



COMMON CORE STATISTICS: WHAT NON-STATISTICIANS SHOULD KNOW

NCTM National Meeting

New Orleans April 2014

Julie Graves

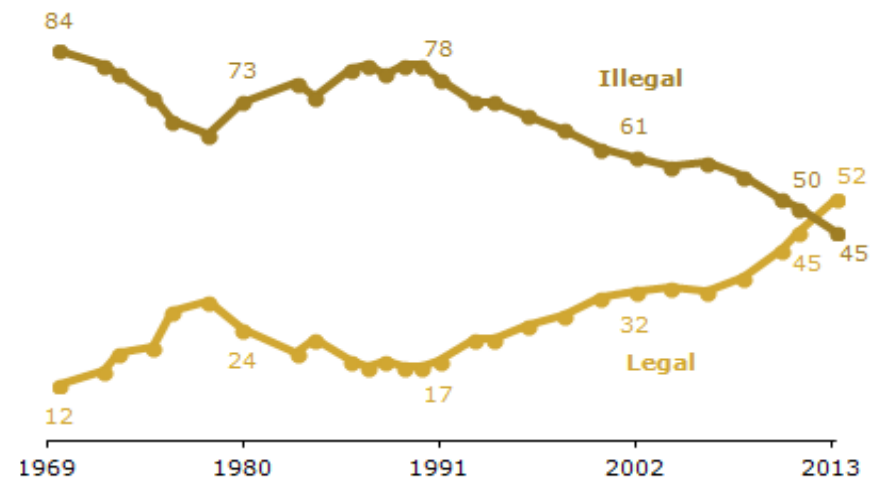
North Carolina School of Science and Mathematics

Philips Exeter Academy

We routinely see poll results in the media.

Views of Legalizing Marijuana: 1969-2013

% saying marijuana should be ...



PEW RESEARCH CENTER March 13-17, 2013.
1973-2008 data from General Social Survey; 1969 and 1972 data from Gallup.

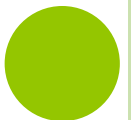




20% of adults 18-29 are married today.
IN 1960, 59% OF ADULTS 18 -29 WERE MARRIED.



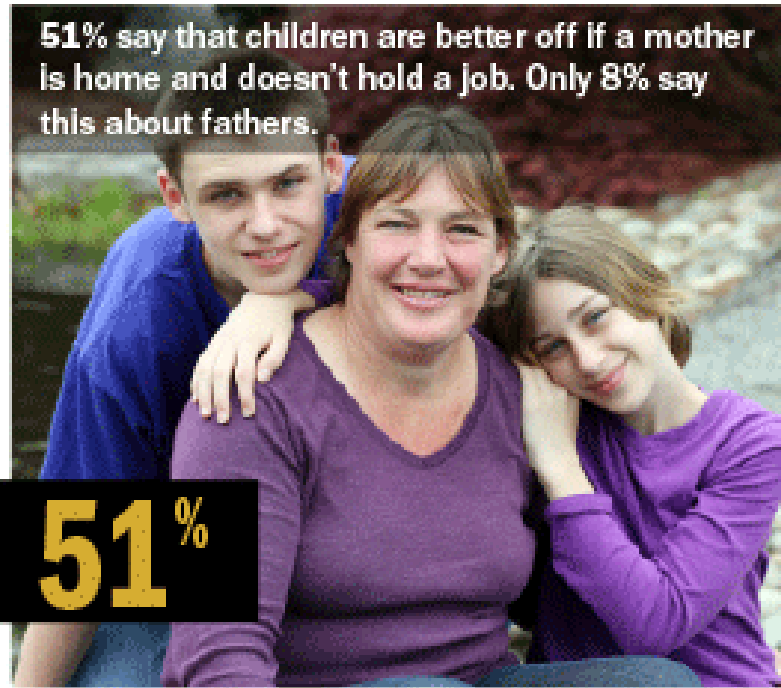
51% of adults 18 or older are married today.
IN 1960, 72% OF ADULTS WERE MARRIED.





47%

Women make up almost of half (47%) of the U.S. labor force today. In 1970, the labor force was only 38% female.



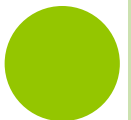
51%

51% say that children are better off if a mother is home and doesn't hold a job. Only 8% say this about fathers.

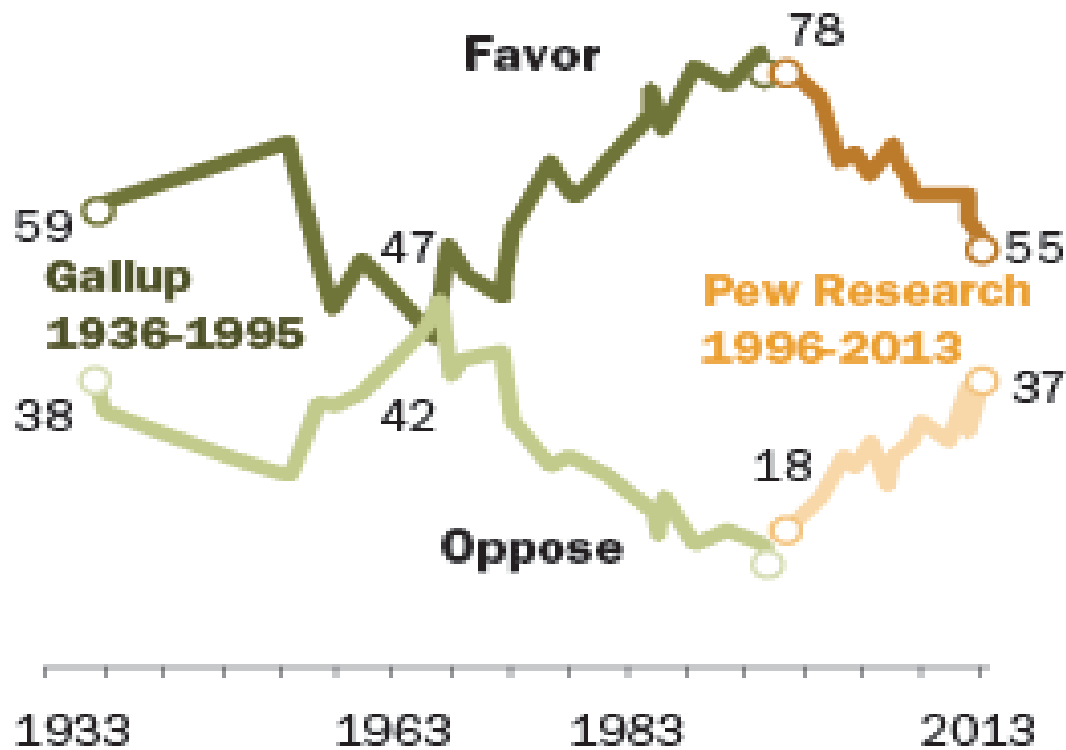


“As President Obama tries to persuade a reluctant Congress to pass new gun laws, the poll found that a majority of Americans — 54 percent — think gun control laws should be tightened, up markedly from a CBS News poll last April that found that only 39 percent backed stricter laws. “

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



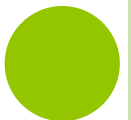
% who favor/oppose death penalty for persons convicted of murder



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.

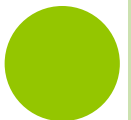


WHAT DOES THIS STANDARD MEAN?

- ❖ 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.



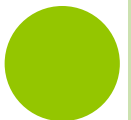
- ❖ The sample proportion is used to make an inference about the true population proportion.
- ❖ The term “margin of error” refers to the anticipated difference between the sample proportion and the true population proportion
- ❖ The standard S.IC.4 states that students should be able to determine how 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

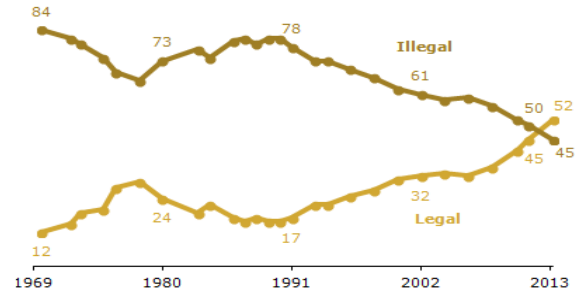
This poll was conducted by telephone from January 11-15, 2013 among 1,110 adults nationwide.

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.



Views of Legalizing Marijuana: 1969-2013

% saying marijuana should be...



PEW RESEARCH CENTER March 13-17, 2013.
1973-2008 data from General Social Survey; 1969 and 1972 data from Gallup.

“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.

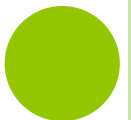
Group	Unweighted sample size	Plus or minus...
Total sample	1,501	2.9 percentage points
Republican	420	5.6 percentage points
Democrat	487	5.2 percentage points
Independent	498	5.1 percentage points
<i>Generations</i>		
Millennial (Born after 1980)	284	6.8 percentage points
Generation X (1965-1980)	322	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

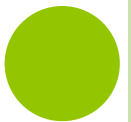


If the sample proportion is 52 % and the margin of error is 2.9 percentage points, then the pollsters are claiming that the true population proportion is somewhere
Between 49.1% and 54.9%.

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.



Simulation In Progress



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 $n = 10$,

$$0.35 < \text{sample proportion} < 0.95$$

$$-0.30 < \text{sample proportion} < 0.30$$

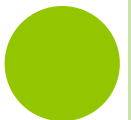
$-\text{population proportion}$

$$0.30 > \text{population proportion} > -0.30$$

$-\text{sample proportion}$

$$\text{sample prop} + 0.30 > \text{pop prop} > \text{sample prop} - 0.30$$

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



Typically, when $n = 100$,

$$0.55 < \text{sample proportion} < 0.75$$

$$-0.10 < \text{sample proportion} < 0.10$$

–population proportion

$$0.10 > \text{population proportion} > -0.10$$

–sample proportion

$$\text{sample prop} + 0.10 > \text{pop prop} > \text{sample prop} - 0.10$$

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



Typically, when $n = 1000$,

$$0.62 < \textit{sample proportion} < 0.68$$

$$-0.03 < \textit{sample proportion} < 0.03$$

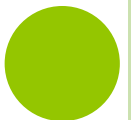
$$-\textit{population proportion}$$

$$0.03 > \textit{population proportion} > -0.03$$

$$-\textit{sample proportion}$$

$$\textit{sample prop} + 0.03 > \textit{pop prop} > \textit{sample prop} - 0.03$$

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



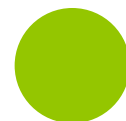
If you don't have beads and paddles to do a physical simulation of polling.....

TI 84 to the rescue!

The command

`randBin(10,0.65)/10`

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



Beads:

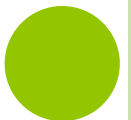
6 mm BBs Airsoft Ammo

10,000 BBs per bin

About \$5 per thousand BBs

Paddles:

My source is no longer available. Try a
“fabrication shop” at a community
college.





Anja S. Greer Conference on Mathematics Science and Technology

Philips Exeter Academy June 22-27 2014

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

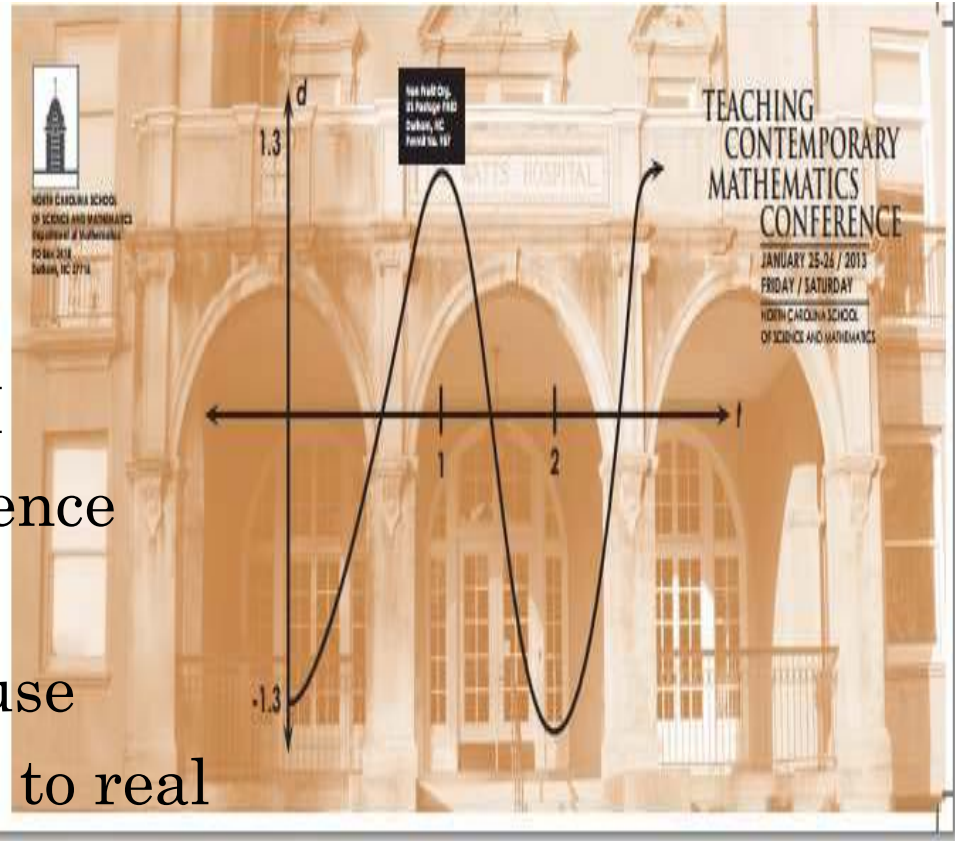


TEACHING CONTEMPORARY MATHEMATICS

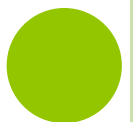
January 2015

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.



Common Core Statistics Julie Graves
NCSSM Philips Exeter Academy



Julie Graves

Until June 2014

Philips Exeter Academy

After June 2014

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