

Confidence interval for a mean difference μ_d

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1. Does memory training help? Suppose a study is conducted where all subject are first given 3 minutes to memorize as many words as possible from a random words list. The subjects are then given a memory training strategy and the experiment is repeated with a new list of random words. The results are shown below:

Strategy 1	Strategy 2	Difference
12	14	2
10	11	1
10	15	5
8	8	0
12	15	3
12	11	-1
8	9	1
10	14	4
8	9	1
6	10	4
11	8	-3
15	17	2
10	12	3
6	10	4
10	18	8
12	12	0
11	14	3
7	12	5
8	10	2
10	8	-1
11	15	4
5	8	3
10	12	2
11	9	-2
8	11	3
7	12	5
10	10	0

2. What is the average word difference?

Solution: $\mu_d = 2.07$

3. What is the sample standard deviation for differences?

Solution: $s_d = 2.51$

4. **(Sate)** Using C.I. estimation what the parameter we would like to estimate. What statistic are we using as a point estimate? What is the confidence level?

Solution: We are interested in estimating the true mean difference between words guessed correctly by people who have and have not used a memory training strategy. Here we will use a confidence level of 95%.

5. **(Plan)** What is the name of the procedure we are conducting? Are the conditions for this procedure being met?

Solution: We would like to conduct a one sample t -interval for μ_d .
Condition Check:

- Random: We will assume that our subjects are representative of the population we are inferring on.
- Independence: Our number of subjects is clearly less than 10% of the population of all people. So we will assume that the differences are independent of each other.
- Normality: Here we do not have enough treatments for the central limit theorem to apply. We will assume the sampling distribution for \bar{x}_d is normal as the sample is shows no strong skew or outliers.

6. **(Do)** Conduct the confidence interval for μ_d .

Solution:

$$\begin{array}{rcl} \text{Point Estimate} & \pm & \text{Margin of Error} \\ \bar{x} & \pm & t^* \frac{s_d}{\sqrt{n}} \\ 2.07 & \pm & 2.056 \frac{2.51}{\sqrt{27}} \end{array}$$

We have a confidence interval of (1.08, 3.07).

7. **(Conclude)** Interpret the confidence interval constructed in the context of the problem.

Solution: We are 95% confident that the interval from 1.08 words to 3.07 words captures the true mean difference in words remembered correctly between people who use the memory strategy and those who don't.