Paired Samples t Test

Data

The following data set reflects a within-subjects (repeated measures) design with two levels of the factor. The data are presented in a format suitable for entry into statistical software.

	Outcome1	Outcome2	Change
1	.00	4.00	-4.00
2	.00	7.00	-7.00
3	3.00	4.00	-1.00
4	5.00	9.00	-4.00

The third variable is a created variable. It shows the difference (Time 1 – Time 2) for each of the individuals. Note that a score of zero on this difference variable would represent no change for that individual, whereas a positive value would mean that the score went down and a negative value that the score went up for that individual.

Computer Output

The following tables represent typical output from statistical software. Options, labels, and layout vary from program to program.

The table of descriptive statistics can be used to determine the inferential statistics.

	N	Mean	Std. Deviation	Std. Error
Outcome1	4	2.000	2.449	1.225
Outcome2	4	6.000	2.449	1.225
Change	4	-4.000	2.449	1.225

The table of inferential statistics shows the key elements to be calculated.

	t	df	p	Mean Difference	SE Difference	Lower CI	Upper CI	Cohen's d
Outcome	-3.266	3.000	0.047	-4.000	1.225	-7.898	-0.102	-1.633

Calculations

For the Paired Samples *t* test, the focus is on the change variable. As a result, it is the only variable that is used in the calculations below.

Mean Difference (Raw Effect): The Mean Difference is the difference between the sample mean and a user-specified test value or population mean.

$$M - \mu = -4.000 - 0.000 = -4.000$$

Statistical Significance: The *t* statistic is the ratio of the mean difference (raw effect) to the standard error of the mean.

$$t = \frac{M - \mu}{SE_M} = \frac{-4.000}{1.225} = -3.266$$

With $df = 3$, $t_{CRITICAL} = 3.182$

Because $t > t_{CRITICAL}$, $p < .05$

Effect Size: Cohen's d Statistic provides a standardized effect size for the mean difference (raw effect).

$$d = \frac{M - \mu}{SD} = \frac{-4.000}{2.449} = -1.633$$

Confidence Interval: For this test, the appropriate confidence interval is around (centered on) the mean difference (raw effect).

$$CI_{DIFF} = (M - \mu) \pm (t_{CRITICAL})(SE_M) = -4.000 \pm (3.182)(1.225) = [-7.898, -.102]$$

APA Style

For this analysis, the differences between two measurements on one set of people are being compared. Thus, the summary and the inferential statistics focus on that difference. The first example focuses on statistical significance testing, whereas the second version includes and emphasizes interpretation of the confidence interval and effect size.

A paired samples *t* test showed that the difference in Outcome scores (*N* = 4) between the first time point (*M* = 2.00, *SD* = 2.45) and second time point (*M* = 6.00, *SD* = 2.45) was statistically significant, *t*(3) = -3.27, *p* = .047.

Analyses revealed that Outcome scores (*N* = 4) increased dramatically from the first time point (*M* = 2.00, *SD* = 2.45) to the second time point (*M* = 6.00, *SD* = 2.45), 95% CI [-7.90, -0.10], *d* = -1.63, *t*(3) = -3.27, *p* = .047.

Alternatively, the means, standard deviations, and confidence intervals could be presented in a table or figure associated with this text.