Two-Sample T Test

Is the difference in mean GCSE scores between boys and girls in Year 11 statistically significant?

When we compared mean GCSE scores between boys and girls above, we saw a slight difference. On average, girls have higher mean GCSE scores than boys do. Is this difference large enough to be interesting? Alternatively, you may want to consider whether the difference in means across both sexes is simply due to chance. Because we calculated these means from data from a sample of the population, it may be that the difference in means across both sexes is due to chance. In order to investigate this, we can run a t test to see whether this difference in means is statistically significant.

In a t test, like in most tests of significance, the significance threshold is traditionally set at p = 0.05. A p-value is basically the likelihood of finding a mean difference by chance if indeed there is no difference in the population. If in the population there is no difference in GCSE score for males and females, we may have caused there to be a different mean for males and females just by randomly selecting the sample. We can work out the chances of the result we have obtained happening by chance. If a p-value reported from a t test is less than 0.05, then that result is said to be statistically significant. If a p-value is greater than 0.05, then the result is insignificant.

Because we have already run frequencies and used a histogram to confirm the normal distribution of our sample, we can run a t test to check for significance.
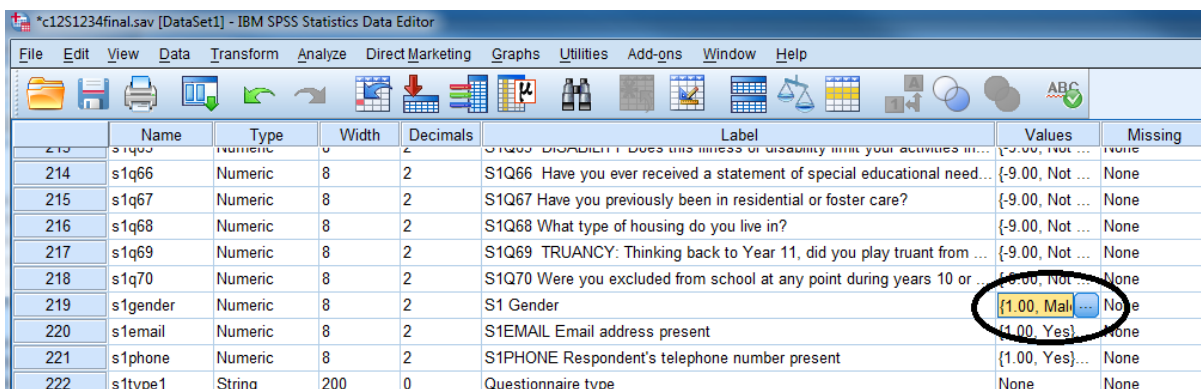
We are going to use the **Independent-Samples T Test**, because we are interested in comparing the means across the two unrelated categories male and female in the variable **s1gender**.

Select **Analyze**, **Compare Means**, and then **Independent-Samples T Test**.

Move our variable **s1gcseptsnew** to the **Test Variable(s)** box.

Move **s1gender** to the **Grouping Variable** box.

Click on **Define Groups** and enter **1** in the **Group 1** box and **2** in the **Group 2** box, because 1=Male and 2=Female in the dataset. (We are using the dataset's codes for Male and Female. You can check the category codes for **s1gender**, or any other variable you choose, by finding the variable's row in **Variable View** and clicking to open the **Values** cell.)

After you've entered the information into **Define Groups**, click **Continue** and then **OK**. You should get the following output:

Group Statistics

	S1 Gender	N	Mean	Std. Deviation	Std. Error Mean
ks4 pts score on new basis not capped	Male	6044	381.2331	131.20956	1.68773
	Female	7726	404.6233	120.38817	1.36964

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
ks4 pts score on new basis not capped	Equal variances assumed	58.186	.000	-10.875	13768	.000	-23.39023	2.15088	-27.60624	-19.17421
	Equal variances not assumed			-10.761	12412.240	.000	-23.39023	2.17356	-27.65073	-19.12972

From the **Group Statistics** table above, you can see that SPSS has again calculated the number of male and female respondents and the mean scores for both groups. We've also been provided with the standard deviations for both men and women.

In the **Independent Samples Test** table, SPSS gives us the significance levels of the differences in means. The first test, **Levene's Test for Equality of Variances**, tests whether the two means have been taken from sample populations that have equal variance. If, for instance, the mean GCSE scores for boys and girls in Sweep 1 of the YCS didn't vary, there would be no mean difference to test. For this test, a p-value of less than 0.05 indicates that there is, in fact, enough variance in the sample to account for possible mean differences. The p-value reported for Levene's Test for Equality of Variance in the table above is p = 0.000, which is well below the 0.05 threshold. So, we can say that "equal variance is not assumed" for this sample and go on to check the significance level reported in the **t test for Equality of Means** section. Because we have decided that equal variances are not assumed, we are going to use the p-value presented in the second row of the table.

The p-value for the t test for Equality of Means is 0.000, much lower than the p-value significance threshold of 0.05. This tells us that there is indeed a statistically significant difference in the mean GCSE scores for boys and girls in Sweep 1 of the YCS.

*Run another two-sample t test to see if there is a statistically significant difference in mean GCSE score between respondents in the variable **s1q1e**, which concerns whether or not a respondent is enrolled in full time education. (Before you run the test, use the Frequencies function to make sure there are no coded missing values in **s1q1e**. If there are, recode them.) What are the results of your t test? Are they what you might expect?*

Summary

You've just run a two sample t test to determine whether or not the differences in mean GCSE scores between girls and boys are statistically significant. You used the Levene's Test for Equality of Means to determine that equal variance was not assumed, and therefore the difference in mean scores is not due to chance and is statistically significant.

***Note: as we are making changes to a dataset we'll continue using for the rest of this section, please make sure to save your changes before you close down SPSS. This will save you having to repeat sections you've already completed!**

Practical Applications of Statistics in the Social Sciences – University of Southampton 2014