Don't just use data
Consume, Critique, Care!

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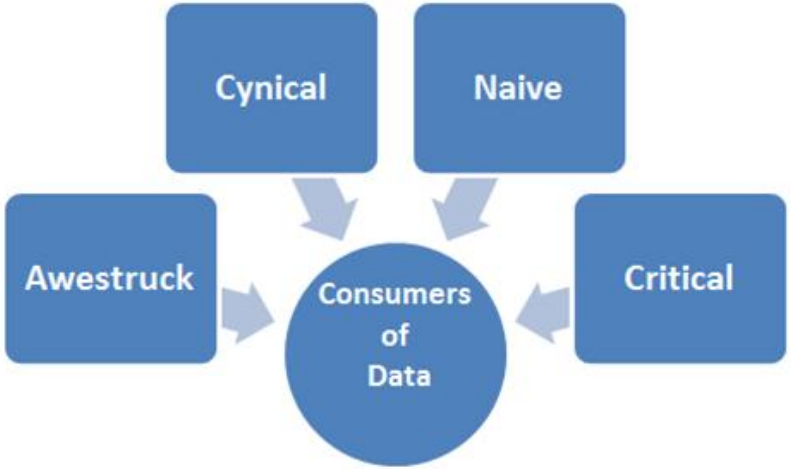
Possible extension activities – Generated by session participants

- Simulate driving using a video game arcade
  - While texting and not texting
- Gather data about reaction times – Try to catch an object (ruler) while texting and not texting
- Blind fold students and ask them to walk around - let other students create obstacles
- Play wii games – record driving time
  - Play wii games; text; Collect data
  - Compare data sets

Data is omnipresent – How do we consume data?



Critical Consumers of Data

- A critical consumer is curious and inquisitive
- Able to ask questions and discern information about data, its collection and analysis methods, and conclusions that are warranted by data

(Joel Best, 2001).

Classroom Connections
Common Core State Standards for Mathematics (CCSSM)

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.
- Use data from a random sample to draw inferences about a population.

Classroom Connections
Guidelines for Assessment in Statistics Educaiton (GAISE) Level B

Data analysis is an investigative process that consists of

- formulating questions,
- collecting appropriate data through various sources (e.g., censuses, nonrandom and random sample surveys)
- analyzing data through graphs and simple summary measures, and
- Interpreting results with an eye toward inference to a population based on a sample.

Background – Text messaging Activity

- Student conversations about texting while driving.
- Teacher's desire to attend to and address student conceptions – Connect data analysis to real-world situation
- This sparked an idea
  - What if we could use texting as the context for a lesson on data analysis?
- Generate a discussion on a socially relevant issue – texting and driving, rooted in a purposeful investigation of data analysis.
  - The activity: Sixth Grade Rocks

Sixth Grade Rocks! – Mathematical Goals

- Generate mock text-messaging data using technology.
- Use statistical representations (e.g., histograms, box-whisker plots) to analyze data and understand the connections between the representations.
- Anticipate potential sources of variations in data; use the concept of variation to explain outliers, gaps, and clusters in data.
- Question the way data was collected, the representations used, and stated conclusions and become critical consumers of data.

Sixth Grade Rocks! – Individual Student Data

Trial 1	Trial 2	Average (rounded to the nearest second)
57	48	53

Sixth Grade Rocks! – Class Data

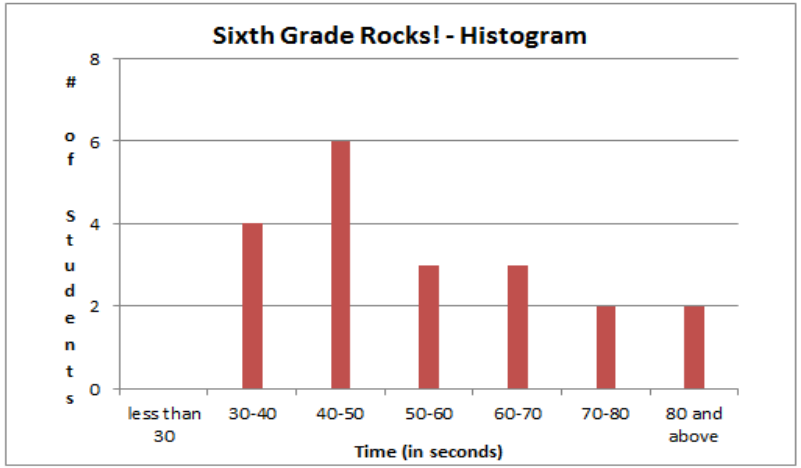
Student	Message Time (rounded to the nearest second)
1	40
2	45
3	57
4	49
5	31
6	33
7	119
8	75
9	83
10	66
11	45
12	32
13	47
14	50
15	41
16	53
17	58
18	80
19	63
20	66

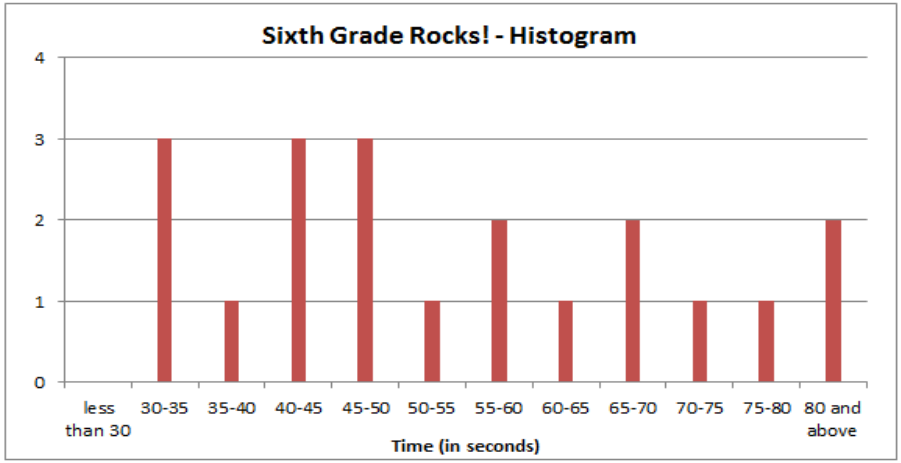
Sixth Grade Rocks! – Consolidated Class Data
Use of Frequency Table

Time Taken	Number of Students
less than 30	0
30-40	4
40-50	6
50-60	3
60-70	3
70-80	2
80 and above	2

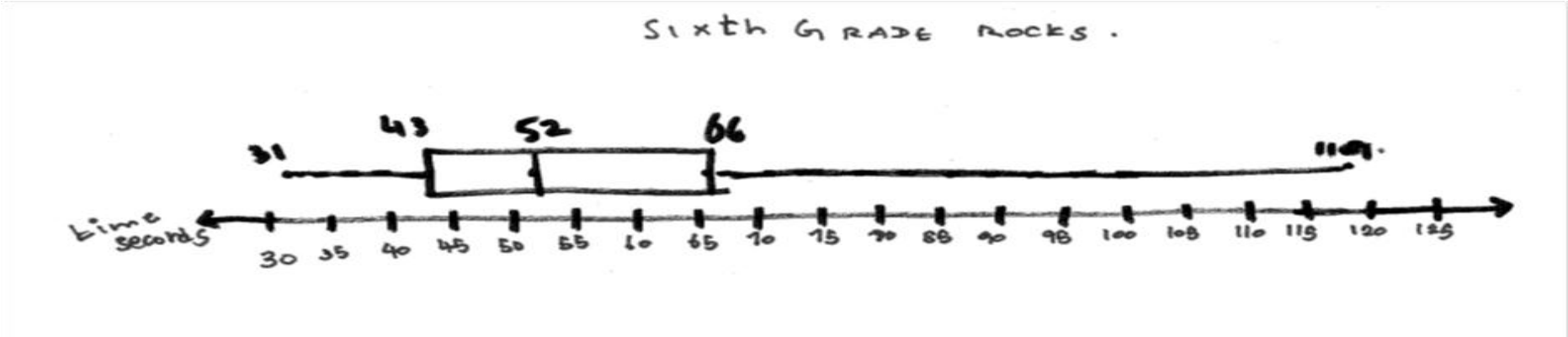
Time Taken	Number of Students
Less than 30	0
30-35	3
35-40	1
40-45	3
45-50	3
50-55	1
55-60	2
60-65	1
65-70	2
70-75	1
75-80	1
Above 80	2

Sixth Grade Rocks! – Consolidated Class Data
Use of Histograms





Sixth Grade Rocks! – Consolidated Class Data
Box-Whisker Plot



Sixth Grade Rocks! – Student Analysis of Representations

- ✓ *From our histogram (the one with interval width 10 seconds) we conclude that many students took 40-50 seconds to type the message. There is one bar that is taller than others – on the right we see many smaller size bars; on the left is only one such bar.*
- ✓ *Our histogram (the one with interval width 5 seconds) has equal sized bars for many time frames. This did not help us. Maybe we should have used a larger interval width like the other group.*
- ✓ *The histograms do not clearly show that one big value – but the box plot does.*
- ✓ *It was difficult to answer the question by looking at the box-plot alone. We also found the mean.*
- ✓ *The mean is 57 – What this says is that on the average it took about 57 seconds for a sixth grader to type the message. But we think this is high because of that one time 119 seconds. If we remove this larger value, then the mean is only 53 and this is close to the median value.*
- ✓ *The median value is useful. If we look at the histogram and the median value, there are about 9 students who had clocked 40-60 seconds.*
- ✓ *There are two modes 45 and 56 – but only two students clocked these two timings.*

Sixth Grade Rocks – Data Interpreatation

- Based on these findings, how long would it take an average sixth grader to type a message?
  - *Analysis of representations*
  - *Descriptive measures: Mean: 57; Median: 52; Mode: 45 & 66*

Sixth Grade Rocks! – A discussion on Variation

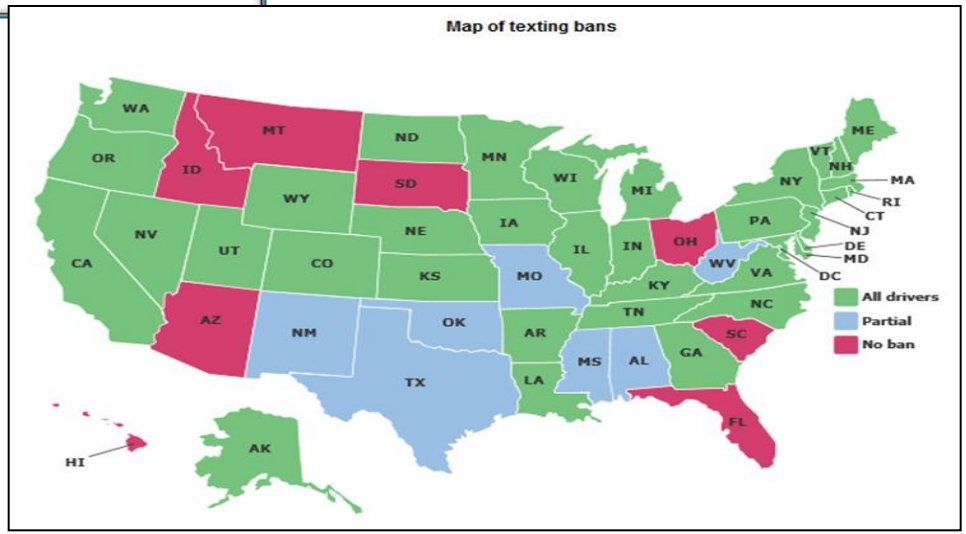
- How long would it take a sixth grader to text this message on a cell phone?
  - *The key board is a lot easier to use – you can use both hands. With the calculator, I used just one hand.*
  - *The phones are smart – they can anticipate your words. The calculator did not.*
  - *The keyboard is familiar – you can type very fast unlike with the calculator.*
  - *People use different cell phones and they are all different. So your data may not look like what we had. We all used the same device here.*
  - *Some cell phones have QWERTY keyboards / touch screens*
- Significantly lesser time
  - How will the representations change?

Sixth Grade Rocks! – An extension Activity

Cell Phone and Texting Laws

Text Messaging: 35 states, D.C. and Guam ban text messaging for all drivers. 32 states, D.C., and Guam have primary enforcement; the others, secondary.

- **Novice Drivers:** An additional 7 states prohibit text messaging by novice drivers.
- **School Bus Drivers:** 3 states restrict school bus drivers from texting while driving.



Analysis of a Map Charts

http://www.iihs.org/laws (Insurance Institute for Highway Safety)
http://www.ghsa.org (Governor's highway safety Association)

- Discuss the circumstances that could have influenced law makers to pass such acts.
- What data might the law makers have considered during this process?
- What additional data might you want to collect in this situation? Why?
- If we were to collect additional data from a much larger and wider audience regarding text messaging, who would benefit from this kind of information? Why?

Discuss the circumstances that could have influenced law makers to pass such acts.

- Excited young drivers – need to be socially connected
- Adults try to multi-task – Trying to get work done
- High accident rates – Ensure safety of pedestrians, bikers, and other drivers.
- Pressures from neighboring state laws.

What data might the law makers have considered during this process?

- Statistics on cell phone related accidents, deaths, and injuries that happened in vehicles.
- Statistics specific to the number of buses operated
  - Buses carry school children, senior citizens, physically disabled, and general public – Concern for their safety

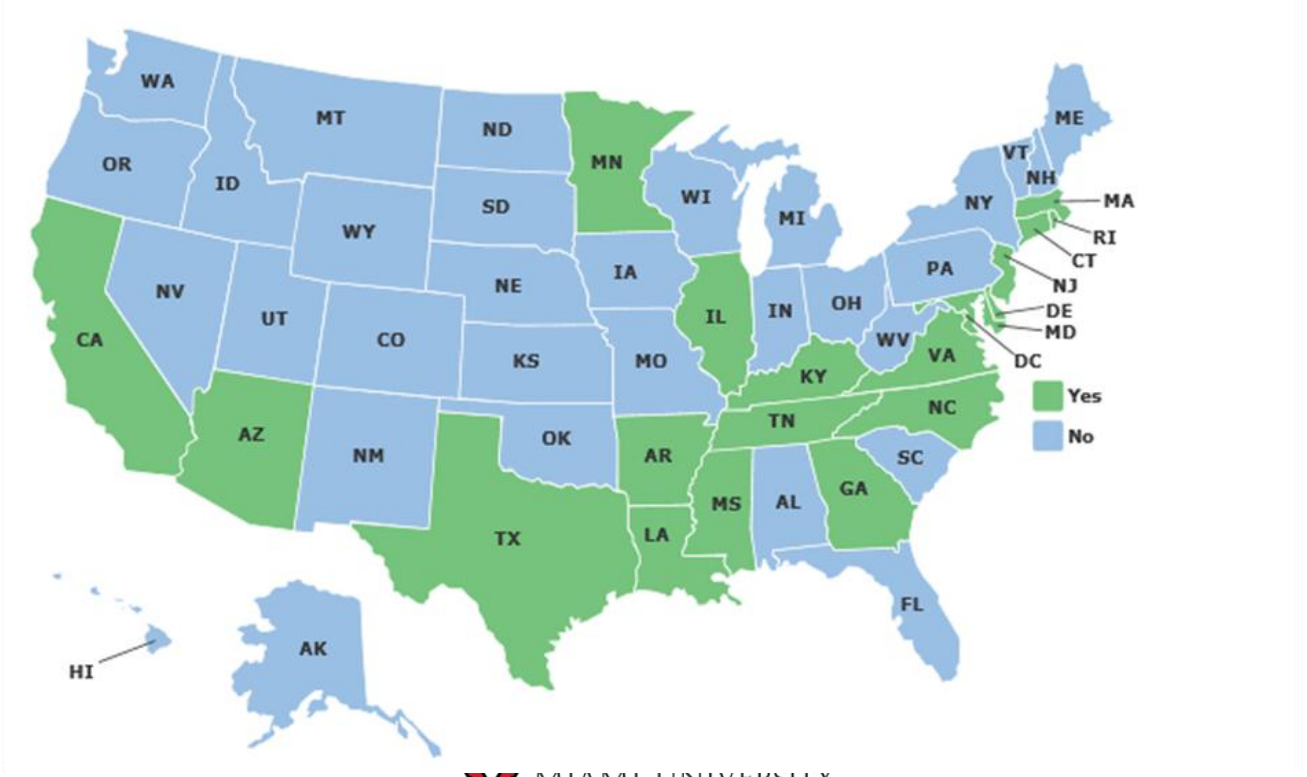
Who would benefit? Why?

- Cellphone manufacturers can improve their products based on customer usage information;
- Offer better features in their cellphone models;
- Since texting is faster, TV shows ask us to send our votes through texting.
- Law enforcement agents
- People, especially teenagers!

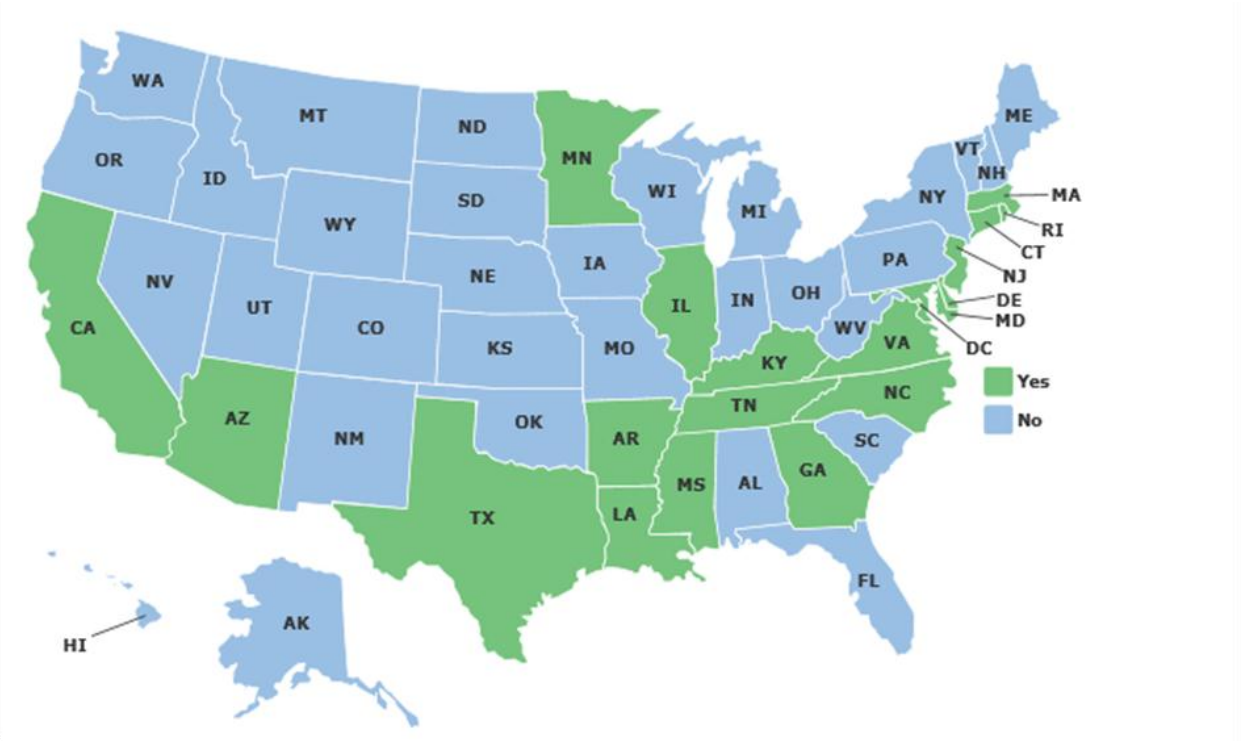
What additional data might you want to collect in this situation? Why?

- An individual's driving record.
- How well a person drives without texting compared to how well they drive texting (simulation).
- What are the effects of other distractions - We can gather additional evidence to support/ oppose the laws.
- What is an individual's opinion on these bans? What percentage of the population is in agreement?
  - Users of blue tooth devices or hands free devices may oppose such bans.
- Difference in reaction times (on the phone vs not on the phone).

Analysis of a Map Chart: Ban on bus drivers

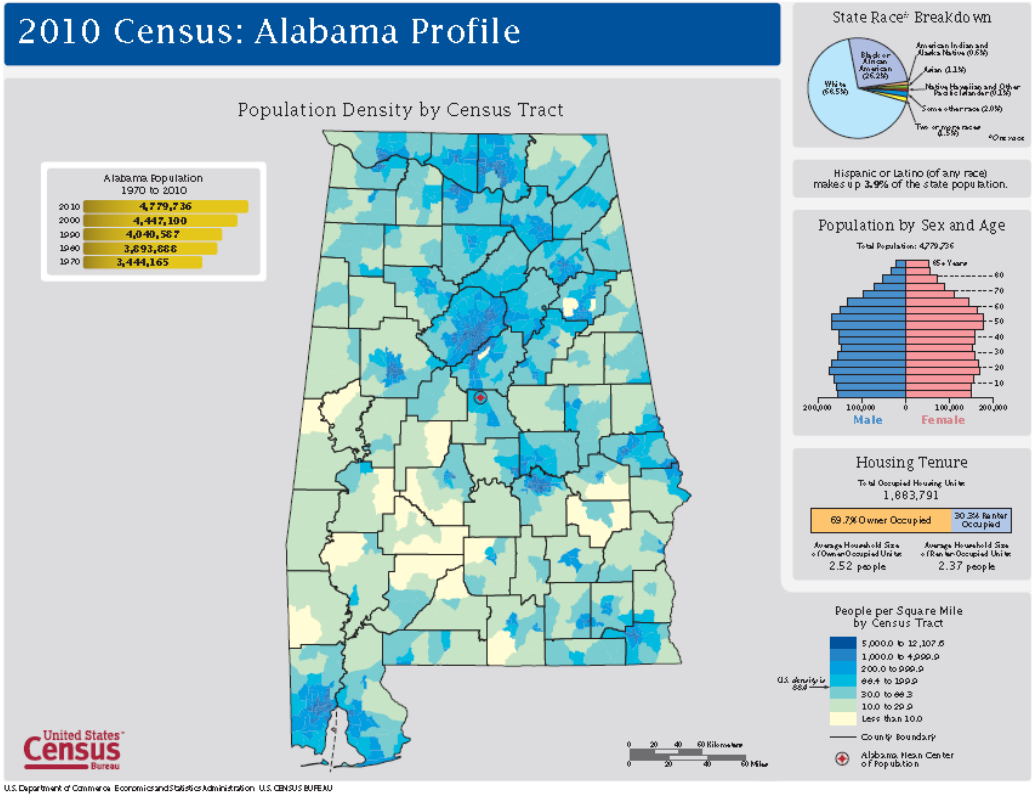


Analysis of a Map Chart: Ban on hand-held devices



More Extensions – Population Statistics United States

http://www.census.gov/geo/www/maps/2010_census_profile_maps/census_profile_2010_main.html



More Extensions – Population Statistics United States

http://www.census.gov/geo/www/maps/2010_census_profile_maps/census_profile_2010_main.html

Discussion Questions

- Based on your analysis of the population pyramid for Alabama,
  - Which age group is largest?
  - How might this affect the quality of life in this state? What challenges might this age distribution create for each state?
- To learn more about interpreting population pyramids, visit Population Reference Bureau at http://www.prb.org/ .
- Data for other countries, as well as for states and even counties is available from the U.S. Census Bureau at http://www.census.gov .

More Extensions – Population Statistics
United States and the World

- Learn how to read/interpret the world through data
- Engage in a meaningful discussion centered on statistics rooted in social issues
- Facilitates both quantitative and qualitative data analysis
- Fosters collaboration between disciplines

Challenges / Successes

- Orchestrating a classroom dialogue is challenging when “students are engaged in authentic data analysis problems” (Groth 2006, 46).
- This process may appear daunting with the infusion of an added social component.
- Nevertheless, with careful planning, this activity can result in a rewarding learning experience
- Such initiatives will help students see and read the world through the lens of mathematics
- Broaden their perspective of mathematics and establish connections between school mathematics and the outside world.

Reflection

- Draw upon your own teaching experiences where you encouraged students to read and interpret the world through data!