Making Sense of Inference for Sampling and Experiments

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Goals for Session:

- Examine similarities and differences between inference procedures in sampling and experimental settings.
- Learn strategies for helping students construct confidence intervals and perform significance tests correctly.

Scope of Inference

- Random sampling allows researchers to generalize to the larger population
- Random assignment allows researchers to establish cause and effect conclusions

		Were subjects randomly selected?	
		YES	**NO**
Were subjects randomly assigned?	**YES**	The researcher: —may infer cause and effect; *and* —may generalize findings to the population.	The researcher: —may infer cause and effect; *but* —may *not* generalize findings to the population.
	NO	The researcher: —may *not* infer cause and effect; *but* —may generalize findings to the population.	The researcher: —may *not* infer cause and effect; *and* —may *not* generalize findings to the population.

Inference for Sampling: Cell phone use

The Pew Internet and American Life Project asked a random sample of U.S. cell phone owners "Do you ever find yourself checking your cell phone for messages, alerts or missed calls, even though you didn't notice your phone ringing or vibrating?" 1309 of the 1954 people surveyed said "Yes." Construct and interpret a 95% confidence interval for the corresponding population proportion. (*www.pewinternet.org/2012/11/30/the-best-and-worst-of-mobile-connectivity/*)

STATE: What *parameter* do you want to estimate, and at what *confidence level*?

PLAN: Identify the appropriate inference *method*. Check *conditions*.

DO: If the conditions are met, perform *calculations*.

CONCLUDE: *Interpret* your interval in the context of the problem.

Inference for Experiments: Subliminal Messages

From *The Practice of Statistics*, 5th edition, by Starnes, Tabor, Yates, and Moore, W.H. Freeman and Co., 2015.

A "subliminal" message is below our threshold of awareness but may nonetheless influence us. Can subliminal messages help students learn math? A group of 18 students who had failed the mathematics part of the City University of New York Skills Assessment Test agreed to participate in a study to find out. All received a daily subliminal message, flashed on a screen too rapidly to be consciously read. The treatment group of 10 students (assigned at random) was exposed to "Each day I am getting better in math." The control group of 8 students was exposed to a neutral message, "People are walking on the street." All 18 students participated in a summer program designed to raise their math skills, and all took the assessment test again at the end of the program. The table below gives data on the subjects' scores before and after the program.

Treatment Group			Control Group		
Pretest	Posttest	Difference	Pretest	Posttest	Difference
18	24	6	18	29	11
18	25	7	24	29	5
21	33	12	20	24	4
18	29	11	18	26	8
18	33	15	24	38	14
20	36	16	22	27	5
23	34	11	15	22	7
23	36	13	19	31	12
21	34	13			
17	27	10			

Source: Data provided by Warren Page, New York City Technical College, from a study done by John Hudesman.

Do the data provide convincing evidence that the subliminal message about getting better at math results in larger increases in scores, on average, than the neutral message?

State: What *hypotheses* do you want to test, and at what *significance level*? Define any *parameters* you use.

Plan: Choose the appropriate inference *method*. Check *conditions*.

Do: If the conditions are met, perform *calculations*.
• Compute the **test statistic**.

• Find the ***P*-value**.

Conclude: Make a *decision* about the hypotheses in the context of the problem.