

Mathematics Instructional Cycle Guide

Choosing the Best Measure of Center (6.SP.5.D)

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teacher

CT CORE STANDARDS

This Instructional Cycle Guide relates to the following *Standards for Mathematical Content* in the *CT Core Standards for Mathematics*:

Apply and extend knowledge of how to calculate measures of center.

6.SP.5 Summarize numerical data sets in relation to their context, such as by:

6.SP.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

This Instructional Cycle Guide also relates to the following *Standards for Mathematical Practice* in the *CT Core Standards for Mathematics*:

MP.3 Construct viable arguments and critique reasoning of others.

- Students will look at the arguments of Rachel and Marty to determine who understands what a measure of center is and which one is closer to the values in the data set.

MP.6 Attend to precision.

- Students will have to accurately calculate mean and median to determine which sneaker size is closer to the values in the data set.

MP.7 Look for and make use of structure.

- During the lesson, students will create conjectures about the effects an outlier has on mean and median, and use those conjectures to answer other questions in the future.

WHAT IS INCLUDED IN THIS DOCUMENT?

- A Mathematical Checkpoint to elicit evidence of student understanding and identify student understandings and misunderstandings (**page 2**)
- A student response guide with examples of student work to support the analysis and interpretation of student work on the Mathematical Checkpoint (**pages 3 – 6**)
- A follow-up lesson plan designed to use the evidence from the student work and address the student understandings and misunderstandings revealed (**pages 7 – 12**)
- Supporting lesson materials (**pages 13 – 18**)
- Precursory research and review of standard **6.SP.5.D** and assessment items that illustrate the standard (**pages 19 – 21**)

HOW TO USE THIS DOCUMENT

- 1) Before the lesson, administer the **Shoes Sizes Mathematical Checkpoint** individually to students to elicit evidence of student understanding.
- 2) Analyze and interpret the student work using the [Student Response Guide](#)
- 3) Use the next steps or **follow-up lesson plan** to support planning and implementation of instruction to address student understandings and misunderstandings revealed by the Mathematical Checkpoint
- 4) Make instructional decisions based on the checks for understanding embedded in the follow-up lesson plan

MATERIALS REQUIRED

- **Interactive Whiteboard**
- **Calculators (optional)**

TIME NEEDED

Shoes Sizes Mathematical Checkpoint administration: **10 minutes**

Follow-Up Lesson Plan: **1 to 2 instructional blocks**

Timings are only approximate. Exact timings will depend on the length of the instructional block and needs of the students in the class

Step 1: Elicit evidence of student understanding

Mathematical Checkpoint

Question(s)

A poll was taken to find all the shoe sizes in a classroom. Look at the table of data shown below.

Student	Shoe Size
Jamal	10
Maddie	8
Stacy	7
Heather	7
Rick	13
Gorge	8
Ben	12
Tim	9
Yu-Mi	7
Lianna	9

The teacher wants to know which shoe size best represents the average student in the class. Two students raise their hand.

Rachel, "I think size 7 because it is the shoe size that most people have."

Marty, "I think 9 because most of the shoe sizes are close to this number."

Which student do you agree with? Rachel Marty

I agree with _____ because _____

I disagree with _____ because _____

Purpose

CT Core Standard:

6.SP.5 Summarize numerical data sets in relation to their context, such as by:
6.SP.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Target question addressed by this checkpoint:

How do students approach best describing a set of data with one measure of center? To what extent do they...

- Know the best description of data is the measure of center closest to the majority of the values in the data.

Step 2: Analyze and Interpret Student Work

Student Response Guide		
Got It	Developing	Getting Started
<p>1) Which student do you agree with? Rachel <input type="radio"/> Marty <input checked="" type="radio"/></p> <p>2) I agree with <u>Marty</u> because <u>the teacher asked the average not the most of what people chose.</u></p> <p>3) I disagree with <u>Rachel</u> because <u>The teacher didn't ask about the most shoe size people chose but the average.</u></p>	<p>Questions:</p> <p>1) Which student do you agree with? Rachel <input type="radio"/> Marty <input type="radio"/></p> <p>2) I agree with <u>Marty</u> because <u>although there are more size sevens nine is more in the middle of 7 and 13.</u></p> <p>3) I disagree with <u>Rachel</u> because <u>there isn't a 7 in the middle.</u></p>	<p>Questions:</p> <p>1) Which student do you agree with? Rachel <input checked="" type="radio"/> Marty <input type="radio"/></p> <p>2) I agree with <u>Rachel</u> because <u>Average means the most popular or common.</u></p> <p>3) I disagree with <u>Marty</u> because <u>Average doesn't mean close to the number it means most popular/common.</u></p>

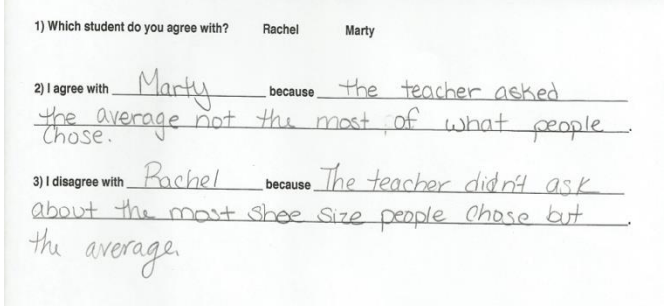
Getting Started

Student Response Example	Indicators
<p>Questions:</p> <p>1) Which student do you agree with? Rachel <input checked="" type="radio"/> Marty <input type="radio"/></p> <p>2) I agree with <u>Rachel</u> because <u>Average means the most popular or common.</u></p> <p>3) I disagree with <u>Marty</u> because <u>Average doesn't mean close to the number it means most popular/common.</u></p>	<ul style="list-style-type: none"> • Student concludes Rachel is correct. • Student response connects the word “average” to most or mode. Mode is not a measure of center. • Student does not connect the word “average” with a measure of center.
In the Moment Questions/Prompts	Closing the Loop (Interventions/Extensions)
<p>Q: What word or phrase in the problem let you know what to look for in the data?</p> <p>Q: What does it mean if a person’s height is described as average?</p> <p>Q: What does the word average mean and how do you know it means that?</p> <p>P/Q: The average person looks about the same as everyone else, and the same is true for an average number. Which of the following numbers looks closest to, or more like the other numbers in the data set, 7 or 9?</p>	<p>Provide students with unit cubes or a number line, they may benefit from being able to model or graph the numbers.</p> <p>http://learnzillion.com/lessons/534</p> <p>http://learnzillion.com/lessons/3797-summarize-a-data-set-using-the-mean-median-and-mode</p>

Developing

Student Response Example	Indicators
<p>Questions:</p> <p>1) Which student do you agree with? Rachel Marty</p> <p>2) I agree with <u>Marty</u> because <u>although there are more size sevens nine is more in the middle of 7 and 13.</u></p> <p>3) I disagree with <u>rachel</u> because <u>there isn't a 7 in the middle.</u></p>	<ul style="list-style-type: none"> • Student concludes Marty is correct, but does not mention the word average nor do they calculate how to find the average. • Student uses the word/phrase “middle”, “center number”, or “in between” to describe average. These words describe the median of a set of data, which is a measure of center, just not the best one to describe the data. • Student does not connect the word “average” with a number representing the majority of the data when outliers are not present.
In the Moment Questions/Prompts	Closing the Loop (Interventions/Extensions)
<p>Q: What word or phrase in the problem let you know what to look for in the data?</p> <p>Q: How did it lead you to picking Marty’s answer as the one you agreed with?</p> <p>Q: Prove to me that 9 is in the middle of the data.</p> <p>P: The student should come to the conclusion that the median is 8.5. If they do not, have them line up all the numbers in order and find the one that is in the middle. They should come to 8 and 9. Ask them what is exactly in the middle of 8 and 9 and they should come up with the 8.5.</p> <p>Q: If 9 is not in the middle of the data, what could be another reason it is the best measure of center to describe the data with?</p>	<p>Have students consider when the mean would not be the best number to describe a data set.</p> <p>http://learnzillion.com/lessons/534</p> <p>http://learnzillion.com/lessons/2482</p>

Got it

Student Response Example	Indicators
 <p>1) Which student do you agree with? Rachel Marty</p> <p>2) I agree with <u>Marty</u> because <u>the teacher asked the average not the most of what people chose.</u></p> <p>3) I disagree with <u>Rachel</u> because <u>The teacher didn't ask about the most shoe size people chose but the average.</u></p>	<ul style="list-style-type: none"> • Student concludes Marty's explanation is correct. • Student response uses the word average to describe the mean. • If response does not use the word average, it may make reference to 9 being a balancing point all the numbers in the data set stem from. • Student shows understanding that average can be found through a mathematical procedure. The student may or may not be able to give the conceptual understanding behind the formula.
In the Moment Questions/Prompts	Closing the Loop (Interventions/Extensions)
<p>Q: What word or phrase in the problem let you know what to look for in the data?</p> <p>Q: How did you know 9 was the average?</p> <p>Q: How does the formula for mean connect to the word "average"? (See Extension)</p> <p>Q: When would the mean not be the measure of center that best describes the data?</p> <p>Answer: <i>When the median is closer to most of the data values than the mean.</i></p>	<p>Have students create statistical questions, collect data, and determine which measure of center best describes their data.</p> <p>http://learnzillion.com/lessons/3797-summarize-a-data-set-using-the-mean-median-and-mode</p> <p><i>See extension task in follow-up lesson plan on page 12.</i></p>

Steps 3 and 4: Act on Evidence from Student Work and Adjust Instruction

Lesson Objective:	Determine the best measure of center to describe a set of data that is given numerically.
Content Standard(s):	<p>6.SP.5 Summarize numerical data sets in relation to their context, such as by:</p> <p>6.SP.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</p>
Targeted Practice Standard:	<p>MP.3 Construct viable arguments and critique reasoning of others.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>

Mathematical Goals	Success Criteria
<ul style="list-style-type: none"> Understand the mean is the best measure of center when no outliers are given. Understand the effect of an outlier on the mean, including how the mean may no longer be the best measure of center. Understand the effect of an outlier on the median. 	<ul style="list-style-type: none"> Look at a set of data and describe which measure of center best describes it and why. Determine what the outlier given will do to the measures on center describing a set of data.

Launch (Probe and Build Background Knowledge)

Note: Prior to this lesson, students should know how to calculate median and mean when given a set of data.

Vocabulary:

Measures of Center – A single number (mean or median) used to describe data.

Mean – The average. This is where you add everything up and divide by the number of items you have to make sure each item has the same value.

Median - The middle value in a set of numbers

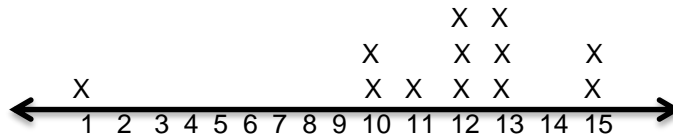
Outlier – A value that “lies outside” most of the other values. It is much larger or smaller than the other values in the data set.

Purpose: Assess and activate background knowledge about the measures of center: Mean and Median

Have the students fill in the following table individually. After the tables are filled in, have them discuss their answers with a partner and see if any of their views change or are broadened (i.e. they change their mind on a idea or find out something they had forgotten).

	Word or Phrase to Describe it	How to Find it Mathematically
Mean		
Median		

Show the students the following line plot that contains an outlier. Ask them what they notice about the graph (shape, number of responses, what it's about). Then introduce the term **outlier** (see vocabulary list above for definition).



Number of States I Have Been To

Q: Based on what the word looks like, which point do you think is the outlier and why?

Answer: *The point to the far left because it just lies further out than the other data.*

P: Today we are going to determine how outliers affect our two measures of center, median and mean.

Instructional Task

Purpose: *Introduce Dog Sizes Task and provide students time to reason and problem solve*

Engage (Setting Up the Task)

1.) Place a picture of 7 medium-sized dogs (Airedale Terrier, Boxer, Bull Terrier, Shar-pei, Collie, Dalmatian, and Lab) up on the board with their weights right below them. Below, put up a second dog group containing a picture of a Chihuahua and a Great Dane with their weights (*see page 13*).

2.) Facilitate a discussion on data collected from the weights of the dogs using the following questions/prompts:

Q: What do you notice about the weights of the dogs in the top row? How do they compare to the weights of the dogs in the second row?

Answer: *The weights of the dogs in the first row are about the same. The Great Dane is a lot bigger than the other dogs. The Chihuahua is a lot smaller than the other dogs.*

Q: Predict what the mean and median of the dogs in Group 1 will be without doing any math. How did you come to this conclusion?

Answer: *The median will be 55 because there are 7 numbers in the set and 55 is the fourth. The mean will be (any number 50-60) because this is where most of the numbers are around.*

Q: Do you think the mean or the median best describes the numbers in the data set? Why?

Answer: *The mean because it is the average. The mean because most of the answers are around this.*

Q: Predict how the Chihuahua will affect each measure of center of the dogs in the first row. Why did you make this prediction?

Answer: *Answers will vary but you are hoping they will understand the mean and median will decrease because you are adding in a small number.*

Q: Predict on how the Great Dane will affect each measure of center of the dogs in the first row. Why did you make this prediction?

Answer: *Answers will vary but you are hoping they will understand the mean and median will increase because you are adding in a large number.*

3.) Explain the students will now work on the Dog Sizes Task. Provide copies of the task to each student and specify how much time they will have to work on it (*see pages 14 – 15 for Dog Sizes Task and Answer Key*).

Explore (Solving the Task)

4.) Provide students time to work on the Dog Sizes task with a partner. Circulate, observe, question, and note students who are strategic candidates to share out responses. Possible questions/prompts to ask as students engage in the task.

Q: How does the weight of the Chihuahua affect the measures of center?

Answer: *The Chihuahua brings the median down a little bit and the mean down quite a bit.*

Q: How does the weight of the Great Dane affect the measures of center?

Answer: *The Great Dane brings the median up a little bit and the mean up quite a bit.*

Q: The Great Dane and Chihuahua are both outliers. Who can remind me what an outlier is?

Answer: A value that “lies outside” most of the other values. It is much larger or smaller than the other values in the data set.

P: An outlier, even though it may be just one number, can have an enormous impact on the measures of center used to describe a data set. The following activity you are about to complete will show you how that really large or really small number affects the median and mean. Be prepared to discuss your findings with the class.

Elaborate (Discuss Task and Related Mathematical Concepts)

5.) *Call the class back together. Project the Dog Size Task on the SMART Board. Ask the following questions to the class.*

Q: How did you find the mean of the medium sized dogs?

Answer: *Found the total of my responses and divided them evenly amongst the seven of responses.*

Q: How did you find the mean when you added each outlier into the data set?

Answer: *I just added the outlier to my original total and divided by the new number of responses, now 8.*

Q: How did you find the median of the medium-sized dogs?

Answer: *I put the weights in order since we need the middle value, not just the middle number. I then worked my way from the outside using the (rainbow, cross out, cover-up) method until I found the value that was exactly in the middle of the data.*

Q: How did you find the median when you added each outlier into the data set?

Answer: *I put my new weight on the end and then worked my way from the outside using the (rainbow, cross out, cover-up) method until I found the value that was exactly in the middle of the data.*

6.) *Have students come up to the interactive whiteboard one at a time and write down the answers to each question on the Dog Size Task, explaining their process after the answer is up.*

7.) *Tell the students they are going to use the data they collected to make some generalizations about how outliers affect the measures of center. Post the “Checking for Understanding” questions on the interactive whiteboard. Have students complete them individually and then discuss them with a partner. Have each partner set share out their answer to a question and do thumbs-up/thumbs-down to see which students agree or disagree with each answer. Any disparities can be a point of discussion for each party to make their case.*

Checking for Understanding

Purpose: Pose the following questions at the end of the Dog Sizes task to have students think about how an outlier affects the three measures of center.

- 1) Circle the underlined word that best answers each section describing how the Chihuahua's weight affects the mean and median.
 - a) The mean (was was not) affected by the Chihuahua's weight. It went (up down stayed the same)
 - b) The median (was was not) affected by the Chihuahua's weight. It went (up down stayed the same)
- 2) Circle the underlined word that best answers each section describing how the Great Dane's weight affects the mean, median, and mode.
 - a) The mean (was was not) affected by the Chihuahua's weight. It went (up down stayed the same)
 - b) The median (was was not) affected by the Chihuahua's weight. It went (up down stayed the same)
- 3) Which measure of center does an outlier affect the most?
- 4) Which measure of center does an outlier affect the least?
- 5) When an outlier is present, which measure of center do you think will best describe a data set?

Common Misunderstanding

Purpose: Students may not understand why an outlier affects the mean so much and the median so little. (See page 18 for number strips for students to cut out and fold)

- 1) Give the students the following strip of numerical data and have them cut it out.

13	13	14	15	17	17	19
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- 2) Have students calculate the mean mathematically. Then have them fold the paper in half. That is the median.

- If you have an odd number of data values, the crease will be in the middle of a square. If you have an even number of data values, the crease will be between two numbers. In this example, the crease will be in the middle of the 15. Circle that number

- 3) Next give the students the same strip of data with an outlier added onto the end and have them cut the new set of data out.

13	13	14	15	17	17	19	79
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- 4) Have the students find the mean of the set of data now that an outlier has been added in.

- Students will see the mean has increased quite a bit because 79 is so much larger than the other numbers.

Next have them fold the new strip in half to find the median if the data with the outlier added in.

Students will physically see the median only shifted by one space because an outlier is a single number added to the end of a set of data.

Checking for Understanding

Purpose: Pose the following question as an exit card to elicit evidence of students' understanding of determining the best measure of center and the reason(s) behind it.

Mr. Stat's math class conducted a survey to see how many states students in the class had been to. The results were as follows: 2, 1, 4, 5, 3, 2, 31, 4, 4, and 3. Mr. Stat wants to know which measure of center best describes the data and why.

Harry, Jose, and Monique all raise their hands to answer...

Harry, "I think the median because the 31 is a big number that makes the mean higher than most of the other numbers."

Jose, "I think the mean because it is the average number, or the balancing point everything stems from."

Monique, "I think the median because the 31 would make the mean lower since you are dividing by another number."

1) Circle the name of the person you think is correct: Harry Jose Monique

2) I agree with _____ because _____

3) I disagree with _____ because _____

4) I also disagree with _____ because _____

Answer: Harry, "I think the median because the 31 is a big number that makes the mean higher than most of the other numbers."

- Since 31 is such a large number, it skews the mean to be higher than it would have been without the outlier.

Closure

Purpose: Provide students an opportunity to self-assess their knowledge of measures center by putting the following questions up on the SMART Board and having students flip their exit ticket over to answer the questions themselves.

Circle the phrase that best matches your level of success with each item.

1.) I can find the mean value of a set of data.

Not at all **Sort of** **Absolutely**

2.) I can find the median value of the set of data.

Not at all **Sort of** **Absolutely**

3.) I know how large and small outliers each affect mean and can explain it to someone else.

Not at all **Sort of** **Absolutely**

4.) I know how large and small outliers each affect median and can explain it to someone else.

Not at all **Sort of** **Absolutely**

5.) I know which measure of center is best to use when I do not have an outlier and can explain it to someone else.

Not at all **Sort of** **Absolutely**

6.) I know which measure of center is best to use when I do have an outlier and can explain it to someone else.

Not at all **Sort of** **Absolutely**

Extension Task

Purpose: *Students will create a real world statistical problem they can ask their classmates and determine whether the data they collect has an outlier and which measure of center best describes the data.*

Everything N' More

Scenario:

A local super store, Everything N' More, sells a variety of items. They have reported that their sales for the last three quarters are down. You and your partner have been hired to do data research for Everything N' More.

Paw-Marts Goal:

The owner wants more middle school students to shop in their store.

Task:

Your job is to find out what middle school students want to purchase.

- Generate 2 statistical questions to survey middle school students about items they like to buy
- Conduct the survey to at least 30 students
 - If technology is available...create a survey online using survey monkey and send the link to your classmates.
 - If technology not available...go around the school and ask 20 people, students or teachers, your question and record the data.
- Graph your results
- Interpret your results using questions 1 - 5
- Prepare a presentation for Everything N' More
 - Choose an appropriate graph to represent your data
 - Use mean, median, and range to describe the shape and spread of your data.
 - Your presentation should be persuasive and informative.

Questions:

1) Does the data contain an outlier? If so, what it? _____

2) Find the mean and median of your data set.

Mean: _____

Median: _____

3) Which measure of center best describes your data? Why?

4) Why did you not choose the other measure of center?

5) How do you decide which measure of center to use when describing a data set?

Group 1



45 Pounds



65 Pounds



55 Pounds



50 Pounds



50 Pounds



60 Pounds



65 Pounds

Group 2



110 Pounds



5 Pounds

Name: _____

Class: _____

Dog Sizes Task

Purpose: Determine how Outliers Affect Measures of Center

Heights of Different Dog Breeds

Dog Breed	Weight (in pounds)
Airedale Terrier	45
Boxer	65
Bull Terrier	55
Shar-pei	50
Collie	60
Dalmatian	50
Chocolate Lab	65

Find the 2 Measures of Center:

Mean: _____

Median: _____

1) Which measure of center best describes the data in this set, the mean or the median?

Why?

Small Outlier:

Chihuahuas are one of the smallest dog breeds. Add this dog's weight to the data set on the previous page and calculate the mean and the median of the new data set. Watch how it changes each measure of center.

Chihuahua	5
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Mean: _____

Median: _____

Circle the best answer for questions 2-3.

- 2) An outlier changes the mean: Not At All Slightly A Lot
- 3) An outlier changes the median: Not At All Slightly A Lot
- 4) With the Chihuahua added in, which measure of center now best describes the data set? Why?

Large Outlier:

The Great Dane's one of the largest dog breeds. Add this dog's weight to the data set on the previous page and calculate the mean and the median of the new data set. Watch how it changes each measure of center.

Great Dane	110
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Mean: _____

Median: _____

Circle the best answer for questions 5-6.

- 5) An outlier changes the mean: Not At All Slightly A Lot
- 6) An outlier changes the median: Not At All Slightly A Lot
- 7) With the Great Dane added in, which measure of center now best describes the data set? Why?

Name: _____ **Answer Key** _____

Class: _____

Dog Sizes Task

Purpose: Determine how Outliers Affect Measures of Center

Heights of Different Dog Breeds

Dog Breed	Weight (in pounds)
Airedale Terrier	45
Boxer	65
Bull Terrier	55
Shar-pei	50
Collie	60
Dalmatian	50
Chocolate Lab	65

Find the 2 Measures of Center:Mean: 55.7Median: 55

- 1) Which measure of center best describes the data in this set, the mean or the median?

Why?

Either answer could work because they are both close to the data.

Small Outlier:

Chihuahuas are one of the smallest dog breeds. Add this dog's weight to the data set on the previous page and calculate the mean and the median of the new data set. Watch how it changes each measure of center.

Chihuahua	5
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Mean: 49.4Median: 52.5**Circle the best answer for questions 2-3.**

- 2) An outlier changes the mean: Not At All Slightly **A Lot**
- 3) An outlier changes the median: Not At All **Slightly** A Lot
- 4) With the Chihuahua added in, which measure of center now best describes the data set? Why?

The median, because it is closer to most of the numbers in the data set.

Large Outlier:

The Great Dane's one of the largest dog breeds. Add this dog's weight to the data set on the previous page and calculate the mean and the median of the new data set. Watch how it changes each measure of center.

Great Dane	110
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Mean: 62.5

Median: 57.5

Circle the best answer for questions 5-6.

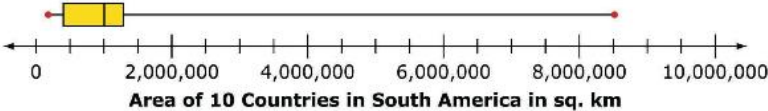
- 5) An outlier changes the mean: Not At All Slightly **A Lot**
- 6) An outlier changes the median: Not At All **Slightly** A Lot
- 7) With the Great Dane added in, which measure of center now best describes the data set? Why?

The median, because it is closer to most of the numbers in the data set.

Common Misconceptions Number Strips

13	13	14	15	17	17	19
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13	13	14	15	17	17	19	79
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Research and review of standard																							
Content Standard(s):	Standard(s) for Mathematical Practice:																						
<p>6.SP.5 Summarize numerical data sets in relation to their context, such as by:</p> <p>6.SP.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</p>	<p>MP.3 Construct viable arguments and critique reasoning of others.</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p>																						
Smarter Balanced Claim	Smarter Balanced Item																						
<p>Claim 3: Communicating Reasoning</p> <p>Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p>The area, in square kilometers, of 10 countries in South America are shown in the table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Country</th> <th>Area in Square Kilometers</th> </tr> </thead> <tbody> <tr><td>Uruguay</td><td>176,215</td></tr> <tr><td>Ecuador</td><td>256,369</td></tr> <tr><td>Paraguay</td><td>406,752</td></tr> <tr><td>Chile</td><td>756,102</td></tr> <tr><td>Venezuela</td><td>912,050</td></tr> <tr><td>Bolivia</td><td>1,098,581</td></tr> <tr><td>Colombia</td><td>1,141,748</td></tr> <tr><td>Peru</td><td>1,285,216</td></tr> <tr><td>Argentina</td><td>2,780,400</td></tr> <tr><td>Brazil</td><td>8,514,877</td></tr> </tbody> </table> <p>The data is also summarized in the box plot.</p>  <p style="text-align: center;">Area of 10 Countries in South America in sq. km</p> <p>Which measure of center, the mean or the median, is best to use when describing this data? Thoroughly explain your reasoning for choosing one measure over the other measure.</p>	Country	Area in Square Kilometers	Uruguay	176,215	Ecuador	256,369	Paraguay	406,752	Chile	756,102	Venezuela	912,050	Bolivia	1,098,581	Colombia	1,141,748	Peru	1,285,216	Argentina	2,780,400	Brazil	8,514,877
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CPR Pre-Requisites <i>(Conceptual Understanding, Procedural Skills, and Representations)</i>	Conceptual Understanding and Knowledge Things to Understand about Measures of Center																						
<p><i>Look at the Progressions documents, Learning Trajectories, LZ lesson library, unpacked standards documents from states, NCTM Essential Understandings Series, NCTM articles, and other professional resources. You'll find links to great resources on your PLC Platform.</i></p>	<ul style="list-style-type: none"> Understand that we use mean and median to deal with complex issues and make decisions. Understand median may be the best measure of center to describe data when outliers are present. Understand the median is in the middle value in a set of values. Know an outlier usually causes the mean to be above or below the majority of the data depending on where it is. Understand the mean as a central balance point where the distances above and below are equal. The mean is also the equal distribution of all the values in the data set. Understand that outliers can impact/distort the mean. Know the best description of data is the measure of center closest to the majority of the values in the data. 																						

Procedural Skills How

- Add positive rational numbers
- Divide positive rational numbers
- The algorithm for the mean: first add the values in a data set and then divide them by the number of values in the data set.
- Ordering positive rational numbers from least to greatest, and determining the middle value of the data set.

Representational

- Represent the mean as an “evening up” of the values in the data by taking units from tall columns on a dot plot or histogram and adding them to the short columns.
- Represent the median as the middle value in a set of data and not the middle of the range.

Social knowledge

- Understand how to find the mean and the median.

Standards Progression		
<i>*Look at LearnZillion lessons and expert tutorials, the Progressions documents, learning trajectories, and the “Wiring Document” to help you with this section</i>		
Grade(s) below	Target grade	Grade(s) above
5.MD.2 Generate and use line plots of measurements of objects including $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$ and redistribute into equal shares	6.SP.2 Understand distributions of data as described by center, spread, and overall shape. 6.SP.3 Recognize measures of center and measures of variation as single values representing data series. 6.SP.5.C Describe measures of center (median, mean) in relation to context. 6.SP.5.D Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. 6.NS.3 Fluently add, subtract, multiply and divide multi-digit decimals using standard algorithms.	7.SP.2 Generate or simulate multiple random samples of a given size to examine variation and informally discuss drawing inferences about the population. 7.SP.3 compare distributions of two data sets visually and explore different ways to quantify and compare the differences including using mean deviation

Common Misconceptions/Roadblocks
<p>What characteristics of this problem may confuse students?</p> <ul style="list-style-type: none"> The large value of the numbers may confuse some students preventing them from accurately calculating the mean and median. <p>What are the common misconceptions and undeveloped understandings students often have about the content addressed by this item and the standard it addresses?</p> <ul style="list-style-type: none"> <i>Student may confuse the definitions of median or mean.</i> <i>Students may not understand why an outlier affects the mean so much more than the median.</i> Students may not know we use mean and median to deal with complex issues and make decisions (usually about the best representation of a certain population) <p>What overgeneralizations may students make from previous learning leading them to make false connections or conclusions?</p> <ul style="list-style-type: none"> <i>Students may believe the mean always best describes the data because it is the average.</i> <i>Students may believe the median is in the physical middle of a set of data that is not ordered numerically because it is in the middle value of a set of data.</i>