The Text Equivalent for the Tutorial Activity

This activity is designed to help students learn to navigate and complete specified actions for class. The activity consists of several annotated screenshots, each representing a step in the process that the student interacts with using either a mouse or touchscreen.
The title for each slide appears as a header in this document and starts with ‘Title:’.
The activity includes both a Tutorial Mode and a Game Mode. In Tutorial Mode, the activity provides both a verbal hint (identified on each slide as ‘Action’) and a visual hint on every slide regarding where the user is to next click with the mouse. The visual hint is a rectangle placed directly over the spot where the user is to click. The Game Mode is a repeat of the Tutorial Mode except that instead of hints on every slide, there are no visual hints, and the user is limited to a specific number of verbal hints overall.
Students with a disability that precludes them from using the app may work their way through this text equivalent of the Tutorial Mode and request an alternative assignment in place of the Game Mode activity.
For each slide, the 'Tutorial: Info' field refers to information presented to the viewer specifically when in Tutorial Mode. The 'Game: Info' field refers to information presented specifically during Game Mode. If these two fields are identical, they are combined and simply referred to as 'Info'. The term 'n/a', meaning 'not applicable', indicates that the field is blank.

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Title: SPSS Now: Single Sample t Test

Action: n/a
Notes: A screenshot based interactive tutorial at Play to Learn: Statistics (www.P2L.io), by Robert Kelley, Ph.D.
Info: n/a
Screenshot Description: n/a

Title: Notices & Learning Objectives

Action: n/a
Notes: SPSS is a registered trademark. Screen images are copyrighted by SPSS. This tutorial is not sponsored by SPSS. Learn more at: https://www.ibm.com/products/spss-statistics Google Docs is a registered trademark of Google LLC. Screen images are copyrighted by Google LLC. Stats Key image used with permission https://www.flickr.com/photos/144008357@N08/32913566784 This tutorial is copyright 2022 by Robert G. Kelley, all rights reserved. Contract: rkelleymcc@gmail.com with 'Play to Learn' in the subject line.
Tutorial Info: Learning Objectives: 1. Interpreting and writing up results APA style, 2. Increased familiarity and confidence with SPSS (R), 3. Analyze data with a single sample t-test, 4.

Hypothesis testing with a Single Sample t-Test.
Game Info: n/a
Screenshot Description: n/a

Title: Step 1: The Completed Report

Action: n/a
Notes: An Example, Interpreting the write-up
Tutorial Info: You are in Tutorial Mode. Upon completing the tutorial, it is recommended to restart this activity in Game mode. Note that the Tutorial Mode is an important step in the learning process. It provides help and information not available in Game Mode. Continue
Game Info: You are in Game Mode. You have three hints available to complete this activity successfully. Follow the directions below the screenshot. Each time an error is made, you will lose one of your hints, and then the next correct action will be shown to you. Should you use up all hints, you will be returned to Tutorial Mode. Continue
Screenshot Description: n/a

Title: Example APA Style Write-Up

Action: Click 'Next' to proceed.
Notes: The results are written in a clear and concise manner. Questions answered are: Who participated? What was the purpose? What decision was made?
Info: You will be asked to write up results APA style. We'll go through the above report to give you a better understanding. Next
Screenshot Description: The following is displayed in a Google Doc: Based on an interview of eighty-nine statistics students, the belief that college students typically have one sibling was rejected, $t(88) = 6.62$, $p < .05$. The results support college students having a greater number of siblings ($M = 2.20$, $s = 1.71$; skewness = 1.29), 95% CI [1.84, 2.56].

Title: A Representative Sample

Action: Click 'Next' to proceed (along the right-hand side).
Notes: The sample consists of eighty-nine statistics students.
Info: Next
Screenshot Description: n/a

Title: Two-Tail Hypothesis Test

Action: Click 'Next' to proceed (along the right-hand side).
Notes: The null hypothesis is that college students typically have one sibling. It will be rejected if the sample mean is so large or so small as to be surprising ($p < .05$).
Info: Next
Screenshot Description: The belief being challenged is referred to as the null hypothesis. The population is all college students.

Title: Observation

Action: Click 'Next' to proceed (along the right-hand side).

Notes: Among the students in the sample, the average number of siblings is 2.20. In light of the null hypothesis, is that result to be expected?
Info: Next
Screenshot Description: n/a

Title: The Big Picture

Action: Click 'Next' to proceed (along the right-hand side).
Notes: Based on the null hypothesis, the distribution of sample means is centered at 1.0 siblings. For samples of size 89, the standard error is equal to 0.181.
Info: Next
Screenshot Description: The standard error is calculated as the standard deviation divided by the square root of the sample size. That equals 1.71 / sqrt(89) = 0.181

Title: Surpising & Unexpected

Action: Click 'Next' to proceed (along the right-hand side).
Notes: Based on the null hypothesis, the sample mean appears improbable and surprising. The sample mean is 6.62 standard errors away from the null specified mean of 1.0.
Info: Next
Screenshot Description: n/a

Title: Reject the Null Hypothesis

Action: Click 'Next' to proceed (along the right-hand side).
Notes: The sample mean was unexpected, surprising, and not consistent with the null hypothesis. With $p < .05$, reject the null hypothesis.
Info: Next
Screenshot Description: n/a

Title: 95% Confidence Interval

Action: Click 'Next' to proceed (along the right-hand side).
Notes: Given our sample data, we conclude (with a probability of .95) that the true population mean for the 'Number of Siblings' is between 1.84 and 2.56.
Info: Next
Screenshot Description: n/a

Title: Retaining the Null

Action: Click 'Next' to proceed (along the left-hand side).
Notes: What if the sample mean had been 1.30 (instead of 2.20)? Then we would have retained the null hypothesis ($p > .05$).
Info: Why retain the null? A sample mean of 1.30 would be common, not surprising, and representative of the null hypothesis. Next
Screenshot Description: Based on an interview of eighty-nine statistics students, the belief that college students typically have one sibling was retained, $t(88) = 1.66$, $p > .05$. The results are

consistent with college students having one sibling (M = 1.30, s = 1.71; skewness = 1.29).

Title: Sample is Skewed

Action: Click 'Next' to proceed.
Notes: Check with your instructor whether it is appropriate to analyze a skewed sample using the single sample t-test.
Info: According to the Central Limit Theorem, for skewed samples, the distribution of sample means becomes very close to normal as the sample size increases (e.g., n >= 30). Even for a skewed distribution, a single sample t-test may be appropriate. Next
Screenshot Description: n/a

Title: Central Limit Theorem

Action: Click 'Next' to proceed (along the right-hand side).
Notes: For skewed samples, check with your instructor. Based on the Central Limit Theorem, it is generally considered OK to proceed for n >= 30.
Info: Next
Screenshot Description: Shows a positively skewed distribution and a positively skewed sample (that was randomly selected from the population. Yet, the distribution of sample means (for n = 89) is very close to an ideal normal distribution.

Title: APA Style Write-Up

Action: Click 'Next' to proceed (along the right-hand side).
Notes: The goal is for a concise (i.e., using few words) and understandable results section. Check with your instructor about including the 95% confidence interval.
Info: Next
Screenshot Description: A more typical and succinct APA style write-up for a normal distribution: Based on an interview of eighty-nine statistics students, college students typically have more than one sibling (M = 2.20, s = 1.71), t(88) = 6.62, p < .05 For a skewed distribution: Based on an interview of eighty-nine statistics students, college students typically have more than one sibling (M = 2.20, Mdn = 2.00, IQR = 2.00; skewness = 1.29), t(88) = 6.62, p < .05.

Title: Step 2: Data and Variables

Action: n/a
Notes: n/a
Info: Next
Screenshot Description: n/a

Title: Switch to Variable View

Action: Click on the 'Variable View' tab at the bottom of the SPSS screen.
Notes: The SPSS project has two variables and 89 records. The variables are Siblings and HighSchoolGPA.
Info: n/a

Screenshot Description: n/a

Title: Scroll to the Right

Action: Click on the scrollbar to indicate scrolling to the right.
Notes: Investigate the variable settings.
Info: n/a
Screenshot Description: n/a

Title: Scale Variable

Action: Click 'Next' to continue.
Notes: Before proceeding with analyzing the 'Number of Siblings' variable, check that it is of type 'Scale'. For the Single Sample t-Test, the dependent variable must be scale.
Info: Next
Screenshot Description: Both variables are of type 'Scale'.

Title: Step 3: Descriptive Statistics

Action: n/a
Notes: n/a
Info: Next
Screenshot Description: n/a

Title: Analyze the Siblings Variable

Action: Click on the Analyze drop-down menu.
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: Not relevant - SPSS is open with the current project.

Title: Get Descriptive Statistics

Action: Click on the 'Descriptive Statistics' drop-down menu option.
Notes: Begin by evaluating the normality of the Sibling variable.
Info: n/a
Screenshot Description: n/a

Title: Explore the Sibling Variable

Action: On the submenu, click on the 'Explore' option.
Notes: The Explore option provides a collection of descriptive statistics and calculates the IQR. The inclusion of a histogram can be selected.
Info: n/a
Screenshot Description: n/a

Title: Select 'Number of siblings'

Action: To move 'Numbers of siblings' to the 'Dependent List', click the arrow (rightward facing).
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: n/a

Title: Add a Graph

Action: Click the 'Plots' button.
Notes: When multiple variables are selected, participants who did not contribute to one variable are removed from all analyses. Work with only one variable at a time.
Info: n/a
Screenshot Description: n/a

Title: Include a Histogram

Action: Check the 'Histogram' checkbox.
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: n/a

Title: Continue

Action: Click the 'Continue' Button.
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: n/a

Title: View the Explore Report

Action: Click 'Ok' to view the Explore report.
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: n/a

Title: Step 3: Evaluating for Normality

Action: n/a
Notes: n/a
Info: Next
Screenshot Description: Is the mean fairly similar to the median? Is skewness small? Is the histogram NOT heavily skewed?

Title: SPSS Explore Report

Action: Click 'Next' to continue.
Notes: Here's what the SPSS 'Explore' report looks like for the Sibling variable. We'll use it (and the histogram) to evaluate the Sibling variable for normality.
Info: Next

Screenshot Description: For Sleep: Mean = 2.20 (with a standard error of .182) Median = 2.00 Std. Deviation = 1.713 Interquartile Range = 2 Skewness = 1.286 (with a standard error of .255)

Title: Normality Tests

Action: The Siblings variable passes the first test and fails the second test. Click 'Next' to continue.
Notes: The (1) Mean and mode should be similar, and (2) the absolute value of skewness (i.e., ignore the sign) should be less than twice the standard error.
Info: Next
Screenshot Description: First, the Mean (2.20) is similar to the Median (2.00). Second, the absolute value of skewness (1.286) is NOT less than twice the standard error of skewness (2 x 0.255). The second test is not passed.

Title: Normality Tests (Continued)

Action: Click 'Next' to continue.
Notes: A variable can be considered 'fairly normally' distributed if it passes at least two of the three normality tests.
Info: Third Normality Test: [3] Check for outliers and if heavily skewed. The graph is strongly positively skewed. Conclusion: Did not pass two of the three tests. The variable Siblings is heavily skewed. Next
Screenshot Description: The histogram clearly reveals a positively skewed distribution.

Title: What Descriptives to Report

Action: For a skewed distribution, the reader appreciates seeing both the mean and median. Click 'Next' to continue.
Notes: For a fairly normal distribution, report the mean and standard deviation. If skewed, provide the mean, median, inter-quartile range, and skewness.
Info: Next
Screenshot Description: As the distribution is skewed, will provide the mean, median, IQR, and skewness in the descriptives for sleep.

Title: n/a

Action: n/a
Notes: n/a
Info: Next
Screenshot Description: n/a

Title: Analyze Using Sample Mean

Action: Click on the Analyze drop-down menu.
Notes: SPSS Now Tutorial
Info: n/a
Screenshot Description: Looking a the SPSS project in Variable view.

Title: Compare Ho & Sample Mean

Action: Click 'Compare Means' from the drop-down menu.
Notes: The term 'Ho' is an uppercase H with a zero next to it. This stands for the Null Hypothesis.
Info: n/a
Screenshot Description: n/a

Title: Single Sample t Test

Action: Click 'One-Sample T Test' from the submenu.
Notes: The single sample t-test compares a sample to the null specified population mean.
Info: n/a
Screenshot Description: n/a

Title: Move Siblings Over

Action: Click on the 'right facing arrow' in the middle of the screen.
Notes: Move the 'Number of siblings' variable to the 'Test Variable(s)' window.
Info: n/a
Screenshot Description: Shows the 'One-Sample T Test' dialog window. Will select a variable and provide a Test Value.

Title: Test Value

Action: Click the 'Test Value' to indicate that for the null hypothesis, the population mean equals 1.
Notes: Set the 'Test Value'. It is based on the null hypothesis (e.g., college students have just one sibling). The Test Value equals the specified population mean.
Info: n/a
Screenshot Description: n/a

Title: View the SPSS Output

Action: Click 'OK' to proceed.
Notes: To use a single sample t-test, the dependent variable must be continuous, scale, and normally distributed. If not normally distributed, then ask how to handle it.
Info: n/a
Screenshot Description: n/a

Title: About the Sample

Action: n/a
Notes: For inferential statistics to be of value, the expectation is that the sample is representative (of the population) and that the sample values are independent of each other.
Info: At the top of the results are the descriptive statistics: The sample size (N = 89), the sample mean (2.20), the standard deviation (1.713), and the standard error of the mean (0.182). It does not convey that the 'Number of Siblings' was skewed (nor the median and IQR). Next

Screenshot Description: n/a

Title: t Test Measurement

Action: Click 'Next' to proceed (along the right-hand side).
Notes: The t-test measures the distance between the null hypothesis specified mean and the sample mean. It reports the number of standard errors between them.
Info: Next
Screenshot Description: The t-test equals 6.62. This tells us that the sample mean is 6.62 standard errors away from the null specified population mean of 1.0.

Title: Alpha Level

Action: Click 'Next' to proceed (along the right-hand side).
Notes: For hypothesis testing, the alpha level is generally set at .05. This commits us to reject the null hypothesis anytime the p-value is .05 or less.
Info: Next
Screenshot Description: The Sig. (2-tailed) < .001 Given that a true null hypothesis (M = 1) would be unlikely to produce this result (p < alpha level), reject the null hypothesis.

Title: p < .05

Action: Click 'Next' to proceed (along the right-hand side).
Notes: For a large p-value, we retain the null hypothesis. For a small p-value (less than or equal to alpha), we reject the null hypothesis. Note: df = (sample size) - 1
Info: Next
Screenshot Description: t-test = 6.62 df = 88 Sig. (2-tailed) < .001 Based on an interview of eighty-nine statistics students, the belief that college students typically have one sibling was rejected, t(88) = 6.62, p < .05.

Title: 95% Confidence Interval

Action: Click 'Next' to proceed (along the right-hand side).
Notes: To determine the 95% Confidence Interval, add the 'Test Value' to the Lower and Upper Boundaries.
Info: Next
Screenshot Description: Test Value = 1 Lower 95% CI Boundary: 1 + .84 = 1.84 Upper 95% CI Boundary: 1 + 1.56 = 2.56 The results support college students having a greater number of siblings (M = 2.20, Mdn = 2.00, IQR = 2.00; skewness = 1.29), 95% CI [1.84, 2.56].

Title: Congratulations!

Action: n/a
Notes: Our learning goals focused on using SPSS to analyze data with the Single Sample t-Test, to interpret the SPSS output, and to read and write the results APA style.
Tutorial Info: You have reached the end of the tutorial. Click the Game button to play again in 'Game Mode'.
Game Info: n/a

Screenshot Description: Fairly Normal Distribution Based on an interview of eighty-nine statistics students, college students typically have more than one sibling ($M = 2.20$, $s = 1.71$), $t(88) = 6.62$, $p < .05$. Skewed Distribution ($N > 30$) Based on an interview of eighty-nine statistics students, college students typically have more than one sibling ($M = 2.20$, $Mdn = 2.00$, $IQR = 2.00$; skewness = 1.29), $t(88) = 6.62$, $p < .05$.