

Creating a Survey and Analyzing and Displaying the Data Results from a Survey

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Problem Statement

Many surveys and survey results are presented in the media. Interpreting these statistical data is vital to making sure that the data have not been manipulated to promote someone's (hidden) agenda. During an election year, polls are used to predict outcomes of races. People are asked to pick who should stay on shows or to pick the person who has the biggest influence on an event. Even today if you answer your telephone during the dinner time you may wind up with someone asking you if you can take a few minutes to answer some survey questions.

Rationale

Surveys are way to collect data on various things. They allow people to make predictions, determine trends, forecast future outcomes, and obtain public opinion. Surveys can help in decision making processes for a business. For example, the marketing research department of a business may use a survey to predict what people will be willing to purchase or whether to open a new store in a certain market area. It is an effective way to collect information on all sorts of things. It can also be beneficial to the person taking the survey because many surveys make people think about the topic and

that process may lead to a deeper understanding of beliefs, give one a deeper understanding of the opinion of others, as well as, be used to influence people's opinion.

Students of all kinds benefit from creating their own surveys by helping them reflect on the results because it involves them, makes them think about the issues, people's perceptions. (<http://www.surveymonkey.com/mp/education-surveys>) . When high school students learn more about each other in a nonthreatening environment, it can lead to more compassion and respect towards each other. As educators, we have become responsible not only as the surveyor of knowledge, but as the teacher of social conscience. Students tend to learn when submersed in a topic allowing them to make choices to fulfill their assignment. Teaching a student how to collect data on a topic of interest to them, as well as to analyze them is a more substantive way to get students to be more statistically proficient.

Objectives

SWBAT

- Pick topic
- Understand issues
- Identify sample appropriate for study
- Identify sample size
- Analyze data:
 - Find central tendencies
 - Determine percents of each choice
 - Determine the distribution of responses (e.g., standard deviations)
- Find survey results in print and determine their validity
- Understand the pros and cons of different survey methods
- Create a survey
- Enter data into an excel spreadsheet
- Graph data as a line graph, bar graph, pictogram, scatter plot, and box-and-whisker plot
- Display survey data in a chart, frequency table, and a stem-and-leaf plot

Background

I am a math teacher, but I originally had a career in business. I was a business major as an undergraduate where I received credit for two statistics courses, but more recently helped

my daughter study last summer for her statistic class. During graduate school, I created a survey that was given to my classes and I analyzed the resulting data. I will further my knowledge of statistics using library and internet resources, as well as gain additional insights from my professor's extensive knowledge in the field.

Standards

I will use the core curriculum standards that are currently being used by the school district of Philadelphia for curriculum development.

CCSS.Math.Content.HSS-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots)

CCSS.Math.Content.HSS-ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

CCSS.Math.Content.HSS-ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

CCSS.Math.Content.HSS-ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Strategies

Learn how to write good survey questions

Understand and apply knowledge of means, medians, and modes.

Students will be assigned to a group and learn how to analyze data.

Students will answer their classmates' surveys as well as have them ask other people they know.

Take survey data and enter the results into an excel spreadsheet

Create a project scored by a rubric that contains their survey, various ways to display their data, and the analysis of their findings.

Do an oral presentation discussing the results of their surveys using Xcel and PowerPoint.

Classroom Activities

How to Write a Good Survey or Questionnaire

In order to prepare students for writing a good survey, it is important for the instructor to make them aware of common pitfalls that can befall a surveyor when creating their survey. For example, regular land line surveys miss millions of younger folk who only have cell phones and on line surveys only reach people with internet access. A question with a double negative is not grammatically incorrect but can confuse the participants. Good questions should not be leading because surveyed people will tend to give you responses they think you want to have not necessarily what they truly believe. The surveyor should only give options that reflect the range of possible outcomes to his studies population.

Survey sample size is important in order to find the margin of error. The sample is affected by what margin of error you are willing to accept on your data results. The smaller the margin of error the larger your sample size will have to be to the desired results. In order to determine the sample size for a survey, you have to square the confidence level's z-score. Next, multiply the estimated percentage you are trying to by 1 minus the estimated percentage you are trying to determine. Then multiply the square of the confidence level by the answer you just calculated. Next you square the margin of error for the survey. The final part is to take the last two numbers calculated and divide them respectively.

Instructions

1. Choose the type of information you want to gather.
2. Make sure the survey has just enough questions to get the needed data.
3. Keep the language at the level of the respondents, and easy to comprehend.
4. The survey questions should go from general to specific and in a naturally flowing order.
5. Multiple-choice questions are preferable.
6. Avoid leading questions.
7. If you have questions that require a similar type of scale, use that same scale throughout the document
8. Try the survey out on a small group before trying it out on a larger group (pretest)

9. Modify the survey if the pretest shows problems.

First of all you'll learn about the two major types of surveys that exist, the questionnaire and the interview; and the different varieties of each. Then you'll see how to write questions for surveys. There are three areas involved in writing a question: determining the question content, scope and purpose, choosing the response format that you use for collecting information from the respondent figuring out how to word the question to get at the issue of interest. Finally, once you have your questions written, there is the issue of how best to place them in your survey.

http://www.ehow.com/how_16596_write-survey-questionnaire.html

How to put your survey online

After the survey has been completed, students will use [surveymonkey.com](http://www.surveymonkey.com) (or similar program) to create an online version of their survey and have it available for their classmates, friends, and relatives to take part in (e.g., www.surveymonkey.com) Survey Monkey (and similar programs) aids in creating the survey questions, validates question for bias and piping, reach the right people, and allows creating charts and graphs. The survey results of the people who participated in the survey are also tabulated.

Lesson Plan on Determining the Mean, Median, Mode, and Range

This lesson will allow students to find the mean, median, mode, and range for a given list of values. Several good examples for finding the central tendencies are the following: test scores, batting averages, bowling score averages, and yearly incomes.

Define the Mean, Median, Mode, and Range

- The mean is what most remember as the average it is derived by finding the sum of the values and dividing it by the number of items you have in the data set.
- The median is the middle or the mean of the two numbers closest to the middle when the data are put in numerical order.
- The mode is the most frequent occurring value. If all the values are different, then there is no mode.
- The range is the difference between the largest and smallest value.

Test Scores Example

If you received an 81, 73, 84, 93, and an 84 on 5 tests, what is your mean score? The median is the middle value when one rewrites the list in order, so the median is _____.

The mode is the number that is repeated more often than any other, so _____ is the mode. The range is the difference between the largest value and the smallest value, so the range is _____.

Average Income Example

The employees of the ABC Company had the following salaries: \$115,000, \$52,000, \$65,000, \$70,000, \$225,000, \$65,000, \$35,000, \$42,000, and \$105,000, what is the mean salary? The median is the middle value when one rewrites the list in order, so the median is _____. The mode is the number that is repeated more often than any other, so _____ is the mode. The range is the difference between the largest value and the smallest value, so the range is _____. What happens to the mean, median and mode if the largest salary is removed?

Bowling Scores Example

Lasean bowled a 130, 125, 130, and 175 in his four games. The median is the middle value when one rewrites the list in order, so the median is _____. The mode is the number that is repeated more often than any other, so _____ is the mode. The range is the difference between the largest value and the smallest value, so the range is _____. What will Lasean have to bowl in his fifth game to increase his average to 150?

Other possible sport examples that can be used to practice central tendencies are baseball batting averages and pitcher earned run averages, basketball points per game and assist per game. Other possible examples that can be used to find central tendencies are country gross national products, average annual income, and people (student) heights.

<http://www.purplemath.com/modules/meanmode.htm>

Introduction to an Excel spreadsheet

Introduce Excel spreadsheets to your classes by having them create a spreadsheet from their examples and/or central tendencies problems. Show them how to display them on different graphs

Test Scores Example Excel Spreadsheet

If you received an 81, 73, 84, 93, and an 84 on 5 tests, what is your mean score?

Test 1	Test 2	Test 3	Test 4	Test 5	Test Average
81	73	84	93	84	83

Average Income Example Excel Spreadsheet

The employees of the ABC Company had the following salaries: \$115,000, \$52,000, \$65,000, \$70,000, \$225,000, \$65,000, \$35,000, \$42,000, and \$105,000, what is the mean salary?

Employee Salaries (in thousands dollars)									
1	2	3	4	5	6	7	8	9	Average
\$115	\$ 52	\$ 65	\$ 70	\$ 225	\$ 65	\$ 35	\$ 42	\$ 105	\$ 86

Bowling Scores Example Excel Spreadsheet

Lasean bowled a 130, 125, 130, and 175 in his four games. What will Lasean have to bowl in his fifth game to increase his average to 150? Answer: 190 The following Excel spreadsheet is used to check the answer. By entering 190 in for game 5 score the average became 150, therefore the answer of 190 was correct.

Bowling Scores					
Game 1	Game 2	Game 3	Game 4	Game 5	Average
130	125	130	175	190	150

Using Graphing or Scientific Calculators to Find Central Tendencies

Another way to use technology to increase student achievement in statistics is the calculator. You can enter your data into a graphing or scientific calculator which will then be able to give you the mean, median, and mode. The graphing calculator can also display results as a graph.

How to Enter Data on an Excel Spreadsheet

My research on entering data on an Excel spreadsheet led me to About.com where Ted French has written a tutorial on data entry. This tutorial covers basic information for entering data into Excel. It is intended for those just getting started with spreadsheet programs. The website explains how to plan a spreadsheet, enter data, keep track of cells and cell references, use auto complete to enter data, know the types of data in Excel, get around your spreadsheet quickly, and edit data in a cell. Although the tutorial is written using Excel, the tutorial information can also be applied to other spreadsheet programs such as *Google Docs Spreadsheets*.

http://spreadsheets.about.com/od/excel101/ss/enter_data.htm

Survey Results Example						
Question 1	1	2	3	4	5	Sample Size
Totals	3	5	7	3	2	20
Percentages	15%	25%	35%	15%	10%	100%

Displaying Data Using Different Types of Graphs

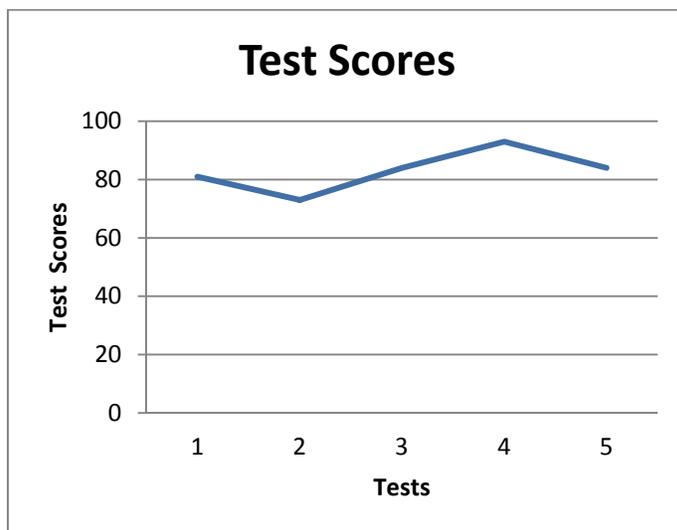
Students will be introduced to different types of graphs to display their survey results. The lesson will include line, horizontal bar, vertical bar, double bar, stacked bar, and Circle graphs (pie charts). Students will learn how to take their Xcel spreadsheet and create graphs from their survey results.

Test Scores Example Excel Spreadsheet

If you received an 81, 73, 84, 93, and an 84 on 5 tests, what is your mean score?

Test 1	Test 2	Test 3	Test 4	Test 5	Test Average
81	73	84	93	84	83

Test Scores Displayed as a Line Graph

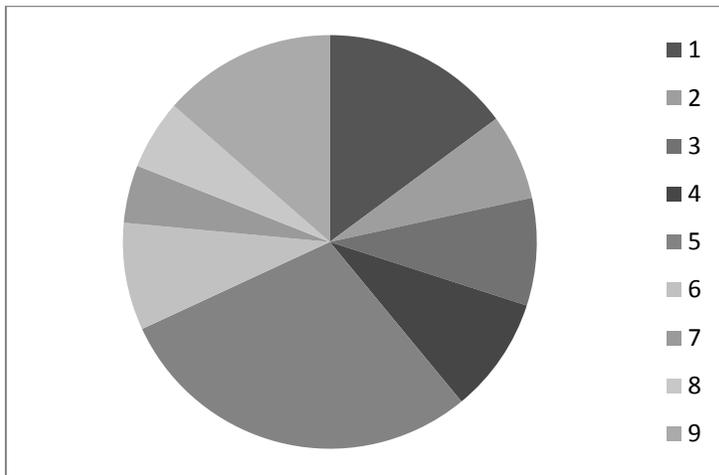


Average Income Example Excel Spreadsheet

The employees of the ABC Company had the following salaries: \$115,000, \$52,000, \$65,000, \$70,000, \$225,000, \$65,000, \$35,000, \$42,000, and \$105,000, what is the mean salary?

Employee Salaries (in thousand dollars)									
1	2	3	4	5	6	7	8	9	Average
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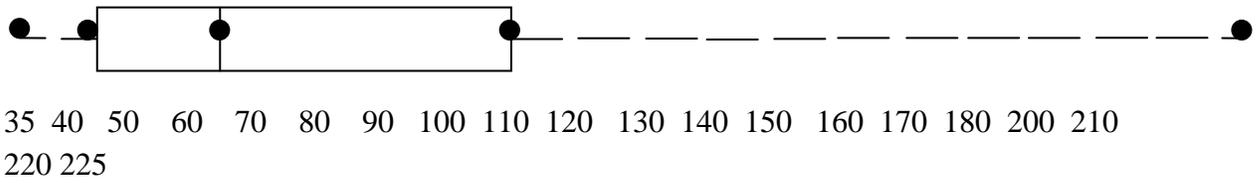
ABC Company Employee Salaries Displayed as a Pie Chart



Pie Charts can show how evenly distributed the money is or in this case how three people earn more than half the salary paid out by this company (Employees 1, 5, and 9).

This ABC Company Employee Salaries example will also be a good one to introduce how to graph a box-and whisker plot the right whisker will show an outlier because of its length in comparison to the rest of the data plotted.

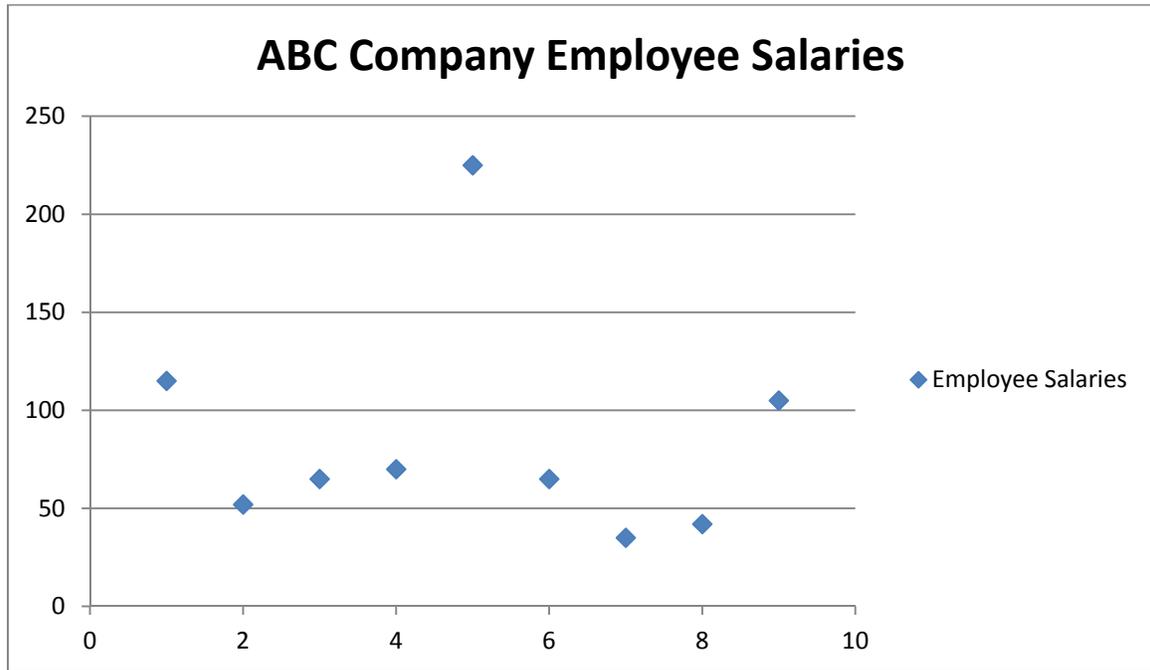
ABC Company Employee Salaries Displayed as a Scatter Plot



Employee Salaries (in thousand dollars)

This ABC Company Employee Salaries example can also be used to graph a scatter plot. Notice how far away several of the points are from the rest of them. It is often a good idea to show several different ways to display data graphically. It not only engages the visual learner but can show your students the importance of choosing the best way to display their survey data in a graph.

ABC Company Employee Salaries Displayed as a Scatter Plot



Scatter plots show the correlation or lack thereof between the data. They also highlight possible outliers. When data has a strong correlation a line of best fit can be drawn to

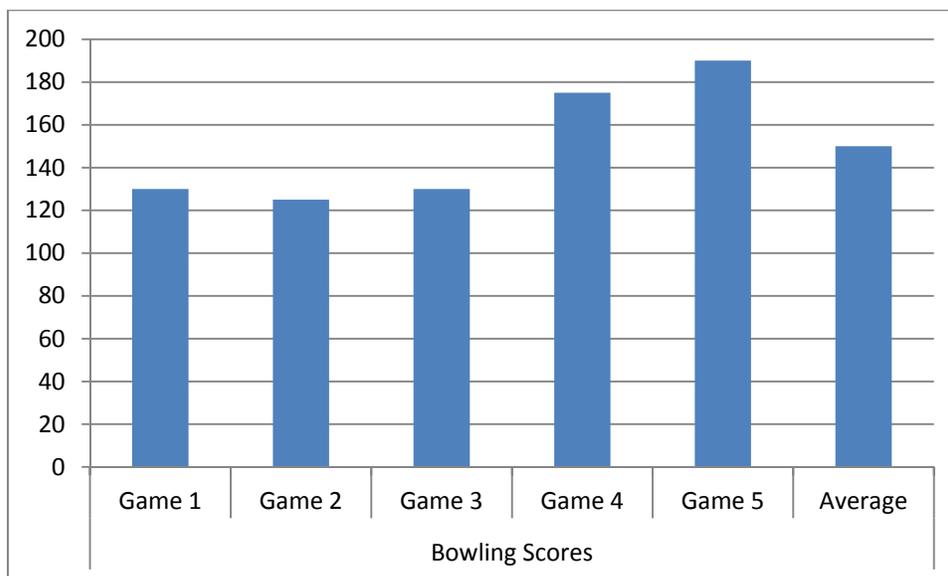
show positive and negative correlation. If a line of best fit is difficult to draw then there may be little or no correlation,

Bowling Scores Example Excel Spreadsheet

Lasean bowled a 130, 125, 130, and 175 in his four games. What will Lasean have to bowl in his fifth game to increase his average to 150? Answer: 190 The following Excel spreadsheet is used to check the answer. By entering 190 in for game 5 score the average became 150, therefore the answer of 190 was correct.

Bowling Scores					
Game 1	Game 2	Game 3	Game 4	Game 5	Average
130	125	130	175	190	150

Bowling Scores Displayed as a Bar Graph



Other Statistical Key Points

Here are some other important things to make sure your students learn about the central tendencies. When data are skewed, the median will more closely reflect the central tendency than the mean because outliers (extreme values) will affect the mean but not the median. The range is the dispersion (spread) of the data set. The mode becomes the

most important central tendency when data are nominal (not numbers) because there is no way to calculate the mean or the median. It is also important not to use the mean when the data are bimodal. Bimodal data has two modes which can influence the means reflection of the central tendency of the data set.

How to Prepare an Oral Presentation

Students need to learn how to give an oral presentation. It is an important skill to have in the job market for the foreseeable future. This lesson is to help them learn how to present orally their information in a clear and succinct way and to make their presentation more interesting to their audience. The website ehow.com provides a format to creating an effective oral presentation. In today's world, PowerPoint skills are synonymous with presentation success of any kind! No matter if you are a student or a professor or a business professional or even a scientist, if you are out there in this world, you need PowerPoint skills to be successful. <http://www.businesstrainingdirect.co.uk/references/powerpoint-skills-07-01-08.php>

Instructions

1. Each part of the presentation should be concise. Necessary information only.
 2. Know your audience. Make sure your presentation meets them at their intellectual level.
 3. Determine your main focus of your presentation.
 4. Write the main sections of your presentation on note cards.
 5. Practice presentation in front of an audience or the mirror.
- http://www.ehow.com/how_5135325_write-oral-presentation.html

Annotated Bibliography

Balle, Louise. "How to Write an Oral Presentation." *EHow*. Demand Media, 29 June 2009. Web. 06 May 2013.

eHow is an internet site that has all sorts of tutorials. This tutorial will allow students to give better oral presentations, a skill they will need as they continue their education and job skill set.

Editor, EHow Business. "How to Write [a Survey](#) or Questionnaire." *EHow*. Demand Media, 19 Apr. 2000. Web. 06 May 2013.

eHow is an internet site that has all sorts of tutorials. This tutorial gives the steps to writing a good [survey](#) question.

"Entering Data in Excel." *About.com Spreadsheets*. N.p., n.d. Web. 06 May 2013.

About.com explains the process of making a spreadsheet. It a good site to see how to do things step-by-step.

Henry, Gary T. *Graphing Data: Techniques for Display and Analysis*. Thousand Oaks, Calif. [u.a.: Sage, 1995. Print.

An excellent book to see how graphs can display data in very unique ways!

"Mean, Median, Mode, and Range." *Mean, Median, Mode, and Range*. N.p., n.d. Web. 06 May 2013.

purplemath.com is a good [website](#) to see a detail explanation of math topics. It has definitions, instructions, examples, and practice problems.

Rowntree, Derek. *Statistics without Tears: A Primer for Non-mathematicians*. New York: Charles Scribner's Sons, 1981. Print.

A book that takes a simpler look at many different topics in statistics. This book breaks down topics in statistics to simpler level than the typical book on statistics. It can prepare the reader for more challenging statistics books.

Urdan, Timothy C. *Statistics in Plain English*. Third ed. New York: Routledge, 2010. Print.

Simplifies statistics for the mathematically challenged!

Wallgren, Anders, Britt Wallgren, Rolf Persson, Ulf Jorner, and Jan-Aage Haaland. *Graphing Statistics & Data: Creating Better Charts*. Newbury Park: SAGE Publications, 1996. Print.

A good reference to help a teacher aid their students in using the right way to display their results.

Yates, Daniel S., David S. Moore, and Daren S. Starnes. *The Practice of Statistics: TI-83/89 Graphing Calculator Enhanced*. New York: W.H. Freeman, 2003. Print.

A textbook with "Technology Toolboxes" that give step-by-step directions on how to use a TI-83/89 graphing calculator to solve problems in statistics.