by the low score of 25. The mode is not meaningful because there are so many different data points.

TO CONCLUDE THE LESSON, present the following problem.

**The hourly salaries for the workers at a fast food restaurant are $5.50, $6.00, $6.50, $7.00, $8.00, $10.00, $24.00, and $25.00. What are the mean, median, and mode of the salaries? If you were a worker, what would you say the average salary is? If you were the owner and wanted to get someone to come to work for you, what would you say the average salary is?**

[Source: Connect to NCTM Standards 2000 - Seventh Grade, Creative Publications, Inc., pages 122-127]

The mean is $11.50; the median is $7.50; there is no mode. The worker may say the average salary is the median because it more closely reflects what 75% of the people get paid. The owner might say the mean since it is the highest measure of central tendency. While students may disagree, this is an interesting problem because there are obviously two types of workers here. (A reasonable guess is that one salary is for the workers and the other is for the managers.) The $7.50 is in the middle of the cluster of the workers. The mean of $11.50 represents no one but is somewhere between the higher paid employees and the lower paid ones.

**Student Pages**

Student page A.87 provides problems for use during the lesson. Student page A.87-a provides similar problems for homework.

**Assessment**

You had the opportunity to assess students in their groups as they solved problems and discussed which measure of central tendency to use. You were able to further assess students' understanding and reasoning as students presented their solutions and arguments.

**NCTM Standards Summary**

In this lesson, students applied reasoning skills to determine which measure or measures of central tendency best represented the data for a given situation. In all cases, students used communication skills to explain and defend their reasoning.

**Answers**

*Page A.87*

1. Mean: 30.55; Median: 33; Mode: 36. See lesson discussion.
2. Mean: 85.36; Median: 88; Mode: 78 and 94. See lesson discussion.

*Page A.87-a*

1. Mean: 71.47; Median: 72; Mode: 72. Answers will vary.
2. Mean: $192,000; Median: $131,000; Mode: none. Answers will vary.
3. Player A: Mean: 12.55; Median: 12; Mode: 14
   Player B: Mean: 12.73; Median: 16; Mode: 6
   Answers will vary.

[Source: Connect to NCTM Standards 2000 - Seventh Grade, Creative Publications, Inc., pages 122-127]

Name _____

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**Find the mean, median, and mode. Then answer the questions.**

∂ The table shows the number of bases stolen by one baseball player for the years 1989-1999. Which measure or measures would you use to best describe the player's number of stolen bases per year over his career? Explain your reasoning.

| Year | Stolen Bases |
|---|---|
| 1989 | 4 |
| 1990 | 15 |
| 1991 | 10 |
| 1992 | 8 |
| 1993 | 33 |
| 1994 | 25 |
| 1995 | 36 |
| 1996 | 40 |
| 1997 | 36 |
| 1998 | 66 |
| 1999 | 63 |

- Students in Mrs. Rivera's math class at Jefferson Middle School recorded the following scores on their last test. Which measure or measures would you use to best describe how the class performed on this test? Explain your reasoning.

78, 94, 83, 78, 100
85, 92, 94, 70, 84
94, 98, 78, 25, 97
86, 93, 91, 88, 79
93, 82, 87, 95, 90

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Name _____

# Using Measures of Central Tendency

**Find the mean, median, and mode for each data set.**
**Then answer the questions.**

∂ The following high temperatures were recorded in San Diego, California for the first 15 days of January. Which measure or measures would you use to best describe the temperature in San Diego during this time? Explain your reasoning.

72°, 72°, 70°, 64°, 66°,
72°, 78°, 78°, 80°, 72°,
70°, 72°, 66°, 68°, 72°

- Beckman Realty sold 12 houses last quarter. Listed are the selling prices for each of the houses they sold. Which measure or measures would you use to describe the average cost of a home that Beckman Realty sold last quarter? Explain your reasoning.

| | | |
|---|---|---|
| $ 85,000 | $156,000 | $124,000 |
| $350,000 | $ 98,000 | $259,000 |
| $128,000 | $127,000 | $298,000 |
| $116,000 | $429,000 | $134,000 |

÷ Imagine you have an opening on your school basketball team. Two new players are vying for the opening. Below are their point totals for the 11 games played last season with their previous teams. Which player would you select for the team? Refer to the measures for each player to support your selection.

Player A: 14, 12, 11
9, 12, 10, 15, 14, 11,
16, 14

Player B: 6, 17, 7,
22, 3, 16, 6, 21, 18,
5, 19

[Source: Connect to NCTM Standards 2000 - Seventh Grade, Creative Publications, Inc., pages 122-127]