

ANALYZING POLLS

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October 18, 2002

Teacher Notes

Lesson Plan

Variation in Poll Samples and Margin of Error

OBJECTIVE: Students should be able to look at actual poll data and interpret and explain the results of a poll.

GRADE LEVEL: Pre-Algebra and Algebra I and II
Can be expanded to Introductory Statistics college-level

NCTM Standards:

Data Analysis and Probability:

- Develop and evaluate inferences and predictions that are based on data
- Understand and apply basic concepts of probability

Communication:

- Communicate mathematical thinking coherently and clearly

Connections:

- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
- Recognize and apply mathematics in contexts outside of mathematics

Activity

Time: 1 – 2 hours

This activity may be done over several days. This gives the students an opportunity to look at Internet sites, newspapers, or magazines that show comparisons of several current polls taken at the same time.

Materials: Box with 20 holes for sampling
Red marbles (51)
Blue marbles (49)
Student Activity Sheet
Newspaper, magazine, or news Web site source with recent poll information

1. Introduce the activity by discussing why one might have variations in random samples responding to the same question. Discuss the purpose of polls and how the margin of error is used.
2. Distribute the activity sheet. Have each student take a sample of twenty voters using the voting box. Data is to be recorded on the activity sheet.
3. Discuss why the results differed among the groups.

Internet Resources:

Activities to help students become better citizens

http://www.pbs.org/democracy/buildyourowncampaign/lesson_plans.html

Recent 2000 Poll Results

<http://www.politics1.com/polls.htm>

Margin of Error

http://www.pbs.org/democracy/buildyourowncampaign/survey_says.html#jump4

Gallup Poll

<http://www.gallup.com>

Pew Research Center for The People and The Press

<http://www.people-press.org>

PollingReport.com

<http://www.pollingreport.com>

Lesson Plans Connected to NCTM Standards

<http://www.mcrel.org/standards-benchmarks/index.asp>

<http://www.mste.uiuc.edu/stat/stat.html>

NCTM Standards Site

<http://standards.nctm.org/>

<http://standards.nctm.org/document/chapter3/data.htm>

Democracy Project – Analyze a Poll

www.pbs.org/democracy/readbetweenthelines/poll.html

We are grateful to PBS for Democracy Project 2000 for information we used for this statistical activity. When we were asked to do a project for the Blue Ribbon Statistical course, Mike and I thought it would be appropriate to analyze data from national polls. As we began researching the topic, we found that PBS and the Democracy Project 2000 had already done such an activity.

ANALYZING POLLS ACTIVITY SHEET

This activity will focus on the idea of population sampling as it applies to polling in elections or polls of public opinion. Polls are often used to provide an estimate of how all voters will vote based on a sample of the entire voting population. Thus, a sample is used to represent the entire voting population.

To begin, we will select our own population sample. Each group of students will receive a “polling” box filled with marbles. Each marble represents a potential voter. Blue marbles will represent a vote for the Democratic candidate and red will represent the Republican candidate. Each group will use their election box to select one sample of the population. The sample will consist of twenty voters. Based on marble color, you will count the number of voters who support either the Republican or Democratic candidate, and record that information in the table below.

DEMOCRAT (BLUE)	REPUBLICAN (RED)

Based on your group’s sample, who do you predict will win the election? _____

Is your prediction accurate? When deciding to use a sample to represent an entire population, it is important to know whether the sample will give an accurate estimation otherwise, the sample is of little use. To help determine how accurate your sample was, we will compare your results to the results of other groups.

In the table below, record your results along with the results of the other groups and then total each column.

DEMOCRAT (BLUE)	REPUBLICAN (RED)

Based on the results of all the groups, who do you predict will win the election? _____

If you are familiar with pre-election polls, you may often notice that poll results often list a calculation called the **margin of error**. This calculation is formulated by an application of the standard deviation. Normally, standard deviation is thought of when investigating the variation of individuals from the mean of the entire group. Here, however, standard deviation will be used to find the variation of the outcomes of several samples taken from the population.

This is an important concept. If you notice the results from the groups using the “polling box,” there was a variation in outcomes. Did some groups predict the Republican candidate would win whereas others predicted the election for the Democrat? The margin of error will allow us to put a numerical value on this variation we see among samples of a population.

The margin of error comes from a calculation called the **standard error** that is given by the following formula:

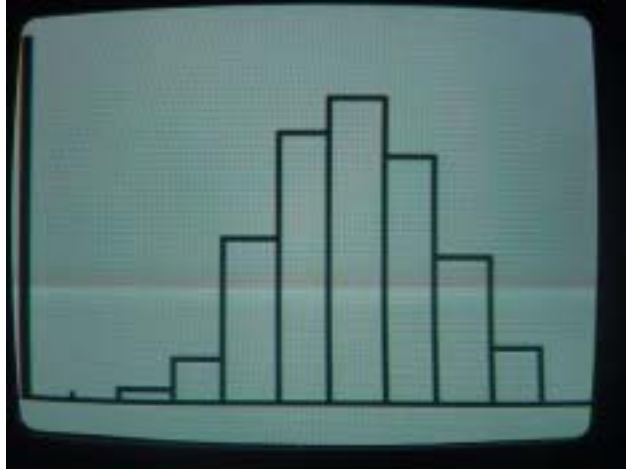
$$\text{Standard error} = \sqrt{\frac{p(1-p)}{n}}; \text{ where } p = \text{estimated proportion and } n = \text{sample size}$$

You may have heard of the bell curve, or normal distribution, used to describe a population.

In a normal population distribution, 95% of the population will lie within two standard deviations of the average. This can be illustrated on the TI-83 calculator. Suppose we sample 10 people from a population and that 60 percent of the population is known to support a certain issue. We could select many different ten-person samples. With each sample the number of people supporting that issue could range from zero to ten, however, we would expect most samples to contain about six people who were in support. If we were to select 500, ten-person samples, we could create a histogram of the results. The histogram would be expected to have the shape of a normal distribution.

To create this simulation on the TI-83, press the **MATH** key and then use the arrow keys to select the **PRB** (probability) menu from the top of the screen. Now, select **7:randBin(** by pressing the **7** key. After selecting this option, we need to enter the commands so that the TI-83 will perform 500 ten person samples from a population where 60 percent of the people support an issue. To enter this, press **10, .6, 500)** followed by these keystrokes which will tell the calculator to enter the generated data in List 1. **STO-> 2nd 1**

Now press **2nd** followed by **Y=** to bring up the **STAT PLOT** menu. Select **Plot1** and choose the histogram icon for **Type:** and L1 for **Xlist**. Now press the **WINDOW** key and choose the following values: Xmin=0, Xmax=11, Xscl=1, Ymin=0, Ymax=150, Yscl=1. Finally, press the **GRAPH** key to see the histogram. Your histogram should look similar to the one below:



As you can see, there is a variation among the collected samples, however, most of the samples would be expected to be within two standard deviations of the mean.

If we use the standard error formula to calculate 2 standard errors and assume a mean proportion of 0.50, the formula simplifies to: $1/\sqrt{n}$. This formula is called the **margin of error**.

Using this formula, calculate the margin of error for a poll of 20 people. _____

What can be said about the margin of error as we increase the sample size? _____

We will now use the TI-83 calculator as a tool for simulating polling data similar to what we did with the marbles.

For our experiment we will assume that 46 percent of the population will vote Republican and 54 percent will vote for the Democratic candidate. The goal is to investigate the effect of sample size in predicting the actual outcome (which we already know in this example) and its effect on the margin of error.

Complete the table below to reflect the outcomes of 5 sample polls using the TI-83. Then calculate the margin of error for each sample size using the formula given above. We will once again use the **randBin**(command used in generating the histogram earlier. For each sample, enter the sample size followed by the proportion for either Republican or Democrat. This will calculate the number supporting that particular political party and then you can easily calculate the number for the other candidate. For example, for a sample size of 20, the command would read: **randBin(20, .54)** to calculate for the Republican candidate.

Sample Size	Democrat	Republican	% Democrat	% Republican	Margin of Error
20					
100					
200					
500					
1000					
2000					

What do you observe as the sample size becomes larger? _____

It is likely that the larger your sample size, the more closely your simulated poll seemed to model the actual population proportions of 0.46 and 0.54. To this end, the margin of error is especially important in polls where the results for the candidates are close. Suppose Candidate A receives 49 percent of a poll and Candidate B receives 51 percent with a margin of error of three percent. How can this be analyzed? Candidate A could receive between 46 and 52 percent of the actual vote while Candidate B could get between 48 and 54 percent. Obviously there is an overlap. This is an important limitation of polls. A poll like this would be too close to call for either candidate and may require a larger sample size to reduce the margin of error.

BRAINSTORMING

Many political polls are based on population samples of 1000 people. What if the sample size were 2000, 5000 or greater? How would this affect the margin of error? Do the benefits of larger populations samples reduce as we increase the sample?

As discussed earlier, polls may reveal certain situations that are “too close to call.” Give an example of a poll of 200 people that would be too close to call but show how a larger sample could give a better prediction. Include numerical examples with your explanation.

Find a report of an opinion poll in a newspaper, in a magazine, or on a web site. What was the poll about? How many people were polled? What were their responses? What was the margin of error and what does it indicate about the actual percentages in the population?
