Key Concepts and Terminology

Paired T-test: A test chosen when presented with the same subject group that is subjected to the same treatments (or synchronized). A bigger group is divided into sub-groups and subjected to old vs new treatments with each taking turns. The means compared are the TREATMENT CONDITIONS as opposed to the treatment groups involved. Used in matched pairs.

Independent T-test: A test chosen when actual differences between treatment groups want to be deciphered. However, a synchronizer is needed (like teaching similar material) to ensure that treatment groups have similar baseline. The means compared in this test not only detect differences between TREATMENT CONDITIONS but also the differences between the TREATMENT GROUPS involved. Used in statistically independent samples.

T-statistic: Is the derived statistic from a t-test.

Cohen's D: A measure of effect size or magnitude of difference. It measures the number of standard deviations from the expected mean (usually 0).

$$\text{Cohen's d (PAIRED)} = {}^{\pm\text{Mean}}/_{\text{SD}} = {}^{\pm 2.35}/_{2.87} = \pm 0.819$$

$$sd = \sqrt{\frac{\sum_{i=0}^{n}(X-\bar{X})^2}{N-1}} = \sqrt{\frac{156.55}{19}}$$

$$sd = \sqrt{\frac{156.55}{19}} = 2.87$$

$$d = {}^{|\bar{x}_{nt}-\bar{x}_{ot}|}/_{sd_{pooled}} = {}^{2.35}/_{9.49} = 0.248$$

$$sd_p = \sqrt{\frac{(N_{nt}-1)*S_{nt}^2+(N_{ot}-1)*S_{ot}^2}{N_{nt}+N_{ot}-2}} * \frac{N-3}{N-2.25} * \sqrt{\frac{N-2}{N}}$$

$$sd_p = \sqrt{\frac{19*10.49^2+19*9.34^2}{20+20-2}} * \frac{40-3}{40-2.25} * \sqrt{\frac{40-2}{40}}$$

$$sd_p = 9.93 * 0.98 * 0.975 = 9.49$$

$$sd_p = \sqrt{\frac{10.49^2+9.34^2}{2}} = 9.93$$

$$\text{Hedges(g)} = \frac{d}{\sqrt{\frac{N=20/40}{df=19/38}}} = \frac{0.248}{1.0259} = 0.242$$

Key Concepts and Terminology

Paired Test Null: $Mean_{old\_test} == Mean_{new\_test}$

Independent Test Null: $|Mean_{new\_test} - Mean_{old\_test}| = 0$

Lavene's Test: A test for homogeneity of variance depicted by an F-stat value.

Within-group or intra-variance: Of great importance in independent T-tests as it ensures that individuals within treatment groups are derivatives of the same population and it facilitates the removal of outliers to help arrive at normality of the data. Primarily helps assess the sampling technique concern.

Between-group or inter-variance: Ensures that treatment groups as a whole are derivatives of the same population albeit being different. A flaw one need not worry about in a paired t-test. Ideally variance between groups should be different to indicate sample demarcation but not too far off, to raise a flag as to the sampling technique.

Key Assumptions

Assumptions

Paired and unpaired t-tests both make the following assumptions:

- The data in both samples was obtained using a random sampling method.
- The data in both samples should be roughly normally distributed.
- There should be no extreme outliers in either sample.