

Inspect

CCR Performance Tasks

**Math Grade 7: Compare Data Sets and
Make Inferences**

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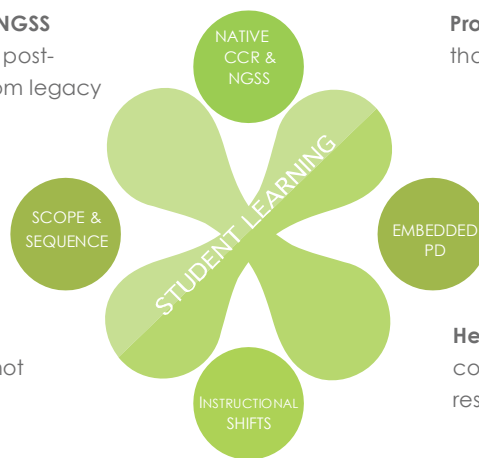
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Content that addresses your scope and sequence so that your assessments do not waste valuable instruction time



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CCR Performance Tasks

Math Grade 7: Compare Data Sets and Make Inferences

Student Test Booklet

Name:

Math Grade 7: Compare Data Sets and Make Inferences

Student Rubric

This problem is meant to test if you can:

- Correctly compute statistics using a set of data;
- Provide a valid comparison of two groups using statistics and visual representations of data;
- Make a prediction about a larger population based on a sample;
- Describe the reasonableness of your prediction based on the sample.

Your teacher will rate your answer as a level 4, 3, 2, 1, or 0. The descriptions below explain the types of answers expected at each level.

Level 4:

Your answer is correct and complete. Your answer includes:

- The correct sample size, mean, and absolute mean deviation of a set of data with complete and correct work shown;
- A valid comparison of data presented in two data displays. The comparison includes central tendency, spread, and sample size;
- A reasonable prediction about a larger population based on a sample;
- A correct and complete description of the reasonableness of your prediction based on the sample.

Level 3:

Your answer is mostly correct but you make minor calculation errors or one or two of your explanations are incomplete. Your answer includes:

- Work that shows a correct strategy for finding the sample size, mean, and absolute mean deviation of a set of data. The work may contain minor calculation errors. The answers are consistent with the work;
- A valid and mostly complete comparison of data presented in two data displays, but the comparison may be incomplete;
- A reasonable prediction about a larger population based on a sample;
- A correct description of how your prediction is reasonable based on the sample, although the description may be incomplete.

Level 2:

You do not answer one part or you have mistakes in several parts. Your answer may include:

- Partially correct work for finding the sample size, mean, and absolute mean deviation of a set of data. The answers are consistent with the work;
- A partially correct comparison of data presented in two data displays, although the comparison may contain some errors or be incomplete;
- A reasonable prediction about a larger population based on a sample;
- A partially correct, weak, or missing description of the reasonableness of your prediction based on the sample.

Level 1:

Your answers are incorrect. Your answer may include:

- Partially correct work for finding the sample size, mean, and absolute mean deviation of a set of data. The answers are consistent with the work;
- A weak or missing comparison of data presented in two data displays;
- A prediction about a larger population based on a sample that is incorrect;
- An incorrect or missing description of the reasonableness of your prediction based on the sample.

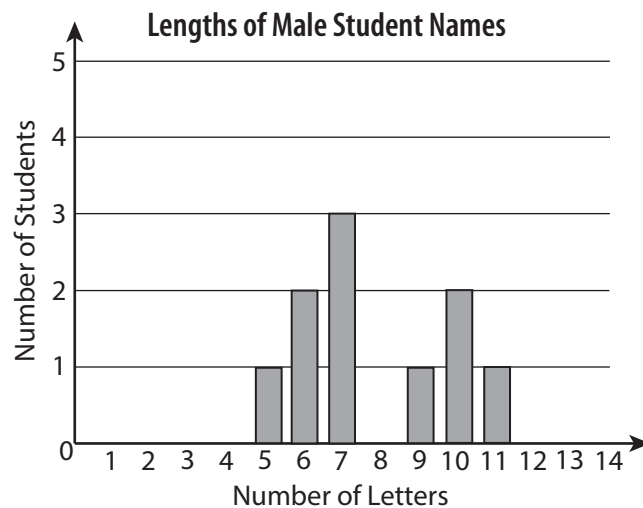
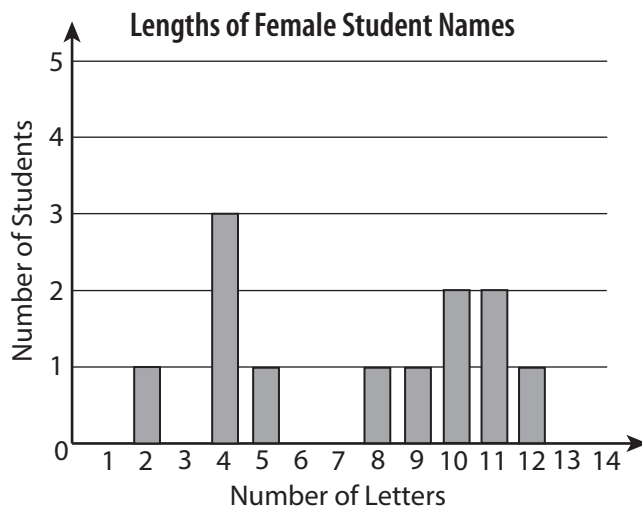
Level 0:

Your answer is not related to the question, the teacher cannot understand your answer, or you do not write anything.

Math Grade 7: Compare Data Sets and Make Inferences

Complete all the tasks in the test booklet.

- 1** The bar graphs below show the number of letters in the first names of students in a seventh-grade class at Liberty Middle School. The graph on the left shows the number of letters in the female students' first names. The graph on the right shows the number of letters in the male students' first names.




The list below shows some basic statistics for the female students' names.

- **Number of students: 12**
- **Mean number of letters: 7.5**
- **Mean absolute deviation: 3.08**

Go On

A. From the data in the bar graph, calculate the statistics for the male students' names. Show your work.

- Number of students: _____
- Mean number of letters: _____
- Mean absolute deviation: _____



B. Compare the two sets of data with respect to central tendency, spread, and sample size. Describe how the data sets are similar and different.

[illegible]

Go On

C. There are a total of 216 seventh-grade students at Liberty Middle School.

- **Based on the data in the bar graphs, make a prediction about the lengths of the first names of all seventh-grade students at the school.**
- **Use the data to support your prediction.**
- **Describe the reasonableness of your prediction based on this sample.**



CCR Performance Tasks

Math Grade 7: Compare Data Sets and Make Inferences

Teacher Guide

About the Teacher Guide

This document contains support materials for “Math Grade 7: Compare Data Sets and Make Inferences.”

This includes:

- (a) The task
- (b) The standards and depth of knowledge level of the task
- (c) The scoring rubric
- (d) Discussion questions
- (e) Extension activities

These specifications have been included to help you connect the task to the Common Core content standards and the standards for mathematical practice. The rubric is designed to help you look for the development of mathematical practices in student work. It is also here to help you look for consistencies in student content errors that can help guide intervention and reteach strategies.

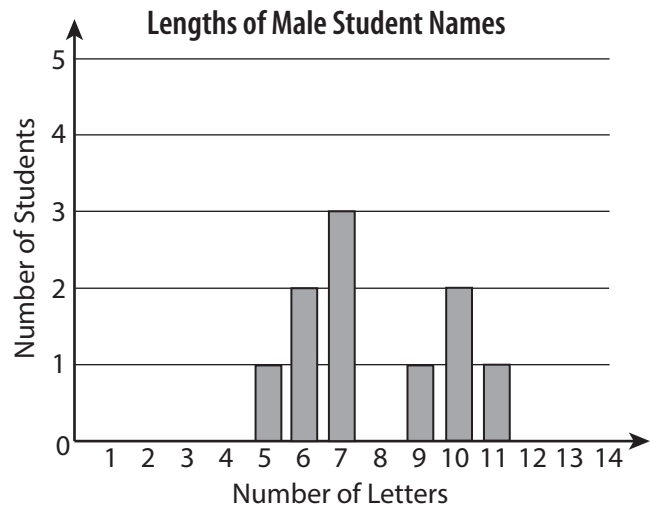
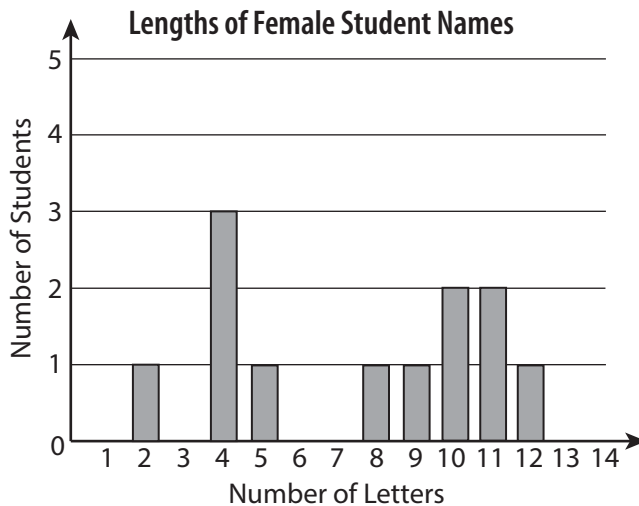
Test Definition File

Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 3	7.SP.1, 7.SP.2, 7.SP.3

SBACC Claims	PARCC Sub-Claims
1 and 3	B and C

Performance Task

The bar graphs below show the number of letters in the first names of students in a seventh-grade class at Liberty Middle School. The graph on the left shows the number of letters in the female students' first names. The graph on the right shows the number of letters in the male students' first names.



The list below shows some basic statistics for the female students' names.

- Number of students: 12
- Mean number of letters: 7.5
- Mean absolute deviation: 3.08

A. From the data in the bar graph, calculate the statistics for the male students' names. Show your work.

- Number of students: _____
- Mean number of letters: _____
- Mean absolute deviation: _____

B. Compare the two sets of data with respect to central tendency, spread, and sample size. Describe how the data sets are similar and different.

C. There are a total of 216 seventh-grade students at Liberty Middle School.

- Based on the data in the bar graphs, make a prediction about the lengths of the first names of all seventh-grade students at the school.
- Use the data to support your prediction.
- Describe the reasonableness of your prediction based on this sample.

Standards Alignment

Practice Standards

MP3 > DOK 3

Construct viable arguments and critique the reasoning of others.-- Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Content Standards

7.SP.1

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

7.SP.2

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

7.SP.3

Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*

SBAC Claims

Mathematics Claim #1: Concepts and Procedures. Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Mathematics Claim #3: Communicating Reasoning. Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

PARCC Sub-Claims

Sub-Claim B: Additional and Supporting Content with Connections to Practices. The student solves problems involving the additional and supporting content for the grade/course with connections to the Standards for Mathematical Practice.

Sub Claim C: Highlighted Practices MP.3, 6 with Connections to Content: expressing mathematical reasoning. The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

Scoring Rubric

4 Point Response:

The response demonstrates a high level of understanding. A level 4 response is characterized by:

- The ability to calculate statistics from a set of data;
- A strong understanding of how statistics and data representations can be used to compare two groups;
- A strong understanding of how statistics should be gathered from a random sample to be able to make predictions about a larger population.

A level 4 response should include:

- Correct answers in part A with correct work shown;
- A correct comparison of the two data sets including central tendency, spread, and sample size;
- A reasonable prediction of the lengths of the names of all seventh-grade students at the school;
- A correct and complete description of the reasonableness of the prediction for all seventh graders based on this sample.

A sample level 4 response follows.

Part A:

Number of students: 10

Mean number of letters: 7.8

Mean absolute deviation: about 1.76 letters.

Student work includes: a calculation of the mean by taking the sum of the number of letters for each of 10 names and then dividing that sum by the number of values (10), and a calculation of the mean absolute deviation by taking the sum of the absolute differences between each value and the mean, and then dividing that sum by the number of values (10). The work may also include a method for finding the number of students (for example, "I counted the number of male students directly from graph").

Part B: "There are more girls than boys in the class (12 girls vs. 10 boys). The longest (12 letters) and shortest (2 letters) names belong to girls. The range of the name length is greater for girls than boys (10 vs. 5), but the mean length of boys' names is a little longer. The boys' names are very close to the mean, but the girls' names are more spread out. This can be seen visually in the bar graph, and the large difference in mean absolute deviation (3.08 for girls, 1.76 for boys) confirms this observation."

Part C: "There are 22 students in the sample class. The sample size is a little small but not bad. The small sample might lead to a fairly large margin of error. This sample may not be random, because it's not clear how students were placed in the class; however, it is unlikely that students were placed in the class because of the lengths of their first names, so it is reasonable to use these data to make predictions about name lengths for all seventh graders. The mean name length for these 22 students is about 7.6 letters, so it is reasonable to predict that the average name length of a seventh grader at Liberty Middle School is between 7 and 8 letters. I might say 6 to 9 letters to adjust for the small sample size."

3 Point Response:

The response demonstrates a strong understanding, but the work contains minor errors. A level 3 response is characterized by:

- The ability to calculate statistics from a set of data, with all work shown and at most one minor error;
- An understanding of how statistics and data representations can be used to compare two groups, with a valid but incomplete explanation based on the provided data and calculated statistics;
- An understanding of how statistics should be gathered from a random sample to be able to make predictions about a larger population, with a valid and sound justification.

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2 Point Response:

The response demonstrates a basic but incomplete understanding. A level 2 response is characterized by:

- A basic ability to calculate statistics from a set of data, possibly with several minor errors;
- A basic understanding of how statistics and data representations can be used to compare two groups, with a vague explanation that is only partially based on the provided data and calculated statistics;
- A basic understanding of how statistics can be gathered from a random sample to be able to make predictions about a larger population, with an incomplete description of reasonableness that may contain logical errors.

1 Point Response:

The response demonstrates minimal understanding. A level 1 response is characterized by:

- A weak ability to calculate statistics from a set of data, with major errors;
- A poor understanding of how statistics and data representations can be used to compare two groups, with a weak explanation that is not based on the provided data and calculated statistics;
- A minimal understanding of how statistics can be gathered from a random sample to make predictions about a larger population, with an insufficient description of reasonableness that contains logical errors.

0 Point Response:

There is no response, or the response is off topic.

Discussion Questions

Use the following questions to help students struggling to access the problem:

1. What information can you get from looking at the bar graphs, without doing any calculations?

Possible Response: *There are more girls (12) than boys (10). The girls' names are more spread out; they range from 2 to 12 letters. No more than 3 girls or 3 boys have the same name length (there are 3 girls with 4 letters and 3 boys with 7 letters); however, there are 4 students total who have 10 letters in their name (2 girls and 2 boys).*

2. What statistics can be calculated based on the graph?

Possible Response: *Since the number of letters for each student is evident from the graph, the median and mode can be determined easily. The number of students can be determined, and then the mean, mean absolute deviation, and other statistics can be calculated.*

3. How can the mean, median, mode, and mean absolute deviation be used to compare two groups?

Possible Response: *The mean, median, and mode can be used to make a basic comparison of central tendency. For instance, if the mean salary of one group is double the mean salary of another group, it is reasonable to think that most people in the first group make more than the second group. However, statistics that describe a spread, like mean absolute deviation, help to give a clearer picture. For example, the mean salary of one group may be double the mean salary of another group because the first group includes a billionaire; in that case, the mean absolute deviation for the two groups is very different. It is really big for the first group and much smaller for the second group.*

4. How can you use statistics to make a prediction about a large group?

Sample Response: *Use random sampling—that is, select some members of the group so that everyone has an equal chance of being selected—and gather data about the sample. Then use the characteristics of the sample to make predictions about the larger group. The precision of the prediction depends on the size of the sample.*

Extension Activities

1. Developing a deeper understanding about basic statistics.

- A. Create multiple sets with the same mean but different absolute mean deviations.

Sample:

{10, 20, 80, 90}, {5, 10, 15, 170}, and {48, 49, 51, 52}

The mean for each of the three sets above is 50, but the absolute mean deviations are 35, 60, and 1.5, respectively. As plain sets, these statistics may not hold much meaning for students, but if the amounts represent the salaries (in thousands) of four employees at a company, students may find it interesting that all four groups appear to receive similar salaries, if the mean is the only statistic used to describe them.

2. Developing a deeper understanding of how random sampling works.

- A. Divide the class into groups, and compare some statistics for each group with the same statistics for the entire class.

Sample:

Randomly divide the class into three groups: four students in group A, and then the remaining students divided equally in two groups, B and C. (Be sure the division is random by choosing names from a hat.) Have students determine the mean height of all members in their group. Then compare those results with the mean height for the entire class. The mean height for groups B and C should give a reasonable approximation for the class mean, but group A may not.

- B. Selectively divide the class into groups, and compare some statistics for each group with the same statistics for the entire class.

Sample:

Choose a group of five students who are very tall based on a related characteristic—for example, basketball players—to form a sample. Determine the mean height of all members in the group, and compare their mean height with the mean height for the entire class. Because the sample was not selected randomly and was in fact based on a characteristic related to the characteristic being measured (playing basketball and height), the group's mean height is not a good predictor of the mean height for the entire class.

3. Incorporating probability.

- A. Have students answer a probabilistic question based on the data.

Samples:

- If you randomly select one boy and one girl, what is the probability the boy's name is longer?
- What is the probability the girl's name is longer?
- What is the probability their names are the same length?

These questions can be answered by creating a table to show all the possibilities such as the one on the next page. The top row shows the length of each boy's name, and the left-most column shows the length of each girl's name. The cells containing 1s show the pairs with longer boy's names, the cells with 0s show the pairs with longer girl's names, and the cells with Ns show the pairs with equal-length names.

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	5	6	6	7	7	7	9	10	10	11
2	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1
5	N	1	1	1	1	1	1	1	1	1
8	0	0	0	0	0	0	1	1	1	1
9	0	0	0	0	0	0	N	1	1	1
10	0	0	0	0	0	0	0	N	N	1
10	0	0	0	0	0	0	0	N	N	1
11	0	0	0	0	0	0	0	0	0	N
11	0	0	0	0	0	0	0	0	0	N
12	0	0	0	0	0	0	0	0	0	0

4. Putting it all together by doing a statistics project that involves collecting data, analyzing data, and presenting results using appropriate displays. This activity is DOK 4.

Sample:

Have students collect data on a question of interest to them. This can be categorical data, such as ranking two or three current movies, or numerical data, such as lengths of leaves on a certain type of plant. They can collect data using an appropriate method, such as surveying a sample of students in the school or measuring the leaves from a sample population of the plants. Discuss how to avoid bias in the sample (using a random selection process or at least avoiding a process based on a characteristic relevant to the characteristic being measured). Once students have collected the data, have them calculate appropriate summary statistics and create an appropriate data display. Students can include the statistics and the display in a report that summarizes the results of the study.