# Central Limit Theorem, Confidence Intervals, and Meta-Analysis: Oh My!

Demo Demo presented at the 44th National Institute on the Teaching of Psychology; January 5, 2022
Andrew N. Christopher – Albion College (achristopher@albion.edu)

This demonstration requires about 10-15 minutes of preparation time and about 15-20 minutes of class time.

## Materials
1. At least one baseball cap (more caps can speed up the demonstration in class but requires a little more prep time)
2. For each cap, 50 small slips of paper, numbered 1 through 50

## Critical information
1. Each number on a slip of paper represents a mean difference in one sample.
2. The 50 slips of paper represent all possible mean differences in the population.
3. Given mean differences range between 1 and 50, the population mean difference is 25.50.

## Procedure
There are two "rounds" of the demo:

### First round
1. Each student draws three slips of paper from the cap (i.e., samples the same population three times), records each number (i.e., mean difference), then puts them back in the cap
2. Each student takes the mean of these three slips and reports it out
3. The teacher records and displays each of these sampling means

### Second round
Same procedure as the first round, except each student draws 10 slips from the cap

## Discussion points
- From the display, we can see when n = 10, the sampling means are more tightly clustered around the population mean (of 25.50) then when n = 3.
- The interval of sampling means will be wider with n = 3 than with n = 10.
- We can conduct a conceptual meta-analysis by taking the mean of the sampling means on display. Doing so, even with n = 3 (x the number of students in class) will approximate the population mean about as well as with n = 10 (x the number of students in class).

Other demonstrations of Central Limit Theorem that can be extended to teach Confidence Intervals and Meta-Analysis:

Aberson, C. L., Berger, D. E., Healy, M. R., Kyle, D. J., & Romero, V. L. (2000). Evaluation of an interactive tutorial for teaching the Central Limit Theorem. *Teaching of Psychology, 27*(4), 289-291. https://doi.org/10.1207/S15328023TOP2704_08

Johnson, D. E. (1986). Demonstrating Central Limit Theorem. *Teaching of Psychology, 13*(3), 155-156. https://doi.org/10.1207/s15328023top1303_18

Matz, D. C., & Hause, E. L. (2008). "Dealing" with the Central Limit Theorem. *Teaching of Psychology, 35*(3), 198-200. doi: 10.1080/00986280802186201

Schoenfelder, E., Olson, R., Bell, M., & Tom, K. (2007). Stop and smell the roses: An activity for teaching Central Limit Theorem. *Psychology Learning and Teaching, 6*(2), 80-84. https://doi.org/10.2304/plat.2007.6.2.80