

7-2012

# This graph is speaking to me; how do I listen? [8th grade]

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# UNDERSTANDING BY DESIGN

## Unit Cover Page

Unit Title: **This graph is speaking to me; how do I listen?**

Grade Level: **8<sup>th</sup> Grade**

Subject/Topic Area(s): **Mathematics - Statistics**

Designed By: **Matthew Patty**

Time Frame: **12 Days**

School District: **NEISD**

School: **Jackson Middle School**

School Address and Phone: **4404 Vance Jackson San Antonio, Texas (210) 442-0550**

**Brief Summary of Unit** (Including curricular context and unit goals):

**This unit is written to address the 8<sup>th</sup> Grade Mathematics TEKS focused around statistics. Students will begin with an exploratory lesson in which they develop the requirements of a valid survey. They will then research and design three separate surveys that could be used to make claims about a population in their area. Next, students will pair up and carry out a survey at a local location. After the surveys, the students will bring their data back to the classroom and create presentations using at least four different types of graphical representations. Accompanying each graphical representation must be at least one complex and valid conclusion. Students must then present their conjectures to the class and be able to defend them with numerical and graphical evidence.**

## Stage 1 – Desired Results

<p style="text-align: center;">Established Goals (e.g., standards)</p> <p>8.12.A select the appropriate measure of central tendency to describe a set of data and justify the choice for a particular situation;</p> <p>8.12.C select and use an appropriate representation for presenting and displaying relationships among collected data.</p> <p>8.13.A evaluate methods of sampling to determine validity of an inference made from a set of data.</p> <p>8.13.B recognize misuses of graphical or numerical information and evaluate predictions and conclusions based on data analysis.</p>	<b>Transfer</b>	
	<p><i>Students will independently use their learning to...</i></p> <p><b>Conduct a valid survey to make claims about a general population. On the smallest level, this could be a claim about a grade level or school, but ambitious students will expand to more aspiring populations. Students will then present their findings and analysis using four different graphical representations of their data.</b></p>	
	<b>Meaning</b>	
	<p><b>Understandings</b> <i>Students will understand that....</i></p> <p><b>They will interact with statistics daily.</b></p> <p><b>Graphical representations are often manipulated and may misrepresent statistics.</b></p> <p><b>Statistics can be used to predict future outcomes.</b></p> <p><b>Graphical representations have different advantages and disadvantages.</b></p>	<p><b>Essential Questions</b></p> <p><b>This graph is speaking to me; how do I listen?</b></p> <p><b>Did that YouTube video just lie to me?</b></p> <p><b>Do weathermen know anything?</b></p> <p><b>When can you use a survey to predict future outcomes?</b></p> <p><b>Why is one graphical representation better than another when displaying data?</b></p>
<b>Acquisition</b>		
<p><b>Knowledge</b> <i>Students will know...</i></p> <p><b>Vocabulary: line plots, line graphs, stem and leaf plots, circle graphs, bar graphs, box and whisker plots, histograms, Venn diagrams, scatterplots, validity, measures of central tendency, survey.</b></p> <p><b>Surveys must contain a random sample that is large enough, and is representative of the claimed population to predict valid conclusions.</b></p>	<p><b>Skills</b> <i>Students will be able to...</i></p> <p><b>Determine the validity of conclusions.</b></p> <p><b>Predict future outcomes.</b></p> <p><b>Conduct a fair experiment.</b></p> <p><b>Determine which form is most beneficial to display a data set.</b></p> <p><b>Calculate and compare measures of central tendency of a given data set.</b></p>	

## Stage 2 – Evidence

CODE	Evaluative Criteria	
M,A	Completeness & Quality of Survey & Data Analysis	<p style="text-align: center;">Performance Task(s) <i>Students will demonstrate meaning-making and transfer by...</i></p> <p><b>Students will Find a research topic that they would like to research and make generalized claims about. Students will then design a valid survey to make a claim about their population of interest. The population can be as small as only a grade level or as large as the San Antonio community based on the student’s aspirations. After designing the survey, the students will pair up with another student in the classroom and actually carry out a survey.</b></p> <p><b>The survey must include at least one multiple choice question and one numerical analysis question to ensure accurate analysis will be able to be</b></p>

<p>T, M, A</p> <p>T</p>	<p>Completeness &amp; Quality of Graphical Representation</p> <p>Completeness &amp; Quality of Conclusion</p> <p>Presentation</p> <p>Equal Share of Work</p>	<p><b>completed.</b></p> <p><b>Documents will be provided to provide the students framework and to ensure success.</b></p> <p><b>Students will work with their partner and create a poster including at least four different graphical representations analyzing the survey’s results. The students will then present their posters which must include at least a circle graph, a box &amp; whisker plot, and two other representations of the student’s choice that display the data accurately. In addition to the graphical representations students must work together and write a conclusion that will answer the following questions:</b></p> <p><b>What did you learn about your population?</b></p> <p><b>Were you surprised about your data?</b></p> <p><b>What could advertisers do with this information?</b></p> <p><b>Do you think your results would be the same if you repeated the survey in Houston using the same survey technique used here?</b></p>
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**Stage 3 – Learning Plan**

<p><b>CODE</b></p> <p>A</p> <p>M</p>	<p style="text-align: center;">Pre-Assessment</p> <p style="text-align: center;"><i>How will you check students’ prior knowledge, skill levels, and potential misconceptions?</i></p> <p>Students will watch the YouTube clip “Did you Know?” and be asked to think about the data. Students will respond to open ended questions such as;</p> <ul style="list-style-type: none"> <li>• What is your intial reaction?</li> <li>• Do you believe the comments? Why or Why not?</li> <li>• If I were to tell you the video was 3 years old would you believe it then?</li> <li>• Nobody asked you about your technology usage before they made this video, however many of these claims involve you. (No one asked about your Facebook account, but you obviously have one.)</li> <li>• Can the maker of this video do that? Why or Why not?</li> <li>• Can you make claims like that about your friends? How can you ensure they are accurate?</li> <li>• What mathematical tools can you use to be able to make claims like the video did?</li> </ul> <p>The goal of this pre-assessment is to have the students begin to wonder and question statistics around them. I would like for the higher students to imply that with the correct mathematical process we can accurately predict claims for a population, which would drive us directly into the unit.</p>
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	<b>Learning Activities</b>	<b>Progress Monitoring</b>
A	<p><b>Day 1: Did that YouTube video just lie to me?</b>  <i>Did that video just lie to me?</i> – Watch YouTube clips<sup>1</sup> as a class that focus on outlandish claims. Students will fill out a reaction sheet that will serve as a pre-assessment for this unit.</p>	Pre-Assessment
M	<p><i>Fun Facts About Teens</i> – Students will be presented with random facts about teens. Discuss how and why these assertions are made.  How did they come up with these stats?  Are they true?  Did they ask you?  Why can they predict these claims?</p>	Valid Not Valid Pre Assessment Exit Slip
M, A	<p><b>Day 2: How can you say that?</b>  <b>When can you use a survey to predict future outcomes?</b>  <i>Valid or Not Valid</i> – Have students perform the concept formation on the set of cards describing different random surveys. Eventually students should separate the cards into valid and non-valid surveys.</p> <p><i>Valid or Not Valid</i> – Students will summarize their results and take notes citing the four requirements for a valid survey.</p>	Valid Not Valid Recording Sheet  Valid or Non Valid Exit Slip
T,M,A	<p><b>Day 3: Performance Assessment Introduction</b>  <i>Research &amp; Design</i> – Students will be shown a completed example of the performance assessment and introduced to the project (Page 6). Students must then complete the brainstorming piece (Page 7) with three populations they would like to analyze and research. They must then create three survey techniques that would ensure valid results. The final goal of this day is to establish a research technique that will be used to complete the final performance assessment. (Page 8)</p>	P.A. - Have you Ever Wondered...  P.A. – Let’s do the Reasearch
A	<p><b>Days 4-6: Classroom Data Sets</b>  <b>Why is one graphical representation better than another when displaying data?</b>  <i>Student Data Collection</i> - Students will participate in several different activities as a class and will be led as a class to create graphical representations of each survey.</p> <ul style="list-style-type: none"> <li>• Positive Scatterplot<sup>^</sup> – Height &amp; Shoe Size</li> <li>• Negative Scatterplot<sup>^</sup> – Recent Test Score &amp; Number Wrong</li> <li>• None Scatterplot<sup>^</sup> – Siblings &amp; Pets  <sup>^</sup>Students are given three stickers as they walk in the classroom, one for each graph, and place their sticker on the graphs based on their experiences. Allow teacher to add stickers where needed to emphasize the correlation.</li> <li>• Line Plot – Hours of sleep</li> <li>• Circle – Favorite Soda</li> <li>• Line – Tardy Referral #'s</li> <li>• Bar – Favorite Subject</li> <li>• Stem &amp; Leaf – Jumping Jacks</li> <li>• Histograms – Birthday Months</li> </ul>	Scat Plot, Line Plot Exit Slip  Circle, Line, Bar, Exit Slip  Stem Leaf, Histogram, Venn, Exit Slip

<sup>1</sup> Did You Know - [http://www.youtube.com/watch?v=oGGYIw\\_plj8&feature=related](http://www.youtube.com/watch?v=oGGYIw_plj8&feature=related)

<p>M,A</p> <p>M,A,</p> <p>T,A</p> <p>T,M,A</p>	<ul style="list-style-type: none"> <li>• Box &amp; Whisker Plot - Pushups</li> <li>• Venn Diagram* – Lunch Options</li> </ul> <p style="padding-left: 40px;">*Make this a human body Venn diagram with circles drawn on the floor and students moving freely with many proposed questions.</p> <p><b>Day 7: This graph is speaking to me; how do I listen?</b>  <i>Data Display Decisions</i> – Students will review the previously seen graphical representations with this review assignment and complete the reflection assignment asking the students to identify the strengths and weaknesses of each representation.</p> <p><i>Graphical Representation Quiz</i> – Students will be given a short quiz summarizing the different graphical representations.</p> <p><b>Day 8: This graph is speaking to me; how do I listen?</b>  <i>Mistaken Statement</i> – First, students will be presented with a graphical representation or a survey situation and be asked to create valid conclusions. Then, students will then be given a graphical representation and a list of seemingly valid conclusions and must identify which statement is not valid. Finally, students will be given a statement and create a graphical representation to best display the statement.</p> <p><b>Day 9: Performance Task – Number Crunch &amp; Data Analysis</b>  <i>Number Crunch &amp; Data Analysis</i> – Students will be reintroduced to the performance assessment and begin working with their collected data. It has now been over a week from the introductory piece so they students should have collected enough data to begin. (See attached)</p> <p><b>Day 10: Performance Task – Presentation Rehearsals &amp; Conclusions</b>  <i>Presentation Rehearsals &amp; Conclusions</i> – Students will use this day to finalize their presentation pieces and to answer the follow up questions.</p> <p><b>Day 11: Performance Task Presentation Day</b>  <i>Presentations</i> – Students present their data and their findings to the rest of the class.</p> <p><b>Day 12: Flex Day</b></p>	<p>Box Whisker Exit Slip</p> <p>Data Display Decisions Recording Sheet</p> <p>Quiz</p> <p>Mistaken Statement Recording Sheet</p> <p>P.A. - Number Crunching!</p> <p>P.A. – Data Analysis &amp; Conclusions!</p> <p>P.A. – Presentation Rubric</p>
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# Have you ever wondered...?

**4 out of 5 doctors recommend this toothpaste!**

**80% of 12 year olds have over 200 Facebook friends!**

**15% of San Antonio 8<sup>th</sup> graders get an allowance.**

**7 out of 8 middle school graduates have been offered illegal drugs.**

**1 out of 4 high school students will not graduate in four years.**

**92% of middle school students have a personal cell phone.**

**30% of teenage girls will become pregnant before the age of twenty.**

Where did these statistics come from? Were they made up out of thin air?! NO! This data is from the National Science Foundation's (NSF) most recent study on Teenagers. The NSF has done these types of studies for years on a national basis but they want more precise data. Their goal this year is to ask middle school teachers and students to design and conduct their own valid surveys to inspire their future research.

Your assignment over the next two weeks is just that, determine a topic you would like to make claims for a population about, design a valid survey, collect the data, analyze the data, reach several numerically supportive conclusions, and then present these conclusions to the class.

These presentations will be recorded and some of the best representations of design, collection, and presentation will be included in a final report written by Mr. Patty and submitted to the NSF for consideration.

Wouldn't it be awesome if your research topic was included in a national study!? So the question really is....

# What's important to you...?

You have complete freedom on what you want to survey. The only restriction is your survey must include at least two questions. One with multiple choice answers, and one with a numerical answer. Obviously the more questions the more conclusions you can make, so don't limit yourselves! Some examples are listed below:

- Favorite store in the mall & average amount of money spent in one trip.
- How important high school graduation is personally & student's age.
- Syllables in the name you go by & estimated number of texts sent out each day.

Remember a valid survey must:

- Contain a **random** sample
- Be given to the **population of interest**
- Be given to a **large enough number** participants

This means if you want to make a conclusion about all of San Antonio, you will need to get a large enough number of random samples from all of San Antonio. For the sake of this project, you may make your population of interest as large as you want, but it may be no smaller than an entire grade level at our school.

## So let's brainstorm...

When Mr. Patty says begin, you will have 1 minute to list as many things as you can think of that would be interesting to YOU to make claims about. Ready, set, GO!

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Ok, now that you have a large list of potential topics, take another minute to narrow it down to your top three. When you have narrowed your topics down, place them in the list below.

Now come up with the population of interest you would like to make claims about, based on your survey topic.

Survey Topic	Population of Interest

Your final goal is to design a survey technique that would produce valid results for each of the three topics in the table above.

Survey Topic	Design of Survey



# Let's Do The Research!

Your final goal of the day is to pair up with a partner around the classroom and determine what your final research topic will be. You will both be responsible for collecting data, analyzing the data, displaying the data, and finally constructing valid conclusions based on your data. This will be a fun assignment, but it will be very intricate and much of the surveying must be done out of class time.

You will be provided with two class days for making the graphical representations and "number crunching." These days will only be useful if your group has completed the survey portion of the assignment since you must have a data set to make graphical representations or conclusions from.

**Please fill out the topic proposal assignment below and have Mr. Patty check it before you leave today.**

My Partner: \_\_\_\_\_

Our Topic(s): \_\_\_\_\_

Required Numerical Question and Potential Answers:

Required Categorical Question and Potential Answers:

Any Additional Questions:

Population of Interest: \_\_\_\_\_

How we plan to carry out our survey to ensure valid results:

**Remember you MUST be completed with your data collection by next Wednesday to ensure you use the in class workdays to their fullest extent.**

# Number Crunching!

You have completed your survey! Excellent, now it is time to do some number crunching.

1. Begin by compiling all of your data. Create a master recording sheet for your questions and begin inputting the data.
2. After completing the master recording sheet, answer the following questions;
  - a. Based on your initial numbers, are you surprised by your results? Why or Why Not?
3. You must complete a circle graph and a box and whisker plot showing the data you have collected. Determine which question would be the best represented for each type. (One question may be used in both graphical representations.)
  - a. Which question will you use for the circle graph? Why did you pick that one?
  - b. Which question will you use for the box & Whisker plot? Why did you pick that one?
4. You must include two other types of graphical representations, determine which ones you would like to include and why.
  - a. Which “extra” graphical representation did you choose? Why did you pick that one? (What were the advantages of that type of graph over others?)
  - b. Which “extra” graphical representation did you choose? Why did you pick that one? (What were the advantages of that type of graph over others?)

**Remember you MUST be completed with your data display & the numerically supported conclusions by the end of the class tomorrow.**

# Data Analysis & Conclusions!

You have completed your displaying of data! Congratulations! Now let's come up with some of the grand claims that the Did You Know YouTube Video had!

1. Begin by reflecting on your population of interest. Did you ask enough people from your population of interest? Were they random?

Remember you may only make claims about your population of interest!

2. You have now conducted a valid survey representing your population of interest. Look at your data and make three generalizations that you can expand to your entire population of interest.

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3. Now create a conclusion that summarizes the entire project. This must be at least 8 sentences long and needs to address the following information and questions:

- A brief summary of your questions and how you collected your data.
- Your initial reaction after the surveys
- Why you choose the graphical representations you choose.
- Your conclusions supported by your numerical data
- Were you surprised about your data?
- What could advertisers do with this information?
- Do you think your results would be the same if you repeated the survey in Houston using the same survey technique used here?

**The box above is just for planning purposes, your conclusion must be included on your final presentation board. You may type it if you would like**

	<b>5 – Excellent</b>	<b>4- Above Average</b>	<b>3 – Average</b>	<b>2 – Below Average</b>	<b>1 - Poor</b>
<b>Completeness of Survey &amp; Data Analysis</b>	Both required questions plus an additional optional question were included. All deadlines were met without hesitation.	Both required questions question were included. All deadlines were met.	Both required questions question were included. All deadlines were met with support.	One required question was missing. Data Analysis was delayed due to poor time management.	One or more required question was missing. Data Analysis was incomplete due to poor time management.
<b>Quality of Survey &amp; Data Analysis</b>	Survey accurately sampled a population of interest larger than 500 people.	Survey accurately sampled a population of interest larger than 100 people.	Survey accurately sampled a population of interest larger than 50 people.	Survey inaccurately sampled a population of interest larger than 50 people.	Survey inaccurately sampled a population of interest larger than 20 people.
<b>Completeness Graphical Representation</b>	All 4 required graphs plus an additional optional graph are included and vary in type.	All 4 required graphs are included and vary in type.	All 4 graphs are included.	One of the required graphs is missing or not complete.	Required graphs are missing and/or
<b>Quality of Graphical Representation</b>	All titles, keys, numbers, and descriptions are clear and easy to read. Color integrated into graphs. 0 errors found.	All titles, keys, and numbers, are clear and easy to read. Color integrated into graphs. 1-3 errors found.	All titles, keys, and, numbers are included but some are not easy to read. Color integrated into graphs. 3-5 errors found.	Some titles, keys, numbers, and descriptions are missing and/or difficult to read. Color missing from graphs. 5-10 errors found.	Many titles, keys, numbers, and descriptions are missing and/or difficult to read. Color missing into graphs. More than 10 errors found.
<b>Completeness of Conclusion</b>	Conclusions are accurately drawn and displayed from 4 or more graphs.	Conclusions are accurately drawn and displayed from 4 graphs.	Conclusions are drawn and displayed from 4 graphs.	One conclusion is missing.	Two or more conclusions are missing.
<b>Quality of Conclusion</b>	One or more combined conclusions.	Conclusions are all complex.	One conclusion may be unexciting.	One or more conclusions may be unexciting and/or one conclusion is inaccurate.	One or more conclusions are inaccurate.
<b>Presentation</b>	Presentation was captivating, rehearsed, professional, and complete.	Presentation was rehearsed, professional, and complete.	Presentation was professional, and complete.	Presentation was complete.	Presentation was incomplete.
<b>Equal Share of Work</b>	Clearly exhibited equal share of work inside and outside of the classroom without stating it.	Equal share of work inside and outside of the classroom implied or stated.	Equal share of work inside the classroom implied or stated. Outside of the classroom work unequal but attempted.	Unequal share of work inside the classroom implied or stated. Outside of the classroom work unequal.	Clearly exhibited unequal share of work inside and outside the classroom without stating it.

**Grades will be out of 30 possibly points. This allows you up to a possible 133 for a test grade!**