Common Core Statistics: What Non-Statisticians Should Know

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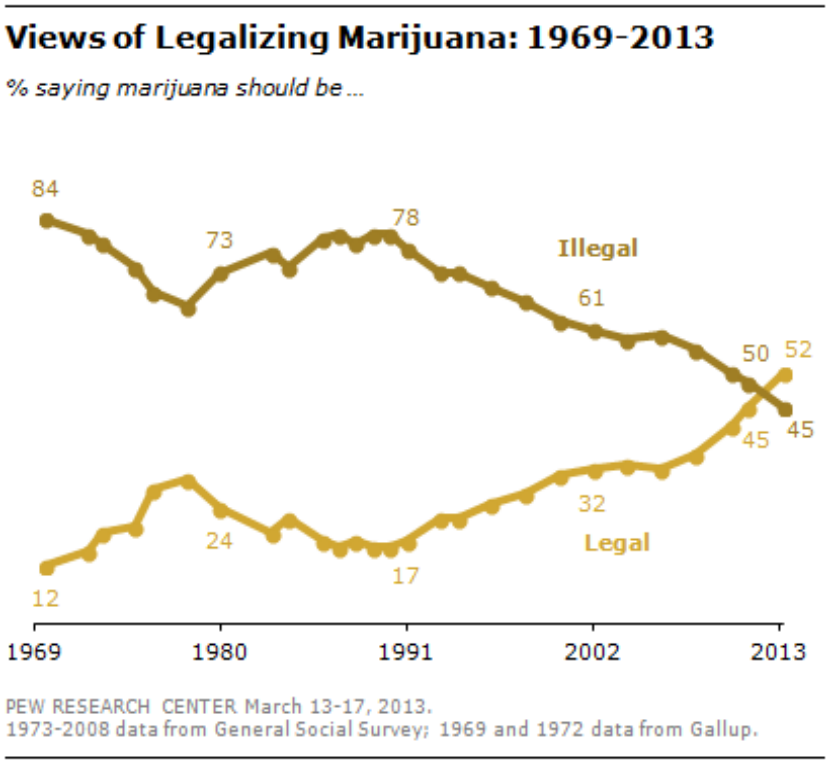
We routinely see poll results in the media.



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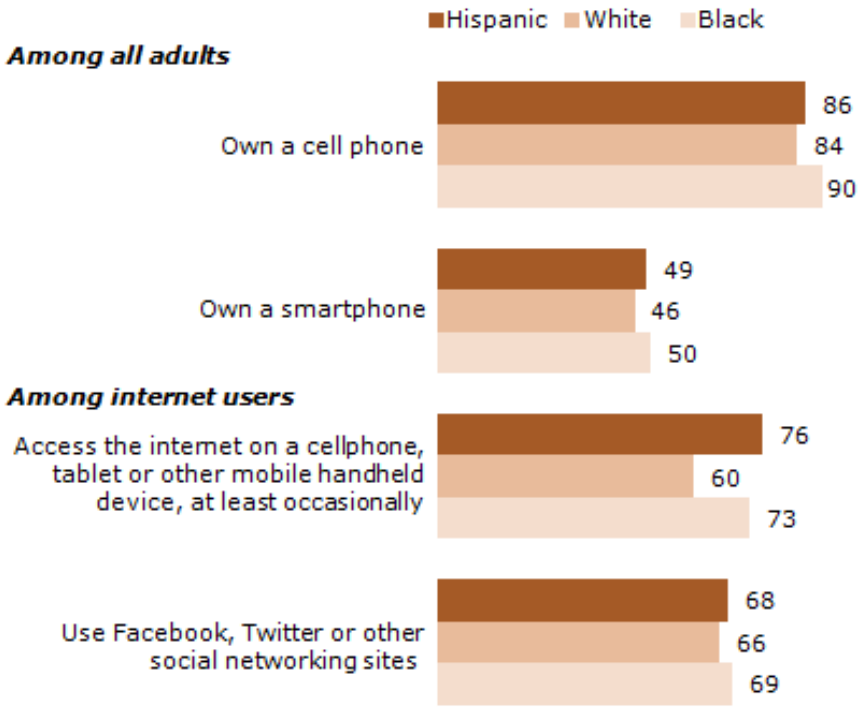
"As President Obama tries to persuade a reluctant Congress to pass new gun laws, the poll found that a majority of Americans — 54 percent — think gun control laws should be tightened, up markedly from a CBS News poll last April that found that only 39 percent backed stricter laws. "

http://www.nytimes.com/2013/01/18/us/poll-shows-school-shooting-sways-views-on-guns.html?ref=newyorktimespollwatch

Figure 2

Smartphone Ownership, Mobile Internet Use, and Social Networking Site Use, 2012

(% saying they ...)



Notes: Blacks and whites include only non-Hispanics. Hispanics are of any race. Smartphone owners are a subset of cellphone owners. An "internet user" is defined as someone who says they either use the internet OR send or receive email at least occasionally.

Source: For Hispanics, Pew Hispanic Center National Survey of Latinos 2012; for whites and blacks, Pew Research Center for the People & the Press June 2012 Biennial Media Consumption Survey and Pew Research Center for the People & the Press February 2012 Political Survey.

PEW RESEARCH CENTER

Pollsters do not gather information from every individual in the population. They poll a sample from the population, and use information from the sample to make an inference about the larger population.

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From the Common Core State Standards for Mathematics:

S.IC.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

What Does This Standard Mean?

- The purpose of a survey or a poll is to learn about a population. For instance, we might want to know what percentage of the US adult population favors legalization of gay marriage. The population of interest is too large to be studied in its entirety.
- A sample of the population is selected at random. Individuals in the sample are questioned and their position recorded. This results in a sample proportion.

- The sample proportion is used to make an inference about the true population proportion.
- The term "margin of error" refers to the anticipated difference between the sample proportion and the true population proportion.

- The standard **S.IC.4** states that students should be able to determine how close a sample proportion will be to a true population proportion. That is, they should be able to determine a "margin of error".

- The way that students are expected to make this determination is with a simulation; a simulation is a physical or computer/calculator process that imitates and shares the important characteristics of an actual experiment.

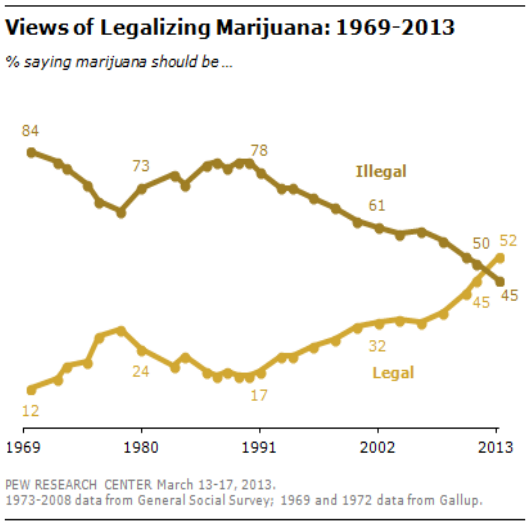
Most of us don't read the fine print at the end of survey results, but we would benefit from taking a closer look.

CBS NEWS/ *January 17, 2013, 7:10 AM*

9 in 10 back universal gun background checks

This poll was conducted by telephone from January 11-15, 2013 among 1,110 adults nationwide.

Phone numbers were dialed from samples of both standard land-line and cell phones. The error due to sampling for results based on the entire sample could be plus or minus three percentage points. The error for subgroups may be higher.



"Most of the analysis in this report is based on telephone interviews conducted March 13-17, 2013, among a national sample of 1,501 adults, 18 years of age or older, living in all 50 U.S. states and the District of Columbia (750 respondents were interviewed on a landline telephone, and 751 were interviewed on a cell phone, including 385 who had no landline telephone). "

www.pewresearch.org

The "fine print" reports how close the pollsters believe the true population proportion will be to the sample proportion that was measured.

Group	Unweighted sample size	Plus or minus...
Total sample	1,501	2.9 percentage points
Republican	420	5.6 percentage points
Democrat	487	5.2 percentage points
Independent	498	5.1 percentage points
Generations		
Millennial (Born after 1980)	284	6.8 percentage points
Generation X (1965-1980)	322	6.4 percentage points
Baby Boomer (1946-1964)	593	4.7 percentage points
Silent (1928-1945)	258	7.1 percentage points
Tried marijuana	680	4.4 percentage points
Never tried marijuana	800	4.0 percentage points

www.pewresearch.org

If the sample proportion is 52 % and the margin of error is 2.9 percentage points, then the pollsters are claiming that the true population proportion is somewhere between 49.1% and 54.9%.

How can the pollster's know this with any degree of certainty?

We will use a simulation to learn how pollsters can determine a margin of error for their poll results.

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Observations:

- Sample proportions vary.
- Sample proportions vary in a predictable way.
- Proportions from small samples vary more than proportions from large samples.
- For any sample size, we can complete this statement: Sample proportions typically differ from the true population proportion by no more than _____ percentage points.

Typically, when $n = 10$,

$$0.35 < sample\ proportion < 0.95$$

$$-0.30 < sample\ proportion\ - population\ proportion < 0.30$$

$$0.30 > population\ proportion - sample\ proportion > -0.30$$

$$sample\ prop + 0.30 > pop\ prop > sample\ prop - 0.30$$

$$\boldsymbol{sample\ prop - 0.30 < pop\ prop < sample\ prop + 0.30}$$

Typically, when $n = 100$,

$$0.55 < sample\ proportion < 0.75$$

$$-0.10 < sample\ proportion\ - population\ proportion < 0.10$$

$$0.10 > population\ proportion - sample\ proportion > -0.10$$

$$sample\ prop + 0.10 > pop\ prop > sample\ prop - 0.10$$

$$\boldsymbol{sample\ prop - 0.10 < pop\ prop < sample\ prop + 0.10}$$

Typically, when $n = 1000$,

$$0.62 < sample\ proportion < 0.68$$

$$-0.03 < sample\ proportion\ < 0.03$$

$$-population\ proportion$$

$$0.03 > population\ proportion > -0.03$$

$$-sample\ proportion$$

$$sample\ prop + 0.03 > pop\ prop > sample\ prop - 0.03$$

$$\boldsymbol{sample\ prop - 0.03 < pop\ prop < sample\ prop + 0.03}$$

If you don't have beads and paddles to do a physical simulation of polling……

TI 84 to the rescue! The command

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randBin(10,0.65)/10
```

yields the proportion of red beads in a random sample of 10 beads taken from a population that contains 65% red beads.

Beads:

6 mm BBs Airsoft Ammo

Paddles:

Christopher Burns
chris@shopbottools.com
ShopBot Tools Inc

NCTM resources:

Core Math Tools

Illuminations

Anja S. Greer Conference on Mathematics Science and Technology

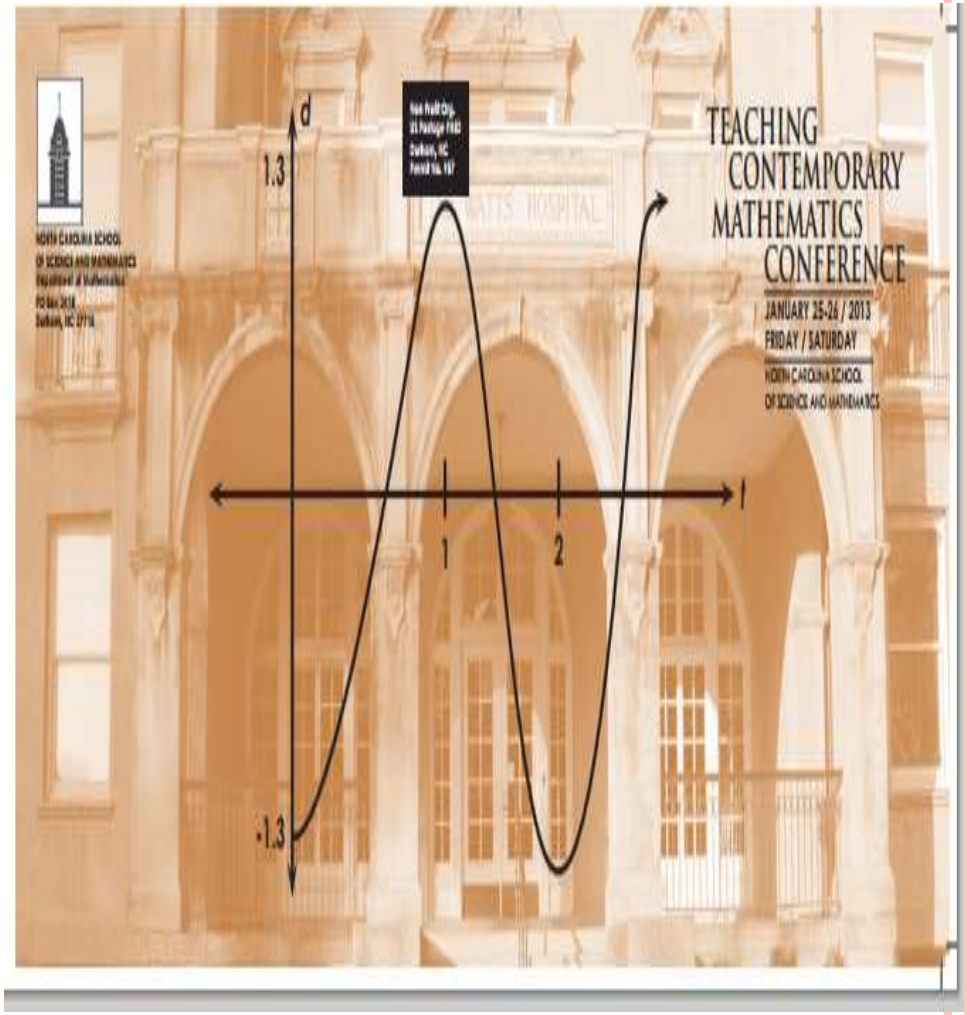
Philips Exeter Academy June 2013

A one-week conference for secondary teachers emphasizes mathematics, focusing on the impact and applications of technology in the classroom and the role of technology in today's and tomorrow's mathematics and science curricula.

Teaching Contemporary Mathematics

January 2014 NCSSM

The Mathematics Department of NCSSM offers a two-day conference filled with great talks by teachers who use technology, apply ideas to real world situations, and involve students as problem solvers.



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