7.5: Practice Example of how to Compute t when Descriptive Statistics are Provided

Usually, data are provided and used to compute the values needed for an inferential test such as the one sample *t*-tests. However, you may encounter times when the sample descriptive statistics are already available and do not need to be computed from the raw data. When this occurs, the preparatory steps of the analysis are already completed and it is possible to move to solving using the formula. Now that we have walked through all the preparatory steps and steps to solving in detail using sample data, let's practice one more time with just the steps for solving.

Let us assume we want to assess whether the students at one school called *Valley College* are scoring significantly higher on a standardized test than students in general in the United States. Let us assume that Valley College had 36 students whose mean score on the test was 80.00 with a standard deviation of 10.00. Let us also assume that we know the mean for the population of students in the U.S. to be 55.00.

Let's use this information to follow the steps in hypothesis testing:

1. State the hypothesis.
   - It is hypothesized that students at Valley College will have a higher mean test score than the mean of 55.00 for students in general in the United States.
2. Choose the inferential test (formula) that best fits the hypothesis.
   - A one sample *t*-test is the best fit for comparing the mean from a sample to the known mean of a population.
3. Determine the critical value.
   - The standard alpha level of .05 can be used. The hypothesis is directional, so a one-tailed test is required. The sample size is 36 so the *df* = 35. Thus, the critical value associated with a *df* of 35 in Appendix D should be used. Below is an excerpt of the section of the *t*-tables that best fits the current hypothesis and data. Under the conditions of an alpha level of .05, a one-tailed test, and 35 degrees of freedom the critical value is 1.690.

	one-tailed test	
alpha level:	α = 0.05	α = 0.01
Degrees of Freedom:	35	35
Critical Values:	1.690	2.438

4. Calculate the test statistic.

Section A: Preparation

The preparatory values are provided and only need to be identified rather than computed. For the current example for a one sample *t*-test, this preparatory values are as follows:

μ = 55.00

n = 36

$\bar{x}$= 80.00

s = 10.00

Section B: Solving

Now that the preparatory work is done, the formula can be used to compute the obtained value. For the one sample *t*-test, this work is as follows:

1. Write the formula with the values found in section A plugged into their respective locations.

$$
\begin{aligned}
t &= \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}} \\
t &= \frac{80.00-55.00}{\frac{10.00}{\sqrt{36}}} \\
t &= \frac{25.00}{\frac{10.00}{6.00}} \\
t &= \frac{25.00}{1.666\ldots} \\
t &= 15.00
\end{aligned}
$$

5. Apply a decision rule and determine whether the result is significant.

   The critical value is 1.690

   The obtained *t*-value is 15.00

   The obtained *t*-value exceeds (i.e. is greater than) the critical value, thus, the result is strong enough to be significant.

   However, an additional consideration is needed when the hypothesis is directional. When a hypothesis is directional, the result must both be strong enough to be significant (by being greater in absolute value than the critical value) and also in the same direction as was hypothesized.

   It was hypothesized that the mean for Valley College would be higher than that of the United States in general. The mean for Valley College was 80.00 and the mean for the U.S. in general was 55.00. Thus, the data are in the same direction as hypothesized.

   In summary, because the data are in the direction hypothesized *and* the obtained value was greater than the critical value, the result can be determined to be significant.

6. Calculate the effect size.

   Cohen's d can be used to calculate the effect size for a one sample *t*-test. The Cohen's *d* calculations for the current data would be as follows:

$$
\begin{aligned}
d &= \frac{\bar{x}-\mu}{s} \\
d &= \frac{80.00-55.00}{10.00} \\
d &= \frac{25.00}{10.00} \\
d &= 2.50
\end{aligned}
$$

   Using the rules of thumb, this would be considered a large effect size.

7. Report the results in American Psychological Associate (APA) format.

   A one sample *t*-test was used to test the hypothesis that students at Valley College would have a higher mean test score than the mean of 55.00 for students in general in the United States. Consistent with the hypothesis, the mean score for the sample (M = 80.00; SD = 10.00) was significantly higher than the mean for the population, $t(35) = 15.00$, $p < .05$. The Cohen's d effect size of 2.50 was large.