This week you will derive the t-score for your paper.

- Derive a t value for the difference between groups, using the data given below.
- The two groups express the **Independent Variable**; "1"is the experimental group, "2" is the control group.
- The outcome scores are the level of your **Dependent Variable** for each participant.

What is *your* **independent variable**: _____

What is *your* **dependent variable**: _____

The concept underlying the t test is the critical ratio:

$$\text{Critical ratio} = \frac{\text{Experimental effect}}{\text{Error variance}} = \frac{(M_{experimental} - M_{control}) - 0}{\sqrt{\frac{Variance_{exp}}{n_{exp}} + \frac{Variance_{control}}{n_{control}}}} = t$$

$$t = \frac{(M_{group1} - M_{group2}) - 0}{\sqrt{\frac{SS_{grp1}/df_{grp1}}{n_{grp1}} + \frac{SS_{grp2}/df_{grp2}}{n_{grp2}}}}$$

The difference between means.

The variance for each group.

$$t = \frac{(M_{group1} - M_{group2}) - 0}{\sqrt{\frac{\sum(X - M)^2_{grp1}/n - 1_{grp1}}{n_{grp1}} + \frac{\sum(X - M)^2_{grp2}/n - 1_{grp2}}{n_{grp2}}}}$$

The complete formula, showing each step you will use on the next pages.

Week 12: Derive your t score

Here are some data. You can use this, make up your own, or get some real data.

Participant	Group Assignment	Outcome Score
1	1.00	3.00
2	2.00	3.00
3	1.00	4 .00
4	1.00	2.00
5	2.00	3.00
6	2.00	4.00
7	1.00	3.00
8	1.00	2.00
9	2.00	4.00
10	1.00	4.00
11	2.00	4.00
12	2.00	4.00
13	2.00	5.00
14	1.00	3.00
15	1.00	4.00
16	2.00	3.00
17	1.00	1.00
18	2.00	4.00
19	1.00	2.00
20	2.00	3.00

Calculating the variances

1. Enter the scores for group 1 and group 2.

Group 1				Group 2			
Scores (X1-X10)	*M1*	X – *M*	$(X - M)^2$	Scores (X1-X10)	*M2*	X – *M*	$(X - M)^2$
$\Sigma (X - M)^2 =$				$\Sigma (X - M)^2 =$			
df =				df =			

2. Find the **mean** for each group; *M1* = _____ *M2* = _____
3. Enter them into the M columns of the table.
4. Create Deviation Scores; subtract each score from the M for the group, add to table.
5. What do the deviation scores sum to? $\Sigma (X - M)$ = _____
6. Calculate the squared deviation scores [$(X - M)^2$] and enter to the table.
7. What do the squared deviation scores sum to [Sum of Squares (**SS)**] $\Sigma (X - M)^2$] ? Enter into the table.
8. Calculate the Degrees of Freedom (**df** = n – 1) for each group and enter into the table.

9. Calculate the **Variance** by Dividing the Sum of Squares – $\Sigma (X - M)^2$, or **SS** – by the Degrees of Freedom (**df**) for each Group.

$$\text{Variance}_{group1} = \frac{SS_{grp1}}{df_{grp1}} = \qquad \text{Variance}_{group2} = \frac{SS_{grp2}}{df_{grp2}} =$$

$$t = \frac{(M_{group1} - M_{group2}) - 0}{\sqrt{\frac{\sum(X-M)^2_{grp1}}{n-1_{grp1}} + \frac{\sum(X-M)^2_{grp2}}{n-1_{grp2}}}{n_{grp1}} + \frac{\sum(X-M)^2_{grp2}}{n-1_{grp2}}}{n_{grp2}}}$$

$$t = \frac{(M_{group1} - M_{group2}) - 0}{\sqrt{\frac{\sum(X-M)^2_{grp1}}{n-1_{grp1}} + \frac{\sum(X-M)^2_{grp2}}{n-1_{grp2}}}{n_{grp1}} + \frac{\sum(X-M)^2_{grp2}}{n-1_{grp2}}}{n_{grp2}}}$$

10. Divide the Variances by the Number of Participants (n) in each Group.

$\frac{\text{Variance}_1}{n_1}$ = _____ $\frac{\text{Variance}_2}{n_2}$ = _____

11. Calculate the **Error Variance**:

   a. Add the 2 Numbers from Step #10 _____ + _____ = _____

   b. Take the Square Root of the Sum. $\sqrt{}$_____ = _____

12. Calculate the **Experimental Effect**: Subtract *M2* from *M1* = _____

13. Compute **t** by Dividing the Experimental Effect by the Error Variance:

$$t = \frac{\text{Experimental effect}}{\text{Error variance}} = \frac{\square}{\square} =$$

(Use absolute value if t is negative)

14. Choose a Significance Level; $P <$ _____

15. Calculate the **df** for the complete experiment: $df_{group1} + df_{grp2}$ = _____

16. Use the experimental **df** and ***p*** value with the t table (below) to identify your **Critical Value**: _____

17. Compare **t** Value to your **Critical Value**.

18. If the t value is larger than the critical value, your findings are statistically significant: Reject the Null Hypothesis and accept the Research Hypothesis.

t value = _____ critical value = _____ Significant? YES or NO

Critical values of t (2 tailed test)

--- ALPHA LEVELS ---

df	0.10	0.05	0.02	0.01	0.001
1	6.314	12.706	31.821	63.657	636.619
2	2.920	4.303	6.965	9.925	31.599
3	2.353	3.182	4.541	5.841	12.924
4	2.132	2.776	3.747	4.604	8.610
5	2.015	2.571	3.365	4.032	6.869
10	1.812	2.228	2.764	3.169	4.587
12	1.782	2.179	2.681	3.055	4.318
14	1.761	2.145	2.624	2.977	4.140
16	1.746	2.120	2.583	2.921	4.015
18	1.734	2.101	2.552	2.878	3.922
20	1.725	2.086	2.528	2.845	3.850
25	1.708	2.060	2.485	2.787	3.725
30	1.697	2.042	2.457	2.750	3.646
40	1.684	2.021	2.423	2.704	3.551
60	1.671	2.000	2.390	2.660	3.460
120	1.658	1.980	2.358	2.617	3.373
inf	1.645	1.960	2.326	2.576	3.291