

## Chapter 7: How can I tell if scores differ between two groups? Independent measures *t* test.

### Full answers to study questions

1. Lab One is more likely to have found the significant difference. Although the mean difference is very slightly larger for Lab Two, the variability in the dataset (as seen in the SD) is much bigger. Therefore, there will be a greater amount of random variance in the study run in Lab Two, making a significant result far less likely.
2. Results in APA format are...
  - 2.1.  $t(14) = 3.19, p < .010$
  - 2.2.  $t(25) = 2.55, p < .020$
  - 2.3.  $t(36) = 3.41, p < .002$
3. For each of the results...
  - 3.1. There is far more random variance, so the result will most likely be not significant.
  - 3.2. There is a similar amount of explained and random variance, so the result will most likely be not significant.
  - 3.3. There is far more explained variance, so the result will most likely be significant.

### Full answers for additional dataset

1. What method of analysis will you use to analyse this dataset?

An independent measures *t* test. The IV is whether the person had a mild or a serious head injury, therefore there are two independent conditions. The DV is their satisfaction with life.

2. Suggest a suitable hypothesis for this analysis.

There will be a significant difference in life satisfaction between patients with mild and serious head injuries. (Note that this is a two-tailed hypothesis).

3. Calculate the *t* statistic and determine whether it is significant.

Note: The steps for calculations in the book chapter are repeated here.

Steps 1 - 6 of the calculations have been completed in the table.

	Mild head injury: Group 1		Serious head injury: Group 2	
	Scores: $x_1$	Squared: $x_1^2$	Scores: $x_2$	Squared: $x_2^2$
	2	$2^2 = 4$	6	$6^2 = 36$
	3	$3^2 = 9$	4	$4^2 = 16$
	5	$5^2 = 25$	5	$5^2 = 25$
	3	$3^2 = 9$	6	$6^2 = 36$
	2	$2^2 = 4$	3	$3^2 = 9$
	1	$1^2 = 1$	5	$5^2 = 25$
	5	$5^2 = 25$	6	$6^2 = 36$
	3	$3^2 = 9$	4	$4^2 = 16$
Total ( $\Sigma$ )	$\Sigma x_1 = 24$	$\Sigma x_1^2 = 86$	$\Sigma x_2 = 39$	$\Sigma x_2^2 = 199$
$(\Sigma x)^2$	$(\Sigma x_1)^2 = 24^2$ $(\Sigma x_1)^2 = 576$		$(\Sigma x_2)^2 = 39^2$ $(\Sigma x_2)^2 = 1521$	
Mean ( $\bar{x}$ )	$\bar{X}_1 = 24/8$ $\bar{X}_1 = 3.00$		$\bar{X}_2 = 39/8$ $\bar{X}_2 = 4.88$	
n	$n_1 = 8$		$n_2 = 8$	

7: Take all of the values calculated in steps 2-6 above, and insert them into the equation.

$$t = \frac{3.00 - 4.88}{\sqrt{\frac{(86 - \frac{576}{8}) + (199 - \frac{1521}{8})}{(8 - 1) + (8 - 1)} * (\frac{1}{8} + \frac{1}{8})}}$$

8: Next calculate all four of the division sums that sit on the lower part of the equation.

$$t = \frac{3.00 - 4.88}{\sqrt{\frac{(86 - 72) + (199 - 190.125)}{(8 - 1) + (8 - 1)} * (0.125 + 0.125)}}$$

9: Then calculate the subtraction on the top part of the equation and the subtraction and addition sums within the brackets on the lower part of the equation.

$$t = \frac{-1.88}{\sqrt{\frac{(14) + (8.875)}{(7) + (7)} * (0.25)}}$$

10: Now complete the two addition sums on the lower part of the equation.

$$t = \frac{-1.88}{\sqrt{\frac{22.875}{14} * (0.25)}}$$

11: Then calculate the division on the lower part.

$$t = \frac{-1.88}{\sqrt{1.6339 * (0.25)}}$$

12: Next complete the multiplication on the lower part.

$$t = \frac{-1.88}{\sqrt{0.4085}}$$

13: Now calculate the square root on the lower part.

$$t = \frac{-1.88}{0.6391}$$

14: Finally, calculate the division to compute the  $t$  statistic!

$$t = -2.9416$$

$$\begin{aligned} df &= (n_1 - 1) + (n_2 - 1) \\ df &= (8 - 1) + (8 - 1) \\ df &= 7 + 7 \\ df &= 14 \end{aligned}$$

4. Interpret and write up your findings using APA standards.

Note: the calculated  $t$  had a negative sign. It is not necessary to report this. It only depends on which condition you labelled as 1, and which you labelled as 2. If you had done it the other way around the  $t$  value would be exactly the same, but a positive value.

There is a significant difference in satisfaction with life ( $t(14) = 2.9, p < .020$ ). Those with a more serious head injury report being more satisfied ( $M = 4.9, SD = 1.1$ ) than those with a mild head injury ( $M = 3.0, SD = 1.4$ ).

5. What do you think is the greatest methodological limitation of this study, and how would you redesign the study to improve it?

There are possibly a few limitations, but the obvious one to me is that there is no “control” group. So are those with a serious head injury more, less or equally satisfied with life in comparison to people who have never had a head injury at all. If I were to re-run this study I would add a control group as an extra condition within the IV. Another possible limitation is that you don’t know how satisfied with life these participants were before their head injury. Theoretically it would be great to run this study with a repeated measures design, measuring satisfaction with life before and after head injury. However, this would be almost impossible to actually run, so a control group will have to do!

**Are p values enough? An additional exercise**

$$d = \frac{3.0 - 4.9}{\sqrt{\frac{1.4^2 + 1.1^2}{2}}}$$

$$d = \frac{3.0 - 4.9}{\sqrt{\frac{1.96 + 1.21}{2}}}$$

$$d = \frac{-1.9}{\sqrt{\frac{3.17}{2}}}$$

$$d = \frac{-1.9}{\sqrt{1.585}}$$

$$d = \frac{-1.9}{1.259}$$

$$d = -1.5091$$

There is a significant difference in satisfaction with life ( $t(14) = 2.9, p < .020; d = 1.51$ ) with a large effect size. Those with a more serious head injury report being more satisfied ( $M = 4.9, SD = 1.1$ ) than those with a mild head injury ( $M = 3.0, SD = 1.4$ ).