4 Interpret Data

Overview and Connection to Culminating Project

By now, students have had a fair amount of practice with finding measures of center (median and mean) and finding five-number summaries to construct box plots. In this Learning Task, students apply their statistical skills in order to compare their class data to a national data set. Depending on how the task is implemented, time, and resource availability, students will have the chance to practice real research skills and use technology software (spreadsheets) to handle larger sets of data. (Note: If you are unable to access national data, have students can compare their data to other classes in their school.)

Learning Objectives

Students will be able to

- **Calculate mean, median, range, five-number summaries, and interquartile range.**
- **Describe, interpret, draw conclusions from, and compare the distribution (central tendency and variability) of data sets.**
- **Represent data using dot plots and box plots.**
- **Understand that data sets can have similar centers but different variability.**
- **Describe typical cases, distinguishing between what different measures of central tendency indicate about data.**

Driving Questions

- **How are we the same and different from other sixth grade students around the country?**
- **What factors might account for those similarities or differences?**
- **How do we evaluate online data to compare to our class data?**
- **How can we "see" ourselves in data displays?**

Assessment

Check for Understanding • Compare Data Sets

Timeline

Lesson 1 • Talk Like a Statistician

Lesson 2 • How Do We Compare?: Part I

Lesson 3 • How Do We Compare?: Part II

Check for Understanding • Compare Data Sets

Materials, Supplies, and Technology

- **Computers with internet access if available**
- **In addition to productivity software such as Excel or free online graphing calculators like Desmos, students will have an opportunity to use search engines to find national data. Students will also formulate a data query for the Census at School website.**
- **http://www.amstat.org/censusatschool/about.cfm (to create a sample data set for students; if you are unable to access national data, create a sample based on data from other classes in the school)**
- **https://tuvalabs.com/**
- **Copies of Check for Understanding • Compare Data Sets (see Handouts and Assessments)**
- **Copies of Group Preview • Transportation Statistics (see Handouts and Assessments)**
- **Copies of Individual Performance Task • Transportation Statistics (see Handouts and Assessments)**

LESSON 1

TALK LIKE A STATISTICIAN

WARM-UP

Word Wall

- **Have students read an article or watch a video as a class (like the ones in the Math Curricular Connection Suggestions).**
- **Update the Statistics Word Wall to include *spread, peak, cluster, gap, outlier, skew*.**

> - **You will read an article or watch a video as a class.**
> - **Update Statistics Word Wall to include *spread, peak, cluster, gap, outlier, skew*.**

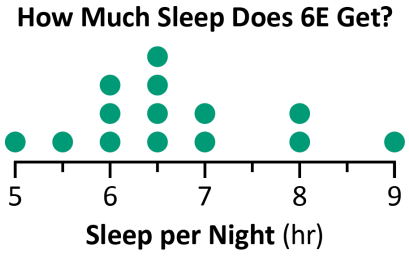
STUDENT EDITION

- **Remind students to update their Sleep Log.**

PROJECT ACTIVITY

Describe Distributions

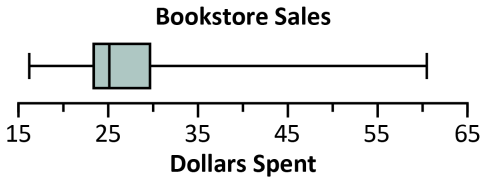
- **Have students use the words from the Statistics Word Wall to complete the activity in the Student Edition.**

> **For each graph below, describe the distribution (central tendency and variability). Use words from the Statistics Word Wall. Then explain what your description means in context, or real life.**
>
> **1.**
>
> 
>

STUDENT EDITION

Describe the central tendency using the words of statisticians.	Describe the central tendency in context.
Answers will vary. Example: *The median is 6.5.* *The mean is approximately 6.7.*	*Answers will vary. Example:* *All students slept around 5–9 hours.* *Half of all students slept more or less than 6.5 hours.* *Most students slept 6–7 hours.*
Describe the variability using the words of statisticians.	**Describe the variability in context.**
Answers will vary.	*Answers will vary.*

2.



Describe the central tendency using the words of statisticians.	Describe the central tendency in context.
Answers will vary.	*Answers will vary.*
Describe the variability using the words of statisticians.	**Describe the variability in context.**
Answers will vary.	*Answers will vary.*

3. Use your sleep data to create a dot plot and a box plot. Describe them below.

Describe the central tendency using the words of statisticians.	Describe the central tendency in context.
Answers will vary.	*Answers will vary.*
Describe the variability using the words of statisticians.	**Describe the variability in context.**
Answers will vary.	*Answers will vary.*

STUDENT EDITION

Math Curricular Connections Suggestions

Stat Trek: How to Describe Data Patterns in Statistics
Khan Academy: Describing Data

LESSON 2

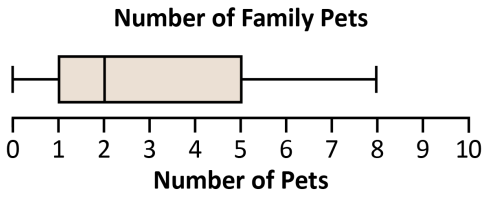
HOW DO WE COMPARE?: PART I

WARM-UP

Interpret Box Plots

- **Have students work on the warm-up activity in their Student Edition.**

The box plot below represents the number of pets per family for students in a sixth-grade class.



1. **Is it possible to know from this graph how many families have exactly 2 pets? Explain why or why not.**

   No, you do not know from the graph. The graph tells you that 50% of the families hav 2 pets or more and 50% of the families have 2 pets or fewer.

2. **Determine whether these statements are true or false. Justify your answers.**

   a. **Some families have 0 pets, some families have 8 pets, and some families have between 0–8 pets.**

      True — the range of the data is from 0 to 8.

   b. **Most of the families have 2 pets.**

      False — you do not know from the box plot. The box plot tells you that 50% of the families have 2 pets or more and 50% of the families have 2 pets or fewer but doe not tell you how many families have 2 pets.

   c. **About $\frac{1}{4}$ of the families have 5 or more pets.**

      True. The fourth quartile which represents one-fourth of the data begins at 5.

   d. **Most of the families have 5 or more pets.**

      False. Only one-fourth of the families have 5 pets or more.

STUDENT EDITION

- **Remind students to update their Sleep Log.**

PROJECT ACTIVITY

How Do We Compare to Others across the Country?

- **You will need to prepare a sample data set for students to use as a comparison. Go to http://ww2.amstat.org/censusatschool/RandomSampleForm.cfm and select a sample size of 25 from All States, Grade Level 6, All Genders, for All Data Collection Years to generate this data set.**
- **Encourage each team to choose a different statistical question to compare in order to make the presentations more varied.**

In building your Class Profile, your team has collected and analyzed data about your class using your own survey questions, Sleep Log, and the Census at School Questionnaire. Now you will see how your data compares with that of other sixth graders across the country. Your teacher has generated a random sample of data from 25 sixth graders across the United States.

For this Learning Task, your team will

a. **Choose a statistical question for which you have numerical class data and national data.**
b. **Calculate the mean and five-number summary for your class data.**
c. **Create a box plot to represent your class data.**
d. **Calculate the mean and five-number summary for the national data.**
e. **Create a box plot to represent the national data.**
f. **Compare and contrast the data sets. (Remember to compare both central tendencies and variability. Use your statistics vocabulary words.)**

Note that you will have a chance to finish this activity in the next lesson.

1. **Statistical question:**
   Answers will vary.
2. **Complete the table below.**

	Class Data	National Data
Mean	***Answers will vary.***	
Five-Number Summary		

3. **Class data box plot:**

Answers will vary.

STUDENT EDITION

4. **National data box plot (make sure to use the same scale as in the class data box plot):**

Answers will vary.

5. **Use the table below to compare and contrast the data sets. Use statistics vocabulary.**

	Class Data	National Data
Central Tendency Differences	*Answers will vary.*	
Variability Differences		
Central Tendency Similarities		
Variability Similarities		

6. **What observations can you make about how your class compares with the national data? Is there anything typical about your class? Do you notice anything unique to your class? What reasons do you think there might be for any differences?**

Answers will vary.

STUDENT EDITION

Math Curricular Connections Suggestions

Engage NY: Box plot activities
Khan Academy: Box plots
Learnzillion: Data distributions
Learnzillion: Analyzing data
NCTM Illuminations: Box Plot tool

LESSON 3

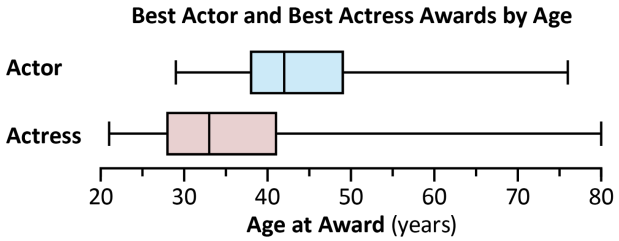
HOW DO WE COMPARE?: PART II

WARM-UP

Compare Box Plots

- **Have students work on the warm-up activity in their Student Edition.**

The box plots below summarize the ages of leading actress and leading actor Academy Award winners.



(Source: http://en.wikipedia.org/wiki/List_of_Best_Actor_winners_by_age_at_win https://en.wikipedia.org/wiki/List_of_Academy_Award_Best_Actress_winners_by_age)

1. **Which has a bigger range—the ages of best actors or best actresses? Or, is it not possible to tell from this graph?**

   Yes, you can tell from the box plot. The actresses have a range from about 21 to 80, while the actors have a range of about 28 to 77.

2. **Give evidence that supports the claim that it is harder for an older actress to win an Academy Award than it is for an older actor.**

   The oldest 25% of the actors are from about 50 to 77, while the oldest 25% of the actresses are from about 42 to 80. So, more actors are over 50 when they win the award.

STUDENT EDITION

- **Remind students to update their Sleep Log.**

PROJECT ACTIVITY

How Do We Compare to Others across the Country?

- **Have students complete their work comparing the class data set to the national data set.**

1. **Continue to work on the class versus national data comparison from the previous lesson.**

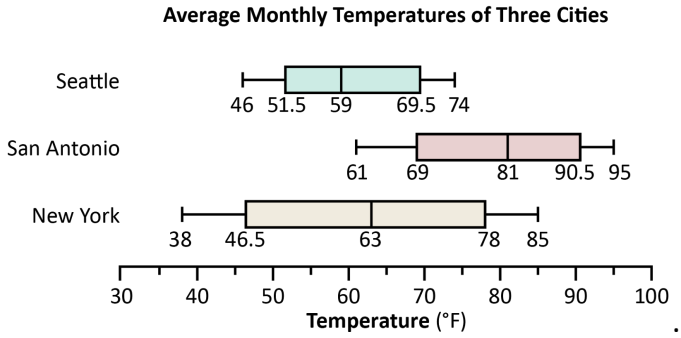
STUDENT EDITION

CHECK FOR UNDERSTANDING

Compare Data Sets

- **Distribute the Learning Task 4 assessment: Check for Understanding • Compare Data Sets**

The box plots below show the distribution of three cities' average monthly temperatures.



Kari and Jack disagree about which city is coldest. Kari says that Seattle is coldest, but Jack insists that New York is coldest.

1. **Provide evidence that supports Kari's claim.**
   Kari's claim could be based on the fact that the median temperature in Seattle is 59, while the median temperature in San Antonio is 81 and the median temperature in New York is 63.
2. **Provide evidence that supports Jack's claim.**
   Jack's claim could be based on the fact that about 25% of New York's temperatures are between 38 and 46.5, while Seattle's lowest temperature is 46.
3. **Who do you agree with? Why?**
   Answers will vary.

HANDOUTS AND ASSESSMENTS

Math Curricular Connections Suggestions

Khan Academy: Data and statistics
Learnzillion: Data distributions
Learnzillion: Analyzing data
NCTM Illuminations: Box Plot tool

CULMINATING PROJECT

CLASS PROFILE

PROJECT ACTIVITY

Work on the Culminating Project

- **Give student teams time to finish their Class Profile Culminating Project. Refer them to the rubric and checklist in Learning Task 1. Students should make sure that they have completed all the items on the checklist, and have assessed their project using the rubric. Then have students present their comparison of their class to sixth graders across the nation through presentations or a gallery walk.**

> - **Finish your work on the Class Profile Culminating Project. Make sure you have completed all the items on the Class Profile Culminating Project checklist and assessed your project using the rubric (both the checklist and rubric are from Learning Task 1, Lesson 1).**
>
> STUDENT EDITION

INDIVIDUAL PERFORMANCE TASK (including a Group Preview)

- **Arrange students in groups and have them work on the Group Preview (see Handouts and Assessments). An answer key for the Group Preview is found in the Overview section of this Teacher Edition. If you feel it would be helpful, discuss the Group Preview.**

- **Then administer the Individual Performance Task (see Handouts and Assessments). A rubric and answer key are provided in the Overview section of this Teacher Edition.**