Mathematics Reasoning Across Subject Areas

Summarizing and Analyzing Data

Webinar Activity Book

Institute for the Professional Development of Adult Educators

SUMMARIZING AND ANALYZING DATA

Mathematics Reasoning Across Subject Areas

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ABE Mathematics Domains Addressed

Below are the Mathematics Domains addressed by this webinar. All the sections highlighted in yellow are the major components in the domains addressed by focusing on Summarizing and Analyzing Data.

ADULT BASIC EDUCATION MATHEMATIC DOMAINS					
Domain Number	**NRS Reporting** **Grade Equivalent (GE)**	**NRS Level 1** **0.0 – 1.9**	**NRS Level 2** **2.0 – 3.9**	**NRS Level 3** **4.0 – 5.9**	**NRS Level 4** **6.0 – 8.9**
1	Number and Operations: Base Ten	0.0 – 1.9	2.0 – 3.9	4.0 – 5.9	
2	Operations and Algebraic Thinking	0.0 – 1.9	2.0 – 3.9	4.0 – 5.9	
3	Measurement and Data	0.0 – 1.9	2.0 – 3.9	4.0 – 5.9	
4	Geometry	0.0 – 1.9	2.0 – 3.9	4.0 – 5.9	6.0 – 8.9
5	Number and Operations: Fractions		*3.0 – 3.9	4.0 – 5.9	
6	Expressions and Equations			4.0 – 5.9	6.0 – 8.9
7	The Number System			4.0 – 5.9	6.0 – 8.9
8	Ratios and Proportional Relationships			4.0 – 5.9	6.0 – 8.9
9	Statistics and Probability			4.0 – 5.9	6.0 – 8.9
10	Functions				*7.0 – 8.9

Standards of Mathematical Practices Addressed

Below are the Standards of Mathematical Practice addressed by this webinar. MP's 2, 3, 4, 5, 6, 7 and 8 are the practices addressed by focusing on Summarizing and Analyzing Data in classroom lessons.

Reason abstractly and quantitatively. (MP.2)

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

Construct viable arguments and critique the reasoning of others. (MP.3)

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. Less experienced 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. Later, students learn to determine domains to which an argument applies. Students at all levels can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Model with mathematics. (MP.4)

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. This might be as simple as writing an addition equation to describe a situation. A student might apply proportional reasoning to plan a school event or analyze a problem in the community. A student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Use appropriate tools strategically. (MP.5)

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

Attend to precision. (MP.6)

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. Less experienced students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Look for and make use of structure. (MP.7)

Mathematically proficient students look closely to discern a pattern or structure. Students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 x 8 equals the well-remembered 7 x 5 + 7 x 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, students can see the 14 as 2 x 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Look for and express regularity in repeated reasoning. (MP.8)

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Early on, students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, students might abstract the equation (y – 2) (x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1) (x + 1), (x – 1) $(x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.*

*Pimentel (2013). *College and Career Readiness Standards for Adult Education*, U.S. Department of Education, Office of Vocational and Adult Education. Washington, DC.

GED Science Practice Addressed

Below are the GED Science Practices addressed by this webinar. SP's 1, 2, 4, 5, and 8 are the practices fully addressed by focusing on Summarizing and Analyzing Data in classroom lessons. SP's 3, 6 and 7 are partially addressed.

SCIENCE PRACTICES
SP.1 Comprehending Scientific Presentations SP.1.a. Understand and explain textual scientific presentations SP.1.b. Determine the meaning of symbols, terms and phrases as they are used in scientific presentations SP.1.c. Understand and explain a non-textual scientific presentations
SP.2 Investigation Design (Experimental and Observational) SP.2.a. Identify possible sources of error and alter the design of an investigation to ameliorate that error SP.2.b. Identify and refine hypotheses for scientific investigations SP.2.c. Identify the strength and weaknesses of one or more scientific investigation (i, e, experimental or observational) designs SP.2.d. Design a scientific investigation SP.2.e. Identify and interpret independent and dependent variables in scientific investigations
SP.3 Reasoning from Data SP.3.a. Cite specific textual evidence to support a finding or conclusion. SP.3.b. Reason from data or evidence to a conclusion. SP.3.c. Make a prediction based upon data or evidence.

SP.3.d. Using sampling techniques to answer scientific questions.
SP.4 Evaluating Conclusions with Evidence SP.4.a. Evaluate whether a conclusion or theory is supported or challenged by particular data or evidence.
SP.5 Working with Findings SP.5.a. Reconcile multiple findings, conclusions or theories.
SP.6 Expressing Scientific Information SP.6.a. Express scientific information or findings visually. SP.6.b. Express scientific information or findings numerically or symbolically. SP.6.c. Express scientific information or findings verbally.
SP.7 Scientific Theories SP.7.a. Understand and apply scientific models, theories and processes. SP.7.b. Apply formulas from scientific theories.
SP.8 Probability & Statistics SP.8.a. Describe a data set statistically. SP.8.b. Use counting and permutations to solve scientific problems. SP.8.c. Determine the probability of events.

GED Reasoning through Language Arts Curriculum Frameworks Addressed

Below are the GED Reasoning through Language Arts Curriculum Frameworks addressed by this webinar.

R.9 & R.7	**Analyze how two or more texts address similar themes or topics.**
R.9.a/R.7.a	Draw specific comparisons between two texts that address similar themes or topics, or between information presented in different formats (e.g., between information presented in text and information or data summarized in a table or timeline).
R.9.b	Compare two passages in a similar or closely related genre that share ideas or themes, focusing on similarities and/or differences in perspective, tone, style, structure, purpose, or overall impact.
R.9.c	Compare two argumentative passages on the same topic that present opposing claims (either main or supporting claims) and analyze how each text emphasizes different evidence or advances a different interpretation of facts.
R.7.b	Analyze how data or quantitative and/or visual information extends, clarifies, or contradicts information in text or determines how data supports an author's argument.
R.7.c	Compare two passages that present related ideas or themes in different genre or formats (e.g., a feature article and an online FAQ or fact sheet) in order to evaluate differences in scope, purpose, emphasis, intended audience, or overall impact when comparing.
R.7.d	Compare two passages that present related ideas or themes in different genre or formats in order to synthesize details, draw conclusions, or apply information to new situations.

Activity 1: Summarizing Data

Think of the simplest way you can organize the data below, showing the length of nails found in a packet of assorted nails.

Length of Nails (mm)								
11	22	29	15	17	27	21	23	27
26	19	16	11	10	16	15	21	21
17	15	23	20	16	17	25	16	21

1. Arrange the numbers in increasing order.

2. Arrange the numbers using a tally table.

Length of Nails	Tally	Length of Nails	Tally

3. Use the tally table to arrange the numbers in the line plot below.

4. Arrange the numbers into a frequency table.

Length of Nails	Frequency

5. Out of the frequency table you created, create a histogram.

6. Summarize the data by creating a box plot.

Activity 2: Using Online Articles as Pre-Activity

Ask students to read the text below prior to introducing various data representation involving wildfires so students can become familiar with the vocabulary words and understand how wildfires spread (specifically the factors impacting the spread of wildfires).

Weather's Role in Wildfires

Wildfires can produce winds that are 10 times stronger than the winds surrounding them.
PHOTO COURTESY BUREAU OF LAND MANAGEMENT

Weather plays a major role in the birth, growth and death of a wildfire. Drought leads to extremely favorable conditions for wildfires, and winds aid a wildfire's progress -- weather can spur the fire to move faster and engulf more land. It can also make the job of fighting the fire even more difficult. There are three weather ingredients that can affect wildfires:

Temperature

Wind

Moisture

As mentioned before, temperature affects the sparking of wildfires, because heat is one of the three pillars of the fire triangle. The sticks, trees and underbrush on the ground receive radiant heat from the sun, which heats and dries potential fuels. Warmer temperatures allow for fuels to ignite and burn faster, adding to the rate at which a wildfire spreads. For this reason, wildfires tend to rage in the afternoon, when temperatures are at their hottest.

Wind probably has the biggest impact on a wildfire's behavior. It also the most unpredictable factor. Winds supply the fire with additional oxygen, further dry potential fuel and push the fire across the land at a faster rate.

Dr. Terry Clark, senior scientist at the National Center for Atmospheric Research, has developed a computer model that shows how winds move on a small scale. Since 1991, he's been converting that model to include wildfire characteristics, such as fuel and heat exchange between fires and the atmosphere.

"We look at what's called coupled fire atmosphere dynamics, where the fire and the atmosphere interact with each other," Clark said. "We've been looking at how fires interact with the environment and getting some of the characteristics of fire spread and fire behavior, through the modeling that we've been doing."

Clark's research has found that not only does wind affect how the fire develops, but that fires themselves can develop wind patterns. When the fire creates its own weather patterns, they can feed back into how the fire spreads. Large, violent wildfires can generate winds, called fire whirls. Fire whirls, which are like tornadoes, result from the vortices created by the fire's heat. When these vortices are tilted from horizontal to vertical, you get fire whirls. Fire whirls have been known to hurl flaming logs and burning debris over considerable distances.

"There's another way that you can tilt the vorticity. That is it can be titled without breaking into fire whirls, and basically be burst forward into what's called hairpin vortices or forward bursts," Clark said. "These are quite common in crown fires [fires at the top of trees], and so you see fires licking up hill sides." Forward bursts can be 20 meters (66 feet) wide and shoot out 100 meters (328 feet) at a speed of 100 mph (161 kph). These bursts leave a scorched region and lead to fire spread.

The stronger the wind blows, the faster the fire spreads. The fire generates winds of its own that are as many as 10 times faster than the ambient wind. It can even throw embers into the air and create additional fires, an occurrence called spotting. Wind can also change the direction of the fire, and gusts can raise the fire into the trees, creating a crown fire.

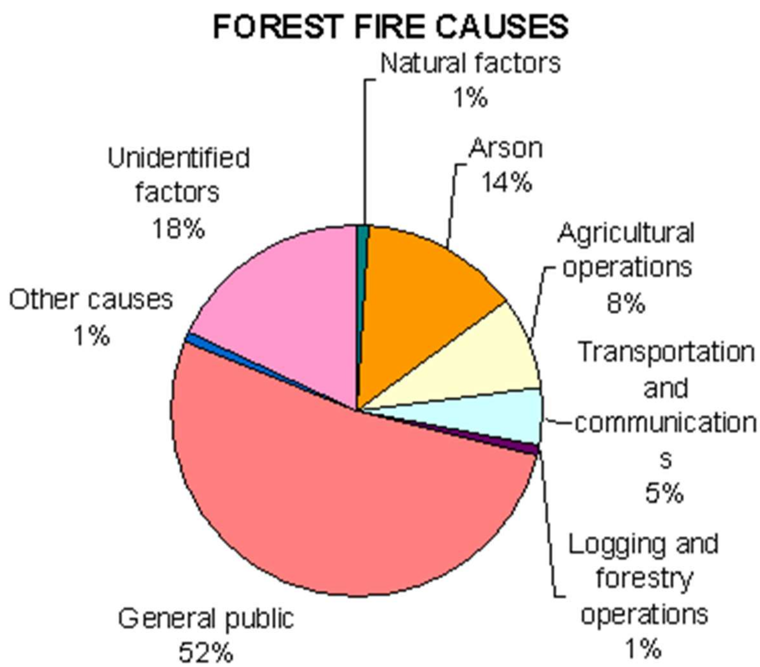
While wind can help the fire to spread, moisture works against the fire. Moisture, in the form of humidity and precipitation, can slow the fire down and reduce its intensity. Potential fuels can be hard to ignite if they have high levels of moisture, because the moisture absorbs the fire's heat. When the humidity is low, meaning that there is a low amount of water vapor in the air, wildfires are more likely to start. The higher the humidity, the less likely the fuel is to dry and ignite.

Since moisture can lower the chances of a wildfire igniting, precipitation has a direct impact on fire prevention. When the air becomes saturated with moisture, it releases the moisture in the form of rain. Rain and other precipitation raise the amount of moisture in fuels, which suppresses any potential wildfires from breaking out.

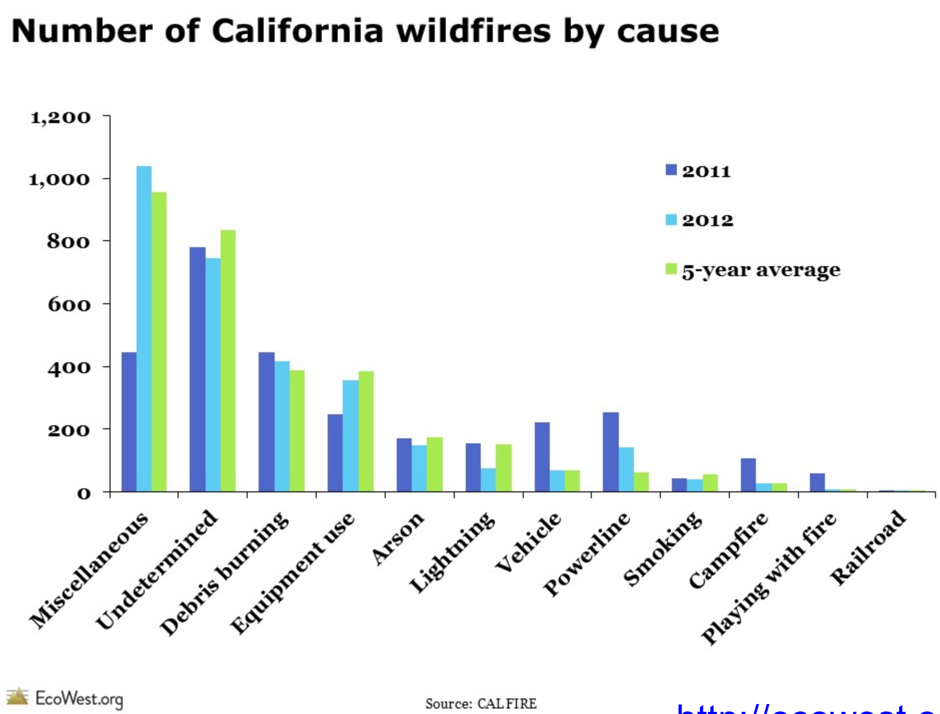
Article Taken From: **https://science.howstuffworks.com/nature/natural-disasters/wildfire2.htm**

Activity 3: Analyzing Data

Generate various questions for students focusing on the two data representations below. Ask students to develop a claim on what they can do to help reduce the occurrence of wildfires in the areas they live or close to where they live.



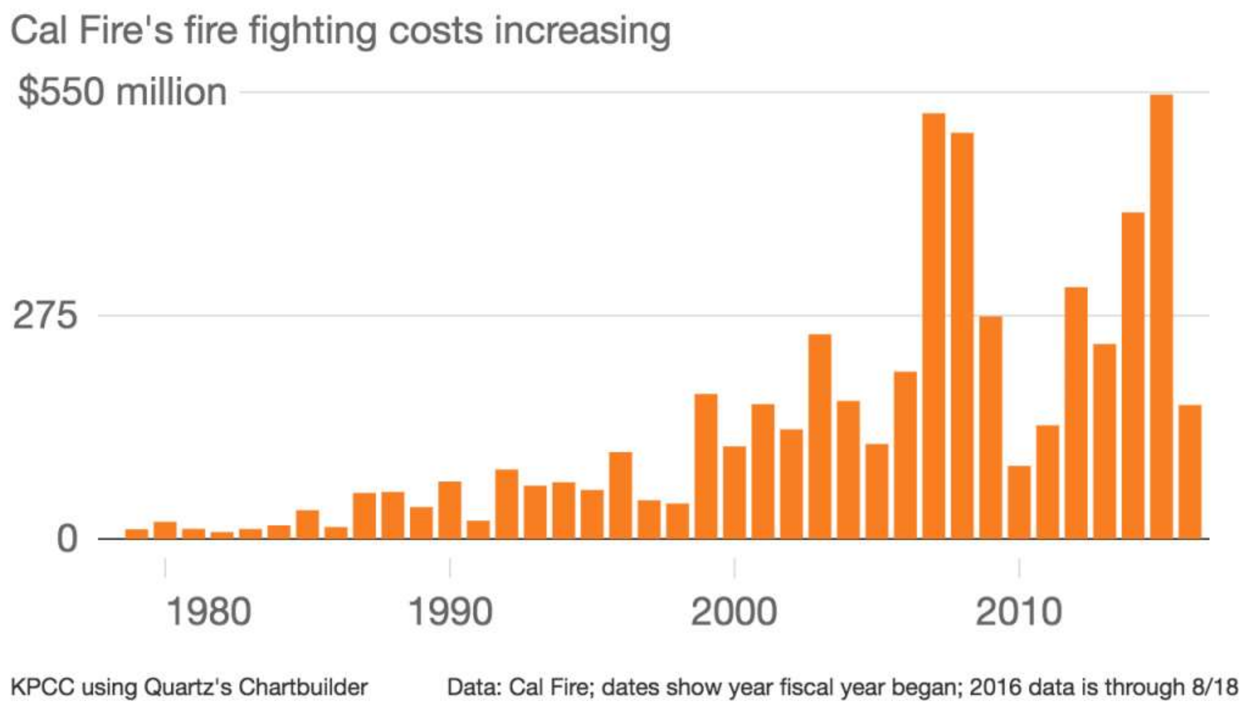
http://esseacourses.strategies.org/module.php?module_id=69



http://ecowest.org/category/wildfires/

Activity 4: Analyzing Data

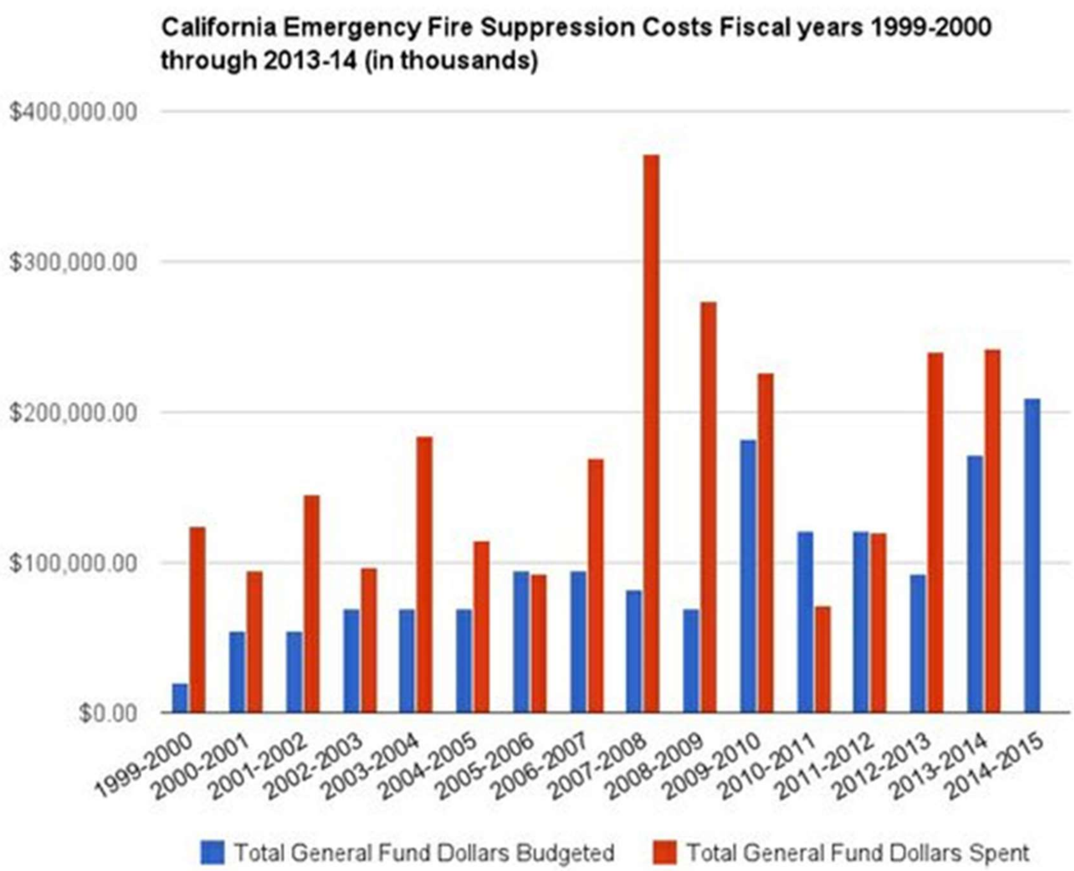
Using the data below, ask students to estimate the mean, median and mode of the data set.



http://www.scpr.org/news/2016/08/19/63757/why-fighting-california-s-wildfires-cost-more-than/

Activity 5: Using Data

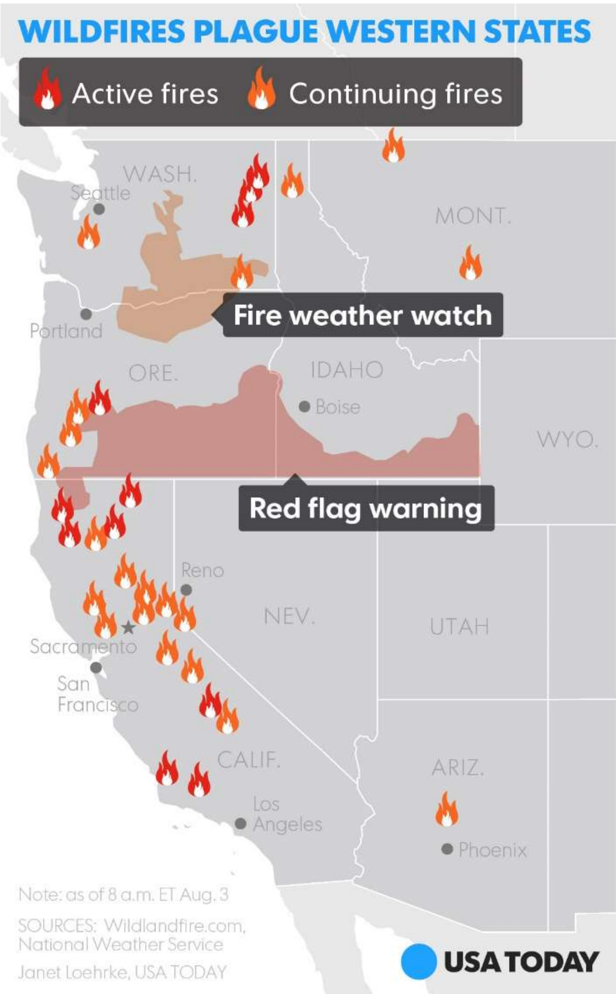
Using the chart below, ask students about what claims can they generate from the information presented. Make sure to ask students to support their claim by using information directly from the chart or cite research/article that they have read related to local government spending on wildfires.



http://www.kpbs.org/news/2014/aug/01/more-25-percent-californias-firefighting-budget-al/

Activity 6: Extending the Lesson into Writing

Using the diagram and picture below, ask students about what claims can they generate. You may ask students to research more about California Wildfires. Make sure to ask students to support their claim by using information directly from the diagram and picture or cite research/article that they have read related to local government spending on wildfires.



http://abcnews.go.com/US/weather-fueled-california-wildfires/story?id=50380169

https://www.mediamatters.org/research/2015/