

Survey Says: Exploring Statistics through Data Collection and Graphs

Rita Sorrentino

Overbrook Elementary School

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Overview

My first encounter with statistics was painful. I joined study groups, memorized definitions and formula to solve problems, and passed the course, but did not develop an appreciation for statistics. In teaching math to elementary students over the years, I have seen the pendulum swing between traditional and reform mathematical models with little emphasis on understanding “why” we are finding the mean, mode, median and range of data and “how” these measures provide a practical understanding of mathematical concepts in our data-driven world. I was happy to discover that 2013 is the International Year of Statistics¹ and that the Teacher Institute of Philadelphia offered this seminar, “Painless Statistics for Teachers and for Teaching.” I saw the combination of these two events as an opportunity to help me form a closer and more meaningful encounter with statistics in preparation for engaging students in dealing with statistics and interpretation of data.

In this unit of study, we will explore elementary topics that lay the foundation for all other statistical knowledge. Students will be guided in designing surveys and investigations that will allow them to make practical use of statistical skills and concepts. They will use tools of information technology to visualize data and numbers in a variety of charts, graphs and maps, thus making it easier to see patterns and trends. To make the collection, representation and interpretation of data meaningful to students in fifth and sixth grades, we shall investigate topics of interest to students, such as bullying, product preferences, and test data.

Rationale

Developing a statistical way of thinking can shape our reactions to the vast amounts of information we daily encounter. The study of statistics is important as we try to make sense of numerous real world observations. Daily, we observe our environment and make decisions based on our previous experiences. We receive numerical information through printed and digital media, and we purchase certain products based on advertisements. We wonder why our favorite TV show is off the air, we rely on weather reports to make plans, and count on medical research to guide our health care choices. These everyday situations are where an understanding of statistics would help guard us against faulty claims and lead us to question and interpret the sources and procedures used to generate findings.

Mathematical Background

The word statistics originally meant ‘political state’ referring to the government’s role in collecting information regarding population that was useful to the state for taxes and military planning. (Latin status = state). Interestingly, John Graunt was the first man to make a systematic study of birth and death statistics in the 17th century, which led to the idea of Life Insurance.¹ Today many people equate statistics with data collections and their relationship to predicting future events in politics, education, sports and economics to name a few. We probably would not get through a day without some reliance on statistics. However, to develop a statistical way of thinking in our modern world, we need to pay attention not only to the numbers but also to the methods used in collecting and interpreting quantitative data.

Descriptive Statistics

Descriptive statistics is a branch of statistics that includes ways of summarizing large sets of numerical information in a meaningful way and examining relationships among variables. Students are introduced to these summary measures as early as third grade. By the time they are in fifth and sixth grades, the terminology is a little more familiar to them, but they are still in need of instruction to understand the concepts and what these numbers tell us (or not) about the data. In short, descriptive statistics seeks to summarize/describe data from a sample. Descriptive statistics can use graphical and numerical summaries to give a 'picture' of a data set. In this unit, the emphasis will be on understanding the reasoning behind the calculations and the interpretation of results. The measures used to describe the data set are measures of central tendency and measures of spread.

Central Tendency

The central tendency as its name implies, is the center of a distribution of numbers (scores, sizes, votes). It is one number that best summarizes the entire set, a number that is in some way "central" to the set. The three most common measures are: the mean, median, and the mode of the data set. Students will explore which of these measures gives the most accurate picture. We can learn interesting information and make generalizations based on this statistical data. The following measures are a kind of "shorthand" that describe important aspects of the distribution results

- *Mean*: the most common statistical measure and most familiar to students. It is the numerical average found by calculating the sum of numbers divided by the numbers of numbers in the set.
- *Median*: the measure of central tendency that is simply in the middle of the set; half the values are above it and half are below. If there is an even number of pieces of data, the median is the average (mean) of the two middle values.
- *Mode*: the most frequently occurring value of the set. If no value occurs more often than any other, there is no mode. If there is more than one value that occurs most often, then all of the most frequent values are modes. If there are exactly two modes, the set is bimodal.

Measures of Spread

Another way of summarizing data is by describing how the values spread out from the mean.

- *Range*: the difference between the highest and lowest values in a data set. It is also known as measure of variation or measure of dispersion.
- *Quartiles*: the values that divide a set of data into four equal parts. The lower quartile is the median of the lower half of data and the upper quartile is the median of the upper half of data.
- *Absolute Deviation*: the measure of how much a particular sample deviates from the average sample, assuming several samples.

- **Standard Deviation:** the average amount by which individual values in a data set differ from the mean.

Inferential Statistics

As the name implies, inferential statistics is a branch of statistics that makes inferences about a sample to the larger population. It goes beyond what has been observed to make inferences from a sample to a population. Unlike describing the specific sample, it generalizes from a sample to make estimates or inferences about a population. It is extremely important that the sample accurately represents the population. Measures of means and measures of dispersion seldom reveal this, although we can sometimes use statistics to investigate how representative a sample is.

Variables

There are three categories of variables: nominal, ordinal and interval. Nominal variables are those that can be classified just by name (hence, the word “nominal”). There will be characteristics that vary, such as gender, age, make and model of a product, etc. Each category is different but cannot be quantitatively compared to others. Ordinal variables are those that have a value or rank assigned to them. Values measured on ordinal scale contain information about their relationship to other values only in terms of whether they are greater or less than but not by how much. Interval variables are those that rank the items that are measured and compare the size of the differences between them.ⁱⁱ Moreover, the difference between one interval and the next is consistent.

Statistical Graphs

Statistical graphs are used to display data recorded from various sources. There are many types of graphs depending on audience, type of data represented and scope of the inquiry. In this unit, students will use several types of graphs and charts discussing the advantages and disadvantages associated with each. Graphs that do not begin with a 0 value or use the same scale in comparison can be misleading.

Pictograph: A pictograph is a simplistic graph using icons to represent data values of the same item. Its key explains the icon and helps decrease the size of the graph.

Line Graph: A line graph uses connected line segments to show how information changes over time. It allows for quick analysis of data and works best with a small data set. Multiple data sets can be graphed together usually with color-coded keys. Students can easily identify the range as well as exiting outliers. Line graphs can show a trend in data.

Bar Graph: A bar graph is a visually strong graph using bars to represent values for data. The bars are helpful in comparing two or three data sets. The scale sets the value for each bar and, therefore, can be reordered to alter emphasis.

Circle Graph: A circle graph (or pie chart) uses sections of a circle to show how parts of the data are related to the whole. Each section includes a label and a percentage.

Scatter Plot: A scatter plot is a graph that displays information to determine the relationship (or not) between two or more interval level variables. The line of best fit is determined when points fall on or near a line with about same number on each side of line.

Objectives

Upon completion of this unit, the students will be able to:

- Gain awareness of the use of statistics in daily life
- Define and learn basic terms used in statistics
- Use online resources for learning about interacting with statistical measures
- Compute simple measures of central tendency
- Construct tables, graphs that display measures of central tendency, range and distribution

Strategies

As the computer teacher at Overbrook Elementary School, my assignments include supporting the curriculum with technology and working with students on projects to enhance their technological skills. This five-day curriculum unit is designed for fifth grade and sixth students designed to enhance the statistical strand of the School District of Philadelphia's math curriculum. The lesson plans can be used as a weeklong unit or spread out over a longer period of time. The activities included will give students opportunity to use tools of technology to deepen their understanding of concepts that were presented in their classrooms

In this unit, students will have the opportunity to collect data through surveys and online sources. They will use spreadsheets and online tools to represent and interpret data. They will use Survey Monkey (or something similar) to create and collect data.

Since the topic of bullying is of high interest to students, we will incorporate it into a lesson for creating survey, collecting data, and analyzing results.

Students will use a digital journal to reflect on lessons learned, compose questions for clarification, and comment on readings and activities.

At the conclusion of the unit, students will explore infographics, clear visual representations of data and information synthesized for audience appeal. This type of graphic helps students make sense of numbers and share the stories they represent.

Classroom Activities/Lesson Plans

The following lesson plans will be used in the computer lab to supplement the fifth and sixth grade's statistics strand of the School District of Philadelphia's Math Curriculum. Each student will have access to a computer with Internet access. The Smart Board will be utilized for introductory lessons and summative assessments.

Lesson 1: Introduction

Objective: To review terms and definitions related to statistics

Duration: One period: 45 minutes

Procedure: Using the anagram tool on the Smart Board, have one or two students come up to figure out the word STATISTICS. Provide hints along the way if needed. Ask a few students to explain their meaning of the word statistics and how it relates to them both in and out of school.

Ask for several student volunteers to fill in a chart with the number of years they have attended this school. Possible results for fifth graders might be:

5	3	6	5	4	1	6	6	4
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Lead them in a discussion of what these numbers reveal about tenure at the school. This will help ascertain their familiarity with statistical terms and mathematical definitions. Use correct terminology to affirm what they noticed. For example, if someone mentions that 6 was listed three times, I will reply that 6 is the mode for this set since it is listed the most.

Following the discussion, I will ask students if they recall other terms and measurement they used with sets of numbers (test scores, heights, number of siblings). I am confident that they will remember learning something about mean, mode, median and range. Using the Smart Board, we will check for understanding using the data collected about attendance. (Mean = 4, Mode = 6, Median = 5, Maximum = 6, Minimum = 1, Range = 5) As we complete the exercise, we will keep a list of questions about our method and results.

- How many students were represented?
- What would our numbers look like if every student in this class inputted data?
- Does the data tell us whether more boys or more girls attended this school for the least or the longest numbers of years? If we wanted this information, how could we gather and represent it?

Students will then view an interactive map “Global Median Age” from [ChartsBin](#)ⁱⁱⁱ that shows the median age of people in countries around the world which can also be sorted by gender. This graphic reinforces the concept that the median divides a population into two numerically equal groups. An accompanying chart lists searchable data. We will use these graphics to review that half the people are younger than this age and half are older than this age. The median is a numerical value summarizing the age distribution of a population. I will ask students to find the median age for the United States and compare that to other countries around the world.

For the remainder of the class students will use resources from Khan Academy^{iv} to work at their own pace to review concepts and do a few practice exercises. These videos will also be available to them in their classrooms and at home.

Assessment: Students will use their digital journal to reflect on the uses of statistics in their daily lives. They will choose from one of the following prompts and comment on at least one post from peers.

- What data about you are collected? Who collects them? What are their purposes?
- What data do websites collect about your Internet usage?
- What data would you like to collect about your peers, your school or your environment?
- How would you go about determining the median age of students in our school?

Lesson 2: Comparing Graphs

Objective: To read and interpret data from line, circle and bar graphs

Duration: One period: 45 minutes

Procedure: We will begin class by referring to online graphs archived at Math Goodies.^v In lesson 7 of the website, we will use two sample graphs to understand that bar graphs are useful in comparing facts and circle graphs show relationship of part to whole. With the whole group, students will answer questions about Favorite After-School Activities and Amount of Sugar in Certain Food. They will complete an online exercise on their own to interpret data from bar graph.

After students orally report their interpretations from the above activities, we will look at graphs that show composition of the earth's atmosphere. Students will decide which statistical graph best represents the data. Students will preview online examples to examine the advantages and disadvantages of using certain graphs with certain types of data. They will complete an online exercise to check for comprehension.^{vi}

To complete today's lesson, students will compose questions they will ask of their peers. Topics might include: number of text messages sent per day, number of hours watching TV, number of hours doing homework, favorite subject in school or most boring subject in school, number of siblings, etc.) They will print out paper and ask ten people to answer their questions during recess, lunchtime, or after school and they will bring results to next class.

Lesson 3: Survey Says: From Data to Graphs

Objective: To use charts and graphs to present and interpret results from a survey

Duration: Two periods: 45 minutes each

Procedure for Period 1: I will begin the lesson by demonstrating an online tool from NCES^{vii} (National Center for Education Statistics' Kids' Zone). In the "Create a Graph" section, students can choose from five different graphs and charts to represent the data they collected from previous lesson. For this activity, they will create a graph providing a graph title, labels, scale, and number of responses. Graphs will be saved and several students will present their graphs on the Smart Board. We will discuss the advantages and disadvantages of different types of the graphs chosen. For a general discussion, we shall talk about what they noticed from the activity:

- How does the type of question you asked affect the number of columns in your chart?
- Was there a difference between responses from boys and girls who answered the same questions?
- Were the respondents unique to your survey and would that matter if we combined your data?
- What can you determine from your graph?
- What type of graph works best for the information you collected?

This discussion will help them make decisions for the next activity.

Students will then create a grid for asking multiple questions of the same persons. I will ask them to consider grouping questions together that might have a correlation. They will poll students during, lunch, recess or after school and this time students will code

responses by gender. They will tally and bring their results to next class. Possible questions might include the following:

- Method of transportation to school each day: walk, bus, trolley, subway, car and other
- Number of days late in a week
- Favorite subject in school
- Future career choice
- Number of days absent on last report card
- Reasons for absence

Procedure for Period 2: We will begin with a general discussion of the assignment from previous class.). As a few students report out their findings, I will check the understanding of statistical terms defined in math background section. I will show students some examples of double bar graphs. We will analyze and interpret the components paying attention to: title, scale, key.

I will direct their attention to the “Create-a-Graph” section of NCES and point out the options for the “Design-Data-Labels” tabs. The online tool makes it easy to increase rows and columns, adjust scale and preview work in progress. The completed graphs will be saved and printed. (Graphs can also be emailed)

Assessment: Students will make general statements about the results of their survey with possibilities including:

- Students who come to school by bus are late more often than those who come by car; students who walk are rarely late.
- Sickness is the cause of most absences from school.
- Students who favor math are interested in careers with statistics; students who favor reading are interested in song writing.

Lesson 4: SurveyMonkey

Objective: To use online tool take and create an online survey

Duration: One Period: 45 minutes

Procedure: We will begin this class by talking about the processes used thus far in collecting data. I will then introduce the students to an online tool, SurveyMonkey^{viii}, as a method of reaching a wider audience.

- Design: We will preview the various formats used for questions. As a group, we will create a brief survey.

- Collect: The link will be copied and sent out immediately so students can take and view real-time results as they respond.
- Analyze: When the class has completed the survey, we will use the response summary to view results by percentages and then by the selection of a graph or chart.

Students will take a survey that asks:

- What kind of writing do you most enjoy: poetry, journal, narrative, or informative writing?
- Where do you mostly write: At home, in school or other?
- What is most important to you about writing: neatness, spelling, ideas, or grammar?
- Have you ever published your writing? No, Yes online, Yes in a magazine, Yes, in a newspaper

The data from the survey will be used for discussion. We will analyze results and talk about using different formats for questions depending on the results we are seeking. (For example, in question 4, how will you allow for “check all that apply?”

Survey: (<http://www.surveymonkey.com/s/X8BHL6Z>)

Assessment: Students will then work with a partner to create a survey using SurveyMonkey. I will encourage them to choose their own topic, provide at least three questions, and decide on an audience. (It will be easy to collect responses within the school since all classes have access to the Internet and time in lab.)

Lesson 5: Statistics on Bullying

Objective: To compare results of statistics on bullying

Duration: Two Periods: 45 minutes each

Procedure: We will begin class with a gallery walk and discussion of surveys from our last class. Students will display the results of their surveys on their individual monitors and we will use sticky notes to add comments or suggestions.

We will then look at a sample survey on bullying available on SurveyMonkey^{ix}. The survey lists 10 questions asking how many times a student encountered each incident. We will review the questions and edit for our purposes. For example, we might decide on

“In the past two weeks, has someone made fun of you, called you names, or insulted you?” instead of “How many times has someone...” Students will be encouraged to take the survey, but no one will be forced or receive a lower grade if they opt not to take the survey. Parents will be notified that we are using this topic to explore statistics and they may request to view results. We will include this comment before the last question: To help us understand the data, but not to link the data to any individual, please tell us only your age and your gender.

We will first collect data from classes in our own school. As students in fifth and sixth grades take the survey during class time, we will print out and display graphs generated. These graphs will be used to make comparisons as the sample size increases.

Subsequently, we will recruit students in other schools^x to take the survey. With the data collected, we will discuss sampling, descriptive, and inferential statistics.

Assessment: Students will use their digital journals to respond to one of the prompts and comment on at least one of their peers' posts.

- Did you notice any gender/age differences in the results? Explain
- Should we revise the survey to include types of bullying we may have omitted?
- Can research on the topic of bullying better help you formulate questions for survey? Explain

Lesson 6: Numbers Tell a Story

Objective:

Duration: One Period: 45 minutes

Procedure: We will review the various surveys used in the unit. Then I will ask the students what other kinds of information they are interested in collecting. They will use Kidspiration software to create a graphic organizer to narrow down or clarify a topic of interest. Possibilities might include: pets in the family/number of siblings, hours watching TV/ reading grade, bring lunch to school or eat school lunch/eat fruits and/or vegetables for lunch on school day, hours reading outside of school/reading grade.

Students will select an audience of either their classmates, students in lower grades in the school, or friends outside of school. They may choose paper and pencil or online surveys. Each student will prepare a Survey Sheet, Data Sheet, and a Story Sheet.

Survey Sheet: Include a statement of purpose, and questions with corresponding answer choices.

Data Sheet: Include a table with at least ten rows and the needed number of columns.

Story Sheet: In narrative form, explain the results of your survey. For example, did the students who brought their own lunch eat more or less fruits and vegetables than those who ate a school lunch? Were the results similar to what you expected?

Assessment: Write an article for the school or neighborhood newsletter explaining your survey. What interested you in creating it? What did your results suggest for students your age? What results did you find most interesting and why? What else could you report from your data analysis? Include a graph of your data.

Lesson 7: Exploring Infographics

Objective: To combine statistical data with words and images to share information on a topic.

Duration: 2 Periods: 45 minutes each plus extra time in lab or at home

Procedure: We will begin class by browsing through Daily Infographic.^{xi} After viewing the current one displayed, students will browse through the categories of content to focus on a topic of personal interest. We will discuss the elements of the infographic: visual (color, graphics, reference icons), content (time frames, statistics, references), and knowledge (facts, deductions).

For this activity, we will use statistics from online sources. Students will work individually or with a partner to identify a topic, find reliable research and statistics, summarize the key points, and make a visually appealing format.

They may use familiar applications such as: Word, PowerPoint, Comic Life, or *Kidspiration*. I will also demonstrate an online tool for creating infographics. Although there are a variety of tools, I have determined *Pictochart* to be best suited for my students.

Pintochart^{xii} is a user-friendly online editor. The free version includes themes and icons to help students present information as a visual story. Students can add a chart to manually input data or upload a file. This is especially helpful if they have saved data in another program. The completed infographic can be exported, saved in a variety of files, and shared through several media options. See example in Appendix (Illustration 1).

Possible topics include environmental issues, school safety, and the school policy on: cell phones, mobile devices, wearing uniforms, bullying and cyber bullying.

Points to Remember:

- *Research*: Research your topic. Decide what data and graphics you will use depending on your audience.
- *Rehearse*: Take time to look at samples. Learn from the experts whose topic is similar to yours.
- *Knowledge*: Include important content. What are the pros and cons? Are you making a statement about the issue?
- *Plan*: Use a storyboard or flow chart to map out your ideas.
- *Design*: Pay attention to colors and graphics. Keep it simple. Don't overwhelm the reader.

Assessment: Students will use the rubric created for teachers by Kathy Schrock. This will guide them in choice of specific topic, appropriate type, color and objects and images that support the content, and colors and fonts that are reader-friendly.^{xiii}

Annotated Bibliography/Resources

Student Resources

---ChartsBin. "Global Median Age." 2011. Chartsbin.org. 10 May 2013.
< <http://chartsbin.com/view/2866>>

This is a web-based data visualization tool that will allow students to quickly and easily create rich interactive visualizations using their own data.

Willingham, Tim. "Daily Infographic." A New Infographic Everyday. 2010. Willingham. 12 May 2013. <<http://dailyinfographic.com/>>.

Every day this site features the best information design and data visualization from the Internet. Students can also search by categories for archived graphics making this an excellent resource for learning from the experts.

Wingard-Nelson, Rebecca. Data, Graphing and Statistics. New York: Enslow Publications, 2004.

This book is a good resource for classroom library. Students can use it to learn or review the topic in simple language and many examples.

---Khan Academy. "Descriptive Statistics." 2013. KhanAcademy. 2 March 2013.
< <https://www.khanacademy.org/math/probability/descriptive-statistics>>

The free collection of tutorials includes a detailed section on statistics.

NCES. "Create A Graph." NCES KIDS. 2010. National Center for Education Statistics. 14 March 2013. <<http://nces.ed.gov/nceskids/createagraph/default.asp>

This website offers an interactive "Create a Graph" section with several designs for inputting data. The site includes samples of statistics with various ways to display data. We will use the "Percentage of Students Reporting Being Bullied at School" from 1999-2003.

---Math Goodies. "Graphs." Mrs. Glosser's Math Goodies 2013. Hotchalk/Glam Partner Site. 4 April 2013. <<http://www.mathgoodies.com/>>.

---"Piktochart." 2012. 5/17/13< <http://piktochart.com/>>.

Piktochart is an easy drag and drop infographic that helps users produce stunning visuals with just a few clicks.

--- "Statistics Glossary." 2013. Statistica. 23 February 2013. <<http://www.statsoft.com/textbook/statistics-glossary/>>.

This web resource lists alphanumeric list of terms with definitions and graphic representations

---"SurveyMonkey." 1999-2013. 4/13/2013 < <http://www.surveymonkey.com>>.

This free website is a quick and easy tool for creating surveys and questionnaires. Data can then be viewed in variety of formats.

Teacher Resources

Baker, A. "Reasoning about shape as a pattern in variability." *Statistics Education Research Journal* 3.2 (2004): 64-83.

The article provides examples for helping students recognize patterns in shapes of data representation.

DASL. "The Data and Story Library." EESEE. 1996. DASLCornell University. 13 May 2013. <<http://lib.stat.cmu.edu/DASL/DataArchive.html>>.

DASL is an online library of data files and stories that illustrate the use of basic statistics methods. Its goal is to provide data from a wide variety of topics so that statistics teachers can find real-world examples that will be interesting to their students

---"The International Year of Statistics ." *Statistics2013.org*. 2013. ASS. 16 February 2013. <<http://www.statistics2013.org/about-us/>>.

This website established to highlight and celebrate the International Year of Statistics offers free resources to teach students basic statistics literacy and introduce them to careers in the profession.

Kault, David. *Statistics with Common Sense*. Connecticut: Greenwood Press: 2003.

The author appeals to common sense and everyday examples to bring concepts to life.

Paulos, John Allen. *Innumeracy: Mathematical Illiteracy and Its Consequences*. Hill and Wang: New York 1988

In this book, Paulos examines our everyday life and provides practical advice on how to improve strategies for teaching and learning math in our daily experiences.

Roundtree, Derek. *Statistics Without Tears: A Primer for Non-Mathematicians*. New York: Charles Schribner's Sons, 1981.

The author presents basic concepts and terminology needed to understand statistics with everyday examples without getting involved in complex calculations.

Schrock, Kathy. "Infographics." *Kathy Schrock's Guide to Everything*. 5/30/13. (kathyschrock.net). 2 June 2013. <<http://www.schrockguide.net/infographics-as-an-assessment.html>>.

This website offers a comprehensive collection of resources for both beginners and advanced users of infographics. Examples are included for using infographics across the curriculum in various grade levels.

Appendix/Standards

Materials/Resources for Lessons

- Computers with Internet access for each student
- Computer Application Software: Microsoft Word PowerPoint, and Excel, Kidspiration, Comic Life
- Presentation System
- SmartBoard

Illustration 1: Example of a students' infographic about bullying using Piktochart. A team of three students researched facts and figures, decided on a template, and designed a chart to present as final project.



Common Core State Standards

Pennsylvania Standards describe what students should know and be able to do; they increase in complexity and sophistication as they progress through school.

Mathematics

Students will have a variety of experiences in the area of Measurement and Data,

- 2.6.5.A: Gather data from surveys and observations from sources outside the classroom or home.
- 2.6.5.B: Use pictures, tallies, tables, charts, bar graphs, line graphs, diagrams, and graphs to organize, display, and analyze data.
- 2.6.5.C: Calculate mean and range, identify the median and the mode of a set of data, and use these quantities to describe the data.
- 2.6.5.D: Compare data using multiple categories displayed in a graph.
- 2.6.5.E: Determine the reasonableness of a statement based on a comparison to data displayed in a graph and summarized by numerical measures.

Reading, Writing, Speaking and Listening

Students will have opportunities to read and understand essential content of informational texts and documents; use, understand and evaluate a variety of media; and use spoken, written, and visual language to accomplish their own purposes

- 1.2.5.E: Read, understand, and respond to essential content of text and documents in all academic areas.
- 1.8.5.B: Conduct inquiry and research on self-selected or assigned topics using a variety of teacher-guided media sources and strategies.
- 1.8.5.C: Produce an organized product that presents findings, draws reasonable conclusions, and gives proper credit to sources.

Science and Technology and Engineering Education

Students will use a variety of technological and information resources to gather and synthesize information, and to create and communicate knowledge

- 15.4.5.G: Create a digital project using appropriate software/application for an authentic task.
- 15.4.5.K: Use digital media to enhance a content-specific work product.
- 15.4.5.L: Discuss the characteristics of a credible website.

Endnotes

¹ <http://www.statistics2013.org/about-us/>

ⁱ <http://iamsam.hubpages.com/hub/meaning-and-definition>

ⁱⁱ <http://www.statsoft.com/textbook/statistics-glossary>

ⁱⁱⁱ <http://chartsbin.com/view/2866>.

^{iv} https://www.khanacademy.org/math/probability/descriptive-statistics/central_tendency/v/exploring-mean-and-median-module

^v http://www.mathgoodies.com/lessons/graphs/bar_graph.html

^{vi} http://www.mathgoodies.com/lessons/graphs/compare_graphs.html

^{vii} [Nces.ed.gov/nceskids/createagraph](http://nces.ed.gov/nceskids/createagraph)

^{viii} <http://www.surveymonkey.com/>

^{ix} <http://www.surveymonkey.com/s/surveymonkeyantibullying>

^x Requests will be made through my Twitter account (@ritaas) and/or School District of Philadelphia's list serve for technology teachers.

^{xi} <http://dailyinfographic.com/>

^{xii} <http://piktochart.com/>

^{xiii} http://kathyschrock.net/pdf/Schrock_infographic_rubric.pdf?utm_campaign=April13TechTips&utm_medium=email&utm_source=newsletter&utm_content=Infographic%20Rubric