



WHAT IS A STATISTICAL QUESTION?

TEACHER VERSION

Subject Level:

Middle School Math

Grade Level:

6

Approx. Time Required:

60-75 minutes

Learning Objectives:

- Students will be able to distinguish between statistical questions and other types of questions.
- Students will be able to formulate and answer their own statistical questions, drawing conclusions based on those answers.
- Students will be able to understand the concept of variability within a data set.

Activity Description

Students will identify which questions about a data set are statistical questions and which are not. Then they will generate, answer, and draw conclusions from their own statistical questions.

Suggested Grade Level:

6

Approximate Time Required:

60-75 minutes

Learning Objectives:

- Students will be able to distinguish between statistical questions and other types of questions.
- Students will be able to formulate and answer their own statistical questions, drawing conclusions based on those answers.
- Students will be able to understand the concept of variability within a data set.

Topic:

- Statistical questions

Skills Taught:

- Creating statistical questions
 - Identifying statistical questions
-

Materials Required

- The student version of this activity, 10 pages

Activity Items

The following items are part of this activity. The items, their sources, and any relevant instructions for viewing them online appear at the end of this teacher version.

- Item 1: Radio Set Ownership Map
- Item 2: Map of U.S. Regions and the Land Areas of the 50 U.S. States and District of Columbia

For more information to help you introduce your students to the U.S. Census Bureau, read "[Census Bureau 101 for Students](#)." This information sheet can be printed and passed out to your students as well.

Standards Addressed

See charts below. For more information, read

["Overview of Education Standards and Guidelines Addressed in Statistics in Schools Activities."](#)

Common Core State Standards for Mathematics

Standard	Domain	Cluster
<p>CCSS.MATH.CONTENT.6.SP.A.1</p> <p>Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.</p>	<p>6 SP - Statistics & Probability</p>	<p>Develop understanding of statistical variability.</p>

Common Core State Standards for Mathematical Practice

Standard

CCSS.MATH.PRACTICE.MP1. Make sense of problems and persevere in solving them.

Students will examine census data to create and answer their own statistical questions.

CCSS.MATH.PRACTICE.MP3. Construct viable arguments and critique the reasoning of others.

Students will share their questions, explain why they are good statistical questions, and critique each other’s reasoning.

National Council of Teachers of Mathematics’ Principles and Standards for School Mathematics

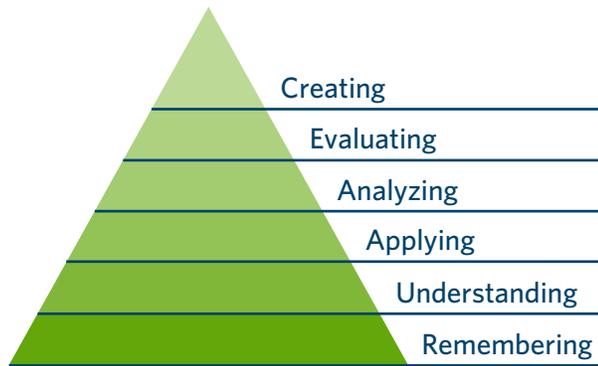
Content Standard	Students should be able to:	Expectation for Grade Band
Data Analysis and Probability	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population.

Guidelines for Assessment and Instruction in Statistics Education

GAISE	Level A	Level B	Level C
Formulate Questions		X	
Collect Data			
Analyze Data		X	
Interpret Results		X	

Bloom's Taxonomy

Students will **apply** what they know about statistical questions and **analyze** questions to determine whether they are statistical.



Teacher Notes

Before the Activity

Students must understand the following key terms:

- **Statistical question** – a question that can be answered by collecting data and that anticipates variability in those data
- **Statistics** – the science of collecting, reviewing, and analyzing data

Students should have a basic understanding of the following concept:

- Categorical data (e.g., colors, ice cream flavors) are different from numerical data (e.g., heights, weights, measures of time).

During the Activity

Teachers will ask students what makes a good statistical question and lead a discussion about their responses. Teachers should help students understand that there are two main features of statistical questions: that they can be answered by collecting data and that there will be variability in those data.

Teachers should closely monitor students as they complete the activity, stopping the class after each part to lead a discussion about the answers. It is especially important that teachers reveal the correct answers to the questions in part 1 so that students can complete parts 2 and 3 successfully.

Teachers should understand that part 4 is optional because it extends well beyond recognizing statistical questions; however, teachers may find that it is appropriate for advanced students. If teachers do decide to include part 4, which adds 10–15 minutes to the total activity time, they may want to make sure each student has a straight edge to read the data across years.

After the Activity

Teachers will have students share their questions from part 3 with the class, encouraging them to explain why they are good statistical questions and to critique each other's reasoning.

Extension Ideas

- Teachers could have students choose a topic that interests them, formulate statistical questions about that topic, and collect and analyze their own data.
- To adapt this activity to GAISE Level A, teachers could:
 - Create the questions for part 3 that students must determine are or are not statistical.
 - Create nonstatistical questions that students must turn into statistical questions for part 3.

Student Activity

Click [here](#) to download a printable version for students.

Activity Items

The following items are part of this activity and appear at the end of this student version.

- Item 1: Radio Set Ownership Map
- Item 2: Map of U.S. Regions and the Land Areas of the 50 U.S. States and District of Columbia

Student Learning Objectives

- I will be able to distinguish between statistical questions and other types of questions.
- I will be able to formulate and answer my own statistical questions, drawing conclusions based on those answers.
- I will be able to understand the concept of variability within a data set.

A statistical question is a question that can be answered by collecting data that vary. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question. This is because to answer the second question, you would need to determine the ages of all students in your school and there would be variability in those data (since not all students are the same age).

Part 1 - Determine If Questions Are Statistical

Imagine you want to find out about the height of students in your class using statistics. Read each question below and decide if it is a statistical question. Then explain your answer.

	Question	Is it statistical? (Yes/No)	Explanation
1	How tall are you?	No	The answer is just my height so there is no variability in the data.
2	How tall, in inches, was Marco on his last birthday?	No	The answer is just Marco's height on his last birthday so there is no variability in the data.
3	How tall are the students in your class, in centimeters?	Yes	The students in my class are not all the same height so there would be variability in the data.
4	Is Preston taller than 60 inches?	No	To answer this question, you just have to know Preston's height, so there is no variability in the data.
5	How do the heights of the students in your class compare with the heights of all sixth-graders in your school?	Yes	To answer this question, you would need to know the heights of all the students in my class and the heights of all the sixth-graders in the school, so there would be variability in the data.
6	How do the heights of the sixth-graders in your school compare with the heights of the seventh-graders in your school?	Yes	To answer this question, you would need to know the heights of all the sixth-graders and the heights of all the seventh-graders in our school, so there would be variability in the data.
7	How do the heights of the sixth-graders in your school compare with the heights of sixth-graders in a school in another country?	Yes	To answer this question, you would need to know the heights of all the sixth-graders in the school and the heights of all the sixth-graders in a school in another country, so there would be variability in the data.

Part 2 – Look at Data and Statistical Questions

- Review **Item 1: Radio Set Ownership Map**, which shows the percentage of families that owned a radio in each U.S. state in 1930, and record any observations about the data.

Student answers will vary but could include: Northern states had higher percentages of families with radios than southern states in 1930.

- Determine which questions in the table below are statistical and if they could be answered using the data in **Item 1**. (You don’t have to actually find the answers to the questions!)

	Question	Is it statistical? (Yes/No)	Could it be answered with data from Item 1? (Yes/No)	Explanation
1	What percentage of families in Florida had a radio set in 1930?	No	Yes	The answer is just the percentage for Florida from Item 1, so there is no variability in the data.
2	Which region of the United States had the lowest rates of radio set ownership in 1930?	Yes	Yes	To answer this question, you would need to look at the percentage in each state for the different regions in Item 1, so the data would vary.
3	In 1930, how much did the radio ownership rates for different states vary?	Yes	Yes	To answer this question, you would need to look at the percentages of families with radios for all states in Item 1, and there is variability in those data.
4	In 1930, why did a greater percentage of families in California own a radio set compared with families in nearby states?	Yes	No	To answer this question, you would need to look at different reasons that families in California and in other states owned a radio (like how much money they have), and there would be variability in those data. However, this question could not be answered using data from Item 1 because those data are not shown.

Part 3 - Write Your Own Statistical Questions

Use **Item 2: Map of U.S. Regions and the Land Areas of the 50 U.S. States and District of Columbia**, where states are listed in order from largest to smallest area, to complete the following prompts:

- Write three statistical questions that you could answer using data from **Item 2**.
- Use data from **Item 2** to actually answer each question.
- Explain how you found each answer.
- Draw a conclusion about what your answer means for the larger data set.
- Write a related question for each of your statistical questions (but don't answer this one).

Example

Question: How do the areas of each of the three states on the West Coast vary?

Answer: Washington = 71,298 square miles; Oregon = 98,379 square miles;
California = 163,695 square miles

Explanation: I found these areas by locating each state in the table.

Conclusion: Each of the three states on the West Coast has a different area, ranging from about 71,000 to 164,000 square miles.

Related Question: How do the areas of the states on the West Coast compare with the areas of the states on the East Coast?

Student responses below will vary.

Question 1:

Answer:

Explanation:

Conclusion:

Related Question:

Question 2:

Answer:

Explanation:

Conclusion:

Related Question:

Question 3:

Answer:

Explanation:

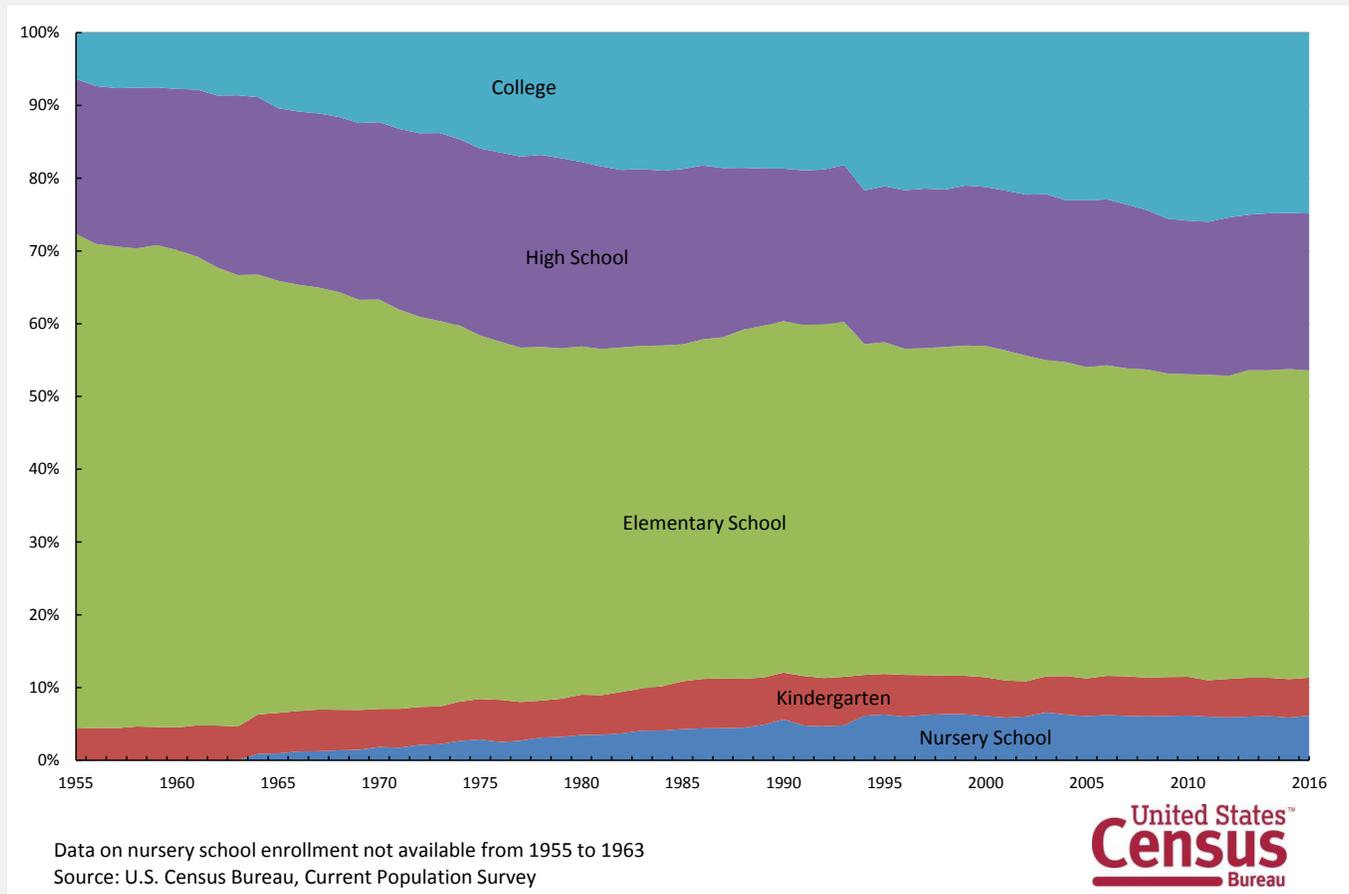
Conclusion:

Related Question:

Part 4 - Draw Conclusions From a Graph (Optional)

The following graph shows the percentages of people aged 3 and older in the United States who were enrolled in school at different levels — ranging from nursery school (pre-K) to college — from 1955 to 2016.

Distribution of School Enrollment of the U.S. Population 3 Years and Older, by Level: 1955 to 2016



www.census.gov/content/dam/Census/library/visualizations/time-series/demo/school-enrollment/Figure%20A-1_2016.pdf

1. Examine the graph and write down any observations about the data or the graph.

Student answers will vary but could include:

- **The percentage of people attending college increased overall.**
 - **The college enrollment rate spiked in the early 1990s.**
 - **The percentage of people enrolled in high school stayed about the same overall.**
 - **The percentage of people in nursery school/pre-K increased.**
 - **All the different-colored bands added together make 100 percent.**
 - **The graph does not show the actual numbers of people enrolled in school at the various levels.**
 - **It appears that no one went to nursery school before about 1963, or maybe the nursery school data just weren't collected before that year.**
2. Write a statistical question that can be answered using data in the graph, answer your question, explain how you found the answer, and write a concluding statement about your answer:

Student responses below will vary.

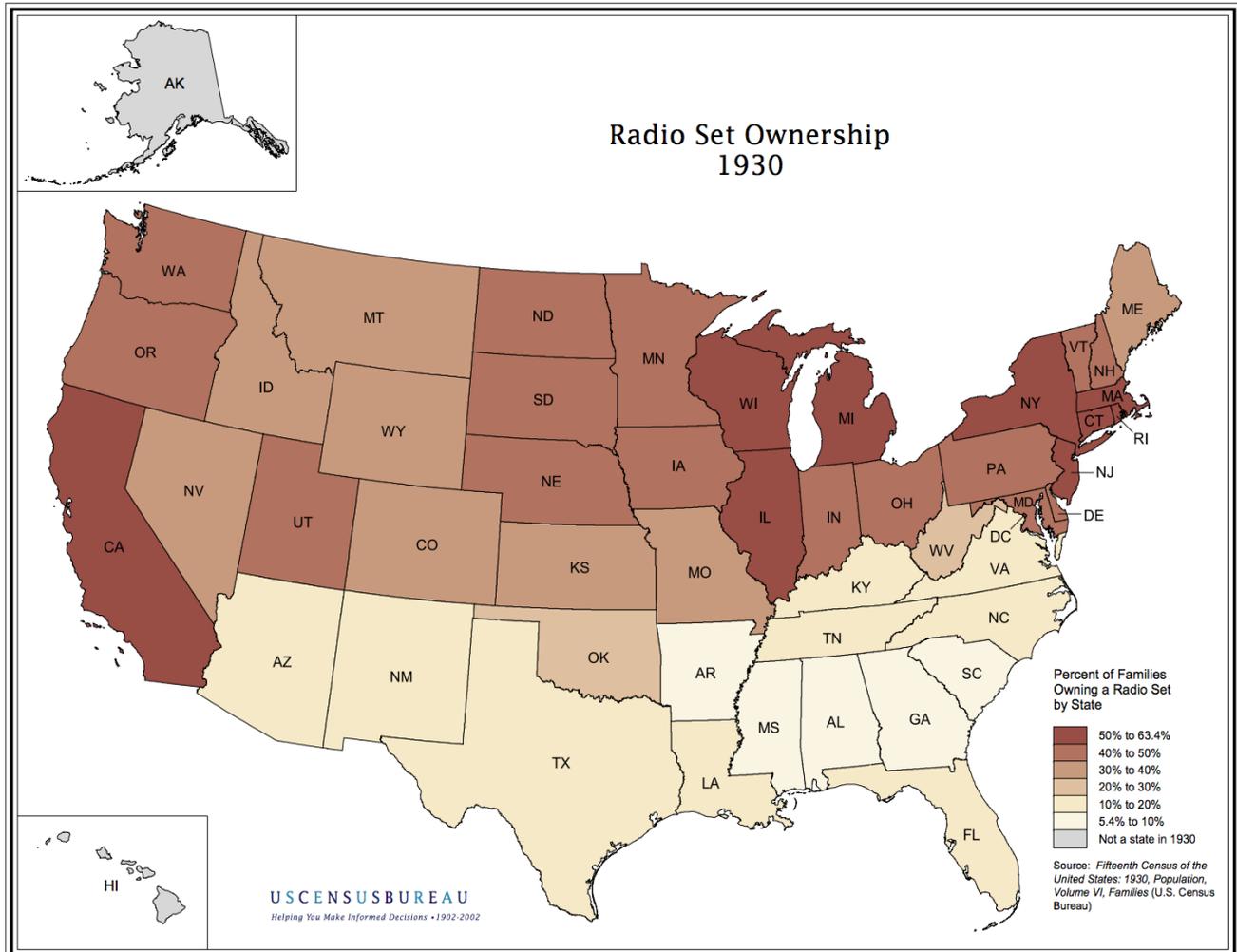
Question:

Answer:

Explanation:

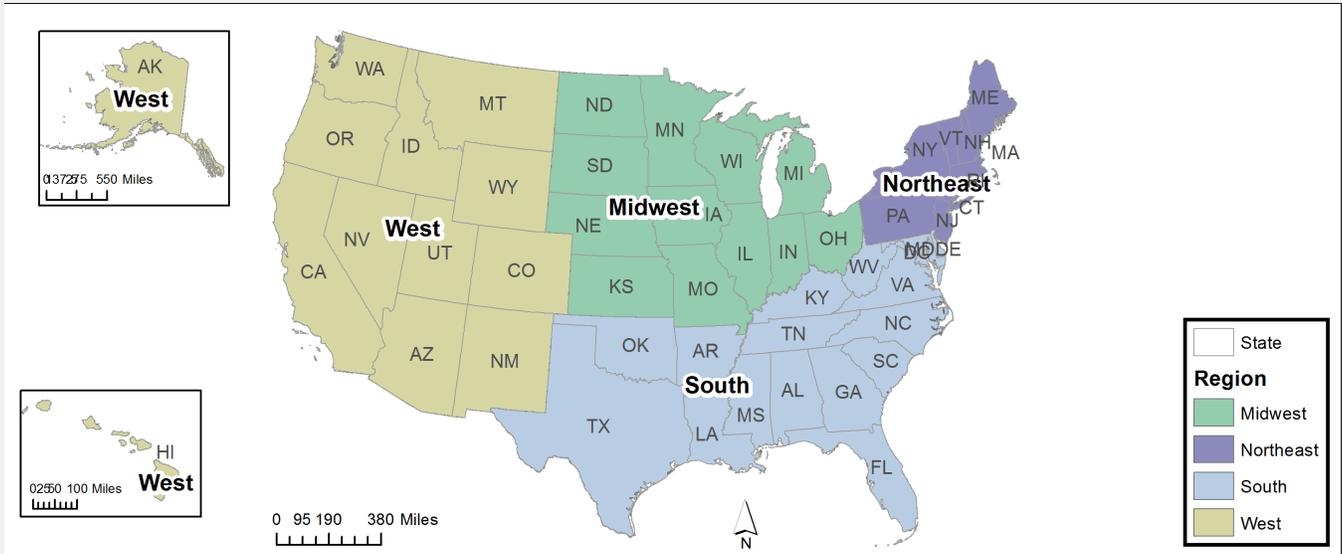
Conclusion:

Item 1: Radio Set Ownership Map



www2.census.gov/geo/pdfs/maps-data/maps/thematic/housing/radios.pdf

Item 2: Map of U.S. Regions and the Land Areas of the 50 U.S. States and District of Columbia



https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

Item 2: Map of U.S. Regions and the Land Areas of the 50 U.S. States and District of Columbia (Continued)

State	Area in Square Miles
United States ¹	3,796,742
Alaska	665,384
Texas	268,596
California	163,695
Montana	147,040
New Mexico	121,590
Arizona	113,990
Nevada	110,572
Colorado	104,094
Oregon	98,379
Wyoming	97,813
Michigan	96,714
Minnesota	86,936
Utah	84,897
Idaho	83,569
Kansas	82,278
Nebraska	77,348
South Dakota	77,116
Washington	71,298
North Dakota	70,698
Oklahoma	69,899
Missouri	69,707
Florida	65,758
Wisconsin	65,496
Georgia	59,425
Illinois	57,914

State	Area in Square Miles
Iowa	56,273
New York	54,555
North Carolina	53,819
Arkansas	53,179
Alabama	52,420
Louisiana	52,378
Mississippi	48,432
Pennsylvania	46,054
Ohio	44,826
Virginia	42,775
Tennessee	42,144
Kentucky	40,408
Indiana	36,420
Maine	35,380
South Carolina	32,020
West Virginia	24,230
Maryland	12,406
Hawaii	10,932
Massachusetts	10,554
Vermont	9,616
New Hampshire	9,349
New Jersey	8,723
Connecticut	5,543
Delaware	2,489
Rhode Island	1,545
District of Columbia	68

¹ Includes all 50 states and the District of Columbia.

<https://www.census.gov/geographies/reference-files/2010/geo/state-area.html>

Click on the link above to view the 2010 source data online.