Conditions

The paired t-test

A large group of learning-disabled college freshmen, who experienced debilitating anxiety before major tests, were matched on an index of test anxiety. Members of these matched pairs were randomly assigned to two different groups. The first group was given two weeks of relaxation exercises (Relax). The second group of students was given two weeks of study skills training (Study). Using the data below determine if there is a significant difference between their final exam scores. Use this data

Relax: 46 49 47 48 50 52 48 47 46 49 42

Study (y) 50 49 51 52 50 48 52 47 50 52 53

Solution

The null hypothesis is

$$H_0: M_1 = M_2$$

The *t* statistic to test whether the means are different can be calculated as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1X_2}\sqrt{\frac{2}{n}}},$$

where

$$S_{X_1X_2} = \sqrt{\frac{1}{2}\left(S_{X_1}^2 + S_{X_2}^2\right)}$$

$$S_{X_1}^2 = \frac{\sum_{i=1}^{11}(X_1 - M_1)^2}{n}$$

$$S_{X_2}^2 = \frac{\sum_{i=1}^{11}(X_2 - M_2)^2}{n}$$

$$M_1 = \frac{46 + 49 + 47 + 48 + 50 + 52 + 48 + 47 + 46 + 49 + 42}{11} \approx 47.64$$

$$M_2 = \frac{50 + 49 + 51 + 52 + 50 + 48 + 52 + 47 + 50 + 52 + 53}{11} \approx 50.36$$

$$S_{X_1}^2 \approx 6.654545$$

$$S_{X_2}^2 \approx 3.454545$$

$$S_{X_1X_2} \approx 2.248232$$

$$t = \frac{2.727272}{0.958649} = 2.844912$$

The degrees of freedom:

$$k = 22 - 2 = 20$$

The t-criterion value is 2.08600 (for p=0.95).

As our t is bigger, than t-criterion value, so the null hypothesis is rejected.

Answer: Yes, there is a significant difference between their final exam scores