

Standard Deviation and Difference in Means

Standard Deviation:

- The measurement of the amount of variation or dispersion of a value set
- If standard deviation is low the value is close to the mean
- If standard deviation is high the values are spread out

$$\text{SD (population)} = \sqrt{\frac{\sum |x - \mu|^2}{N}} \quad \text{SD (sample)} = \sqrt{\frac{\sum |x - \bar{x}|^2}{n-1}}$$

Steps for Computing Standard Deviation:

- Find the mean (μ)
- Find the square of the distance to the mean for each data point ($\mu - x$)
- Find the sum of those values (Σ)
- Divide that by the number of data points
- Take the square root of that value

Difference in Means:

- Research hypothesis is a difference between the means
- Null hypothesis is no difference between the means
- The null hypothesis is rejected if the difference between the means is bigger or smaller

Steps to Calculate Differences in Means:

- Find the mean for each sample
- Find the variance for each sample
- Find the standard error of the difference between means
- Calculate the t value
- Find the critical value of t using degrees of freedom

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}} \quad s_{\bar{x}_1 - \bar{x}_2} = \left(\frac{N_1 s_1^2 + N_2 s_2^2}{N_1 + N_2 - 2} \right) \left(\frac{N_1 + N_2}{N_1 N_2} \right)$$

$$\text{degree of freedom} = N_1 + N_2 - 2$$