The Before and After: Analyzing Pre and Post Surveys in Excel
Preliminary and Day of Instructions

This handout provides step-by-step instructions on how to set up and analyze pre- and post-test data using Excel. There are four parts to this handout: preliminary instructions, day of presentation Scenario 1, and day of presentation Scenario 2 instructions, as well as a glossary to assist you with terminology. The data being used in the examples is not real testing data.

Preliminary Instructions

If you wish to follow along with the presenter on your computer, complete steps 1-4 below. If you would rather just observe the demonstration, **skip these steps.**

1. Before the training on August 24, 2023, download Excel's Data Analysis. To do t-tests in Excel, you must have the free Data Analysis Toolpak installed. To check to see if you already have it, click on **Data** in Excel's menu across the top and look for **Data Analysis** in the **Analyze** section. If you do not see it, proceed to the next steps. If you see it, you can stop here until the day of the training. You already have it!

2. Click the **File** tab, click **Options**, and then click the **Add-Ins** category.

3. In the **Manage** box, select **Excel Add-ins** and then click **Go**. If you're using Excel for Mac, in the file menu go to **Tools > Excel Add-ins**.

4. In the **Add-Ins** box, check the **Analysis ToolPak** check box, and then click **OK**.

Note: If Analysis ToolPak is not listed in the Add-Ins available box, click **Browse** to locate it. If you are prompted that the Analysis ToolPak is not currently installed on your computer, click **Yes** to install it.

Day of Presentation Instructions

❑ Open the Excel file sent to you with your access information and instructions.

Scenario 1

For this example, imagine that we have a Prevention Specialist training program to prepare for the IC&RC exam, and we need to determine whether the difference between the mean pretest score and the mean posttest score is significantly different to show if our training is effective. The same participants are in each group.

In this example, participants choose a unique identifier (ParticipantID) and use it to label their pre-test and post-test so we can match them. We have their average scores on the Certified Prevention Specialist Exam before receiving the training (Pretest column) and after receiving the training (Posttest column).

ParticipantID	Pretest	Posttest
1	91	111
2	95	102
3	110	121
4	90	83
5	98	109
6	91	116
7	97	100
8	98	118
9	89	106
10	91	83
11	89	117
12	116	129
13	121	120
14	88	108
15	94	96

1. In Excel, click *Data Analysis* on the Data tab.

2. From the Data Analysis popup, choose **t-Test: Paired Two Sample for Means.** Remember, we choose this t-Test because our participants are the same in our sample for the pre-test and post-test.
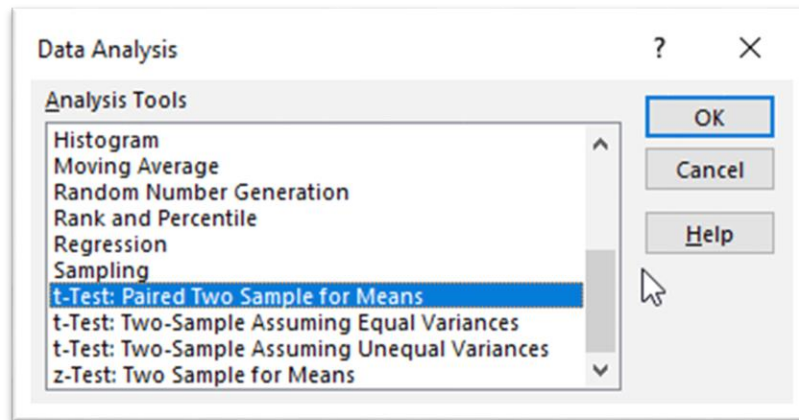
3. Under **Input**, select the ranges for both **Variable 1** and **Variable 2**.

4. In **Hypothesized Mean Difference**, you'll typically enter zero. This value is the null hypothesis value, which represents no effect (all that training did not make a difference in test scores). In this case, a mean difference of zero represents no difference between the two methods, which is no effect.

5. Check the **Labels** checkbox if you have meaningful variables labels in row 1. This option helps make the output easier to interpret.

6. Excel uses a default **Alpha value of 0.05**, which is usually a good value and standard for hypothesis testing. Alpha is the significance level. Change this value only when you have a specific reason for doing so.

7. Click OK.

For the example data, your popup should look like the image below:
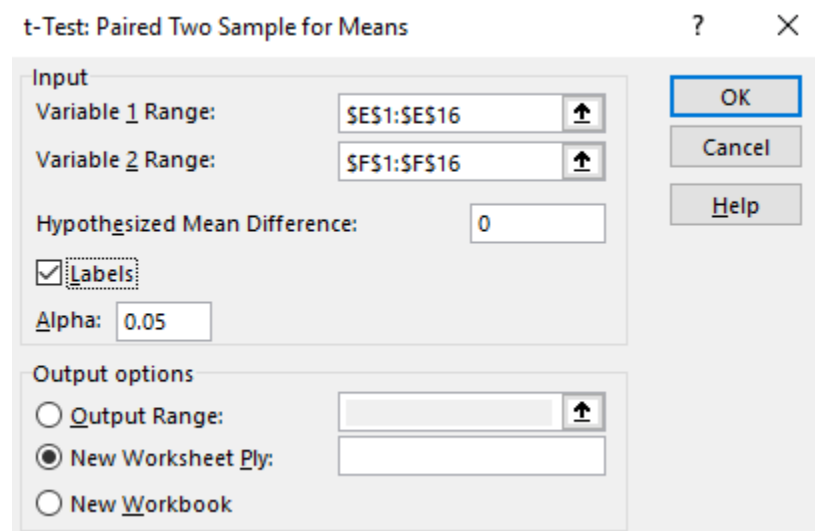
Interpreting Excel's Paired t-Test Results

t-Test: Paired Two Sample for Means

	Pretest	Postest
Mean	97.2	107.9333333
Variance	106.1714286	179.0666667
Observations	15	15
Pearson Correlation	0.579268946	
Hypothesized Mean Difference	0	
df	14	
t Stat	-3.710792098	
P(T<=t) one-tail	0.001163535	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	**0.002327069**	
t Critical two-tail	2.144786688	

The output indicates that mean for the Pretest is 97.2 and for the Posttest it is 107.933.

If the p-value is less than your significance level, the difference between means is statistically significant. Again, Excel provides p-values for both one-tailed and two-tailed t-tests—and we'll stick with the two-tailed result.

For our results, we'll use P(T<=t) two-tail, which is the p-value for the two-tailed form of the t-test. Because our p-value (0.002) is less than the standard significance level of 0.05, we can reject the null hypothesis. Our sample data support the hypothesis that the population means are different. Specifically, the Posttest mean is greater than the Pretest mean, and we can say that our training had a benefit on increasing test scores.

Scenario 2

Our second hypothetical scenario is that we are comparing test scores from two different teaching methods after instruction. We drew two random samples of participants. One sample comprises training participants who learned using Virtual Instruction while the other sample learned using In-Person Instruction. These samples contain entirely different participants. Now, we want to determine whether the two means are different to see which was more effective.

1. Use the same Excel file, but click on the **Example 2** tab at the bottom.

2. To perform a 2-sample t-test in Excel, arrange your data in two columns, as shown below.

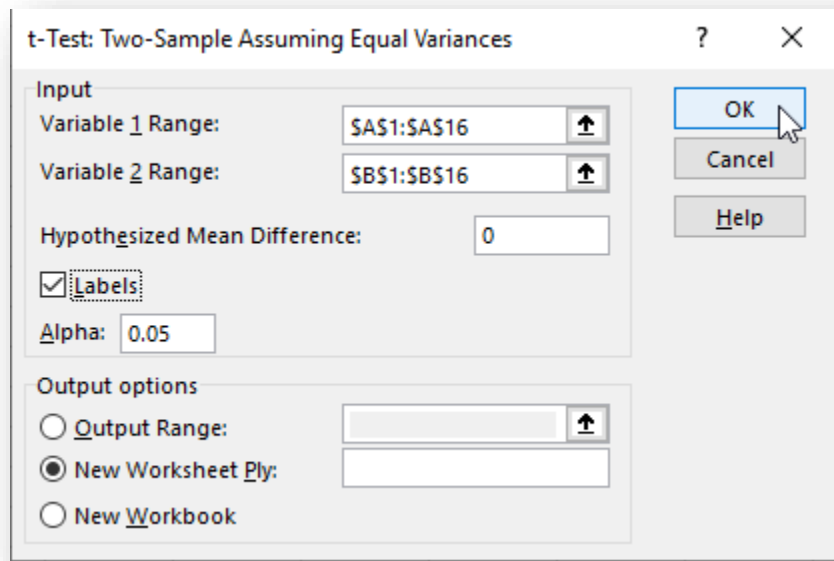| Virtual Delivery	In-Person Delivery
72	72
72	90
70	98
61	84
77	81
81	85
76	71
72	91
82	73
53	94
65	83
90	86
74	92
60	92
68	79

3. In Excel, click **Data Analysis** on the Data tab.

4. From the Data Analysis popup, choose **t-Test: Two-Sample Assuming Equal Variances.**
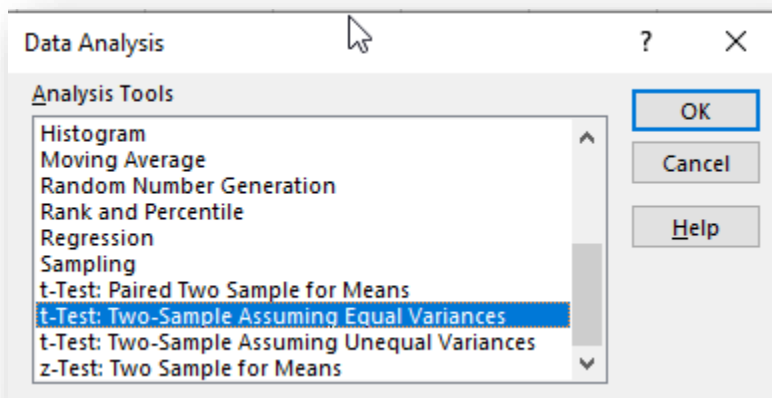
5. Under **Input**, select the ranges for both **Variable 1** and **Variable 2**.

6. In **Hypothesized Mean Difference**, you'll typically enter zero. This value is the null hypothesis value, which represents no effect. In this case, a mean difference of zero represents no difference between the two delivery methods, which is no effect.

South Southwest (HHS Region 6)

PTTC Prevention Technology Transfer Center Network
Funded by Substance Abuse and Mental Health Services Administration

6

7. Check the **Labels** checkbox if you have meaningful variable names in row 1. This option makes the output easier to interpret.

8. Excel uses a default Alpha value of 0.05, which is usually a good value. Alpha is the significance level. Change this value only when you have a specific reason for doing so.

t-Test: Two-Sample Assuming Equal Variances

Input
Variable 1 Range: $A$1:$A$16
Variable 2 Range: $B$1:$B$16
Hypothesized Mean Difference: 0
☑ Labels
Alpha: 0.05

Output options
○ Output Range:
◉ New Worksheet Ply:
○ New Workbook

[OK] [Cancel] [Help]

9. Click **OK**.

Interpreting the Two-Sample t-Test Results

t-Test: Two-Sample Assuming Equal Variances

	Virtual Delivery	In-Person Delivery
Mean	71.53333333	84.73333333
Variance	88.6952381	69.63809524
Observations	15	15
Pooled Variance	79.16666667	
Hypothesized Mean Difference	0	
df	28	
t Stat	-4.062874274	
P(T<=t) one-tail	0.000177468	
t Critical one-tail	1.701130934	
P(T<=t) two-tail	**0.000354936**	
t Critical two-tail	2.048407142	

The output indicates that the mean for **Virtual Delivery** is 71.533 and for **In-Person Delivery** it is 84.733. Looking in the Variances row, we can see that they are not exactly equal, but they are close enough to assume equal variances. The p-value is the most important statistic.

If the p-value is less than your significance level, the difference between means is statistically significant. Excel provides p-values for both one-tailed and two-tailed t-tests.

One-tailed t-tests can detect differences between means in only one direction. For example, a one-tailed test might determine only whether In-Person Delivery is greater than Virtual Delivery. Two-tailed tests can detect differences in either direction—greater than or less than. There are additional drawbacks for using one-tailed tests—so we will stick with the standard two-tailed findings in this example.

For our results, we'll use $P(T<=t)$ two-tail, which is the p-value for the two-tailed form of the t-test. Because our p-value (0.000354) is less than the standard significance level of 0.05, we can reject the null hypothesis. Our sample data support the hypothesis that the population means are different. Specifically, the In-Person Delivery mean score is greater than the Virtual Delivery mean score. We would say based on these results that In-Person Delivery participants earned better scores than Virtual Delivery participants after receiving instruction on taking the IC&RC exam.

Glossary of Terms

1. **Mean**: the average of numbers or scores.

2. **T-test**: tells you if there are significant differences between group means. It lets you know if those differences in means could have happened by chance.

3. **Paired T-test** (Matched Samples T-test): participants are the same for the pre-test and post-test. There is a way to match the data from pre to post.

4. **Un-paired T-test** (Unmatched Samples T-test): participants are not the same in the pre and post test. Typically two different samples that are being compared.

5. **P-value**: P stands for probability and measures how likely it is that any observed difference between groups is due to chance.

6. **Null hypothesis**: states that there is no relationship between the two variables being studied (one variable does not affect the other).

7. **Alternative hypothesis**: states that the independent variable did affect the dependent variable, and the results are significant in terms of supporting the theory being investigated (i.e., not due to chance).