

Results

Two-Tailed Paired Samples *t*-Test

Introduction

A two-tailed paired samples *t*-test was conducted to examine whether the mean difference of Time1_min and Time2_min was significantly different from zero.

Assumptions

Normality. A Shapiro-Wilk test was conducted to determine whether the differences in Time1_min and Time2_min could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were significant based on an alpha value of .05, $W = 0.88$, $p < .001$. This result suggests the differences in Time1_min and Time2_min are unlikely to have been produced by a normal distribution, indicating the normality assumption is violated.

Results

The result of the two-tailed paired samples *t*-test was significant based on an alpha value of .05, $t(56) = -3.64$, $p < .001$, indicating the null hypothesis can be rejected. This finding suggests the difference in the mean of Time1_min and the mean of Time2_min was significantly different from zero. The mean of Time1_min was significantly lower than the mean of Time2_min. The results are presented in Table 1. A bar plot of the means is presented in Figure 1.

Table 1

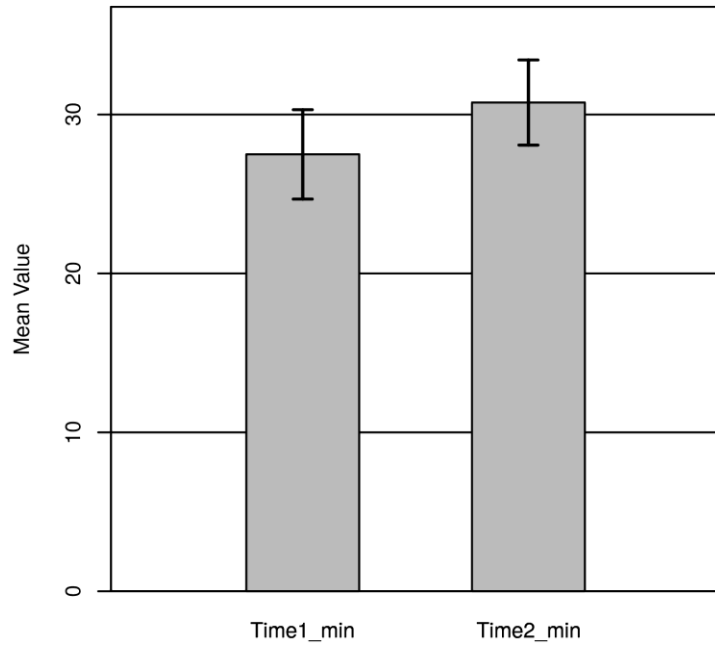
*Two-Tailed Paired Samples *t*-Test for the Difference Between Time1_min and Time2_min*

Time1_min		Time2_min		<i>t</i>	<i>p</i>	<i>d</i>
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
27.49	10.84	30.75	10.32	-3.64	< .001	0.48

Note. $N = 57$. Degrees of Freedom for the *t*-statistic = 56. *d* represents Cohen's *d*.

Figure 1

The means of Time1_min and Time2_min with 95.00% CI Error Bars



References

Intellectus Statistics [Online computer software]. (2023). Intellectus Statistics.

<https://statistics.intellectus360.com>

Razali, N. M., & Wah, Y. B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, 2(1), 21-33.

Glossaries

Paired Samples *t*-Test

The paired (dependent) samples *t*-test is used to assess for significant differences between two scale variables that can be matched. Typically, the scale variables are matched by time (e.g. pretest vs. posttest), but the data can also be matched in other ways (e.g. husband vs. wife). The test uses the average difference between each pair of matched scores to compute the *t* statistic, which is used with the *df* to compute the *p*-value (i.e., significance level). A significant result indicates the observed test statistic would be unlikely under the null hypothesis. The dependent samples *t*-test assumes that the differences between pairs of matched scores are normally distributed (i.e., normality).

Paired Samples *t*-Test Formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s / \sqrt{n}}$$

\bar{X}_1 = sample 1 mean

\bar{X}_2 = sample 2 mean

s = sample standard deviation

n = sample size

Fun Fact! This test is based on the Student's *t* distribution. This distribution was named after William Sealy Gosset, who published a paper about the distribution in 1908 under the pseudonym "Student."

Cohen's *d*: Effect size for the *t*-test; determines the strength of the differences between the matched scores. The larger the effect size, the greater the differences in the matched scores.

Degrees of Freedom (*df*): Refers to the number of values used to compute a statistic. The *df* is determined by the number of observations in the sample and equal the number of observations - 1; used with *t* to compute the *p*-value.

Mean (*M*): The average value of a scale-level variable.

Normality: Refers to the distribution of the data. The assumption is that the data follows the bell-shaped curve.

***p*-value:** The probability of obtaining the observed results if the null hypothesis is true. A result is usually considered statistically significant if the *p*-value is $\leq .05$.

Shapiro-Wilk Test: A test to assess if the assumption of normality is met. If statistical significance is found in this test, the data is *not* normally distributed.

Standard Deviation (*SD*): The spread of the data around the mean of a scale-level variable.

***t*-Test Statistic (*t*):** Used with the *df* to determine the *p* value.

Raw Output

Paired t-Test for Time1_min and Time2_min

Included Variables:

Time1_min and Time2_min

Sample Size (Complete Cases):

N = 57

Shapiro-Wilk Test:

W = 0.877, p = 3.277×10^{-05}

Results:

Time1_min		Time2_min				
M	SD	M	SD	t	p	d
27.491	10.835	30.754	10.322	-3.640	5.956×10^{-04}	0.482

Note. n = 57, df = 56.

Confidence Interval Based on $\alpha = 0.0500$:

Lower Limit = -5.059, Mean Difference = -3.263, Upper Limit = -1.467