What is an Independent Samples T Test?

The independent samples t test (also called the unpaired samples t test) is the most common form of the T test. It helps you to compare the means of two sets of data. For example, you could run a t test to see if the average test scores of males and females are different; the test answers the question, "Could these differences have occurred by random chance?" The two other types of t test are:

- **One sample t test**: used to compare a result to an expected value. For example, do males score higher than the average of 70 on a test if their exam time is switched to 8 a.m.?
- **Paired t test** (dependent samples): used to compare related observations. For example, do test scores differ significantly if the test is taken at 8 a.m. or noon?

This test is extremely useful because for the z test you need to know facts about the population, like the population standard deviation. With the independent samples t test, you don't need to know this information. You should use this test when:

- You do not know the population mean or standard deviation.
- You have two independent, separate samples.

Assumptions for the Independent Samples T Test

- **Assumption of Independence:** you need two independent, categorical groups that represent your independent variable. In the above example of test scores "males" or "females" would be your independent variable.
- **Assumption of normality**: the dependent variable should be approximately normally distributed. The dependent variable should also be measured on a continuous scale. In the above example on average test scores, the "test score" would be the dependent variable.
- **Assumption of Homogeneity of Variance:** The variances of the dependent variable should be equal.

Independent t-test for two samples

Introduction

The independent t-test, also called the two sample t-test, independent-samples t-test or student's t-test, is an inferential statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups.

Null and alternative hypotheses for the independent t-test

The null hypothesis for the independent t-test is that the population means from the two unrelated groups are equal:

$$H_0: u_1 = u_2$$

In most cases, we are looking to see if we can show that we can reject the null hypothesis and accept the alternative hypothesis, which is that the population means are not equal:

$$H_A: u_1 \neq u_2$$

To do this, we need to set a significance level (also called alpha) that allows us to either reject or accept the alternative hypothesis. Most commonly, this value is set at 0.05.

What do you need to run an independent t-test?

In order to run an independent t-test, you need the following:

- One independent, categorical variable that has two levels/groups.
- One continuous dependent variable.

Unrelated groups

Unrelated groups, also called unpaired groups or independent groups, are groups in which the cases (e.g., participants) in each group are different. Often we are investigating differences in individuals, which means that when comparing two groups, an individual in one group cannot also be a member of the other group and vice versa. An example would be gender - an individual would have to be classified as either male or female – not both.

Assumption of normality of the dependent variable

The independent t-test requires that the dependent variable is approximately normally distributed within each group.

Note: Technically, it is the residuals that need to be normally distributed, but for an independent t-test, both will give you the same result.

Assumption of homogeneity of variance

The independent t-test assumes the variances of the two groups you are measuring are equal in the population. If your variances are unequal, this can affect the Type I error rate. The assumption of homogeneity of variance can be tested using Levene's Test of Equality of Variances, which is produced in SPSS Statistics when running the independent t-test procedure. If you have run Levene's Test of Equality of Variances in SPSS Statistics, you will get a result similar to that below:

Levene's Test for Equality of Variances	F	.314	
	Sig.	.579	

This test for homogeneity of variance provides an *F*-statistic and a significance value (*p*-value). We are primarily concerned with the significance value – if it is greater than 0.05 (i.e., $p > .05$), our group variances can be treated as equal. However, if $p < 0.05$, we have unequal variances and we have violated the assumption of homogeneity of variances.