A Blank Two-Factor Design of Experiment

This document has been designed to help you with your DOE. Feel free to use as much or as little of the table(s) here as you wish.

Ultimately, the DOE will turn into two sections of your research paper. (The Data and Observations section AND the Data Analysis and Interpretation section.)

Experiment:

Hypothesis:

Response Variable: (don’t forget units)

Predictor Variable: (don’t forget units)

Predictor Variable: (don’t forget units)

|  |  |
| --- | --- |
| *Variable* | *Variable* |
| - | Standard | + | - | Standard | + |
|  |  |  |  |  |  |

\*\*\*\*\*Don’t forget to put units in your table \*\*\*\*\*

\*\*\*\*\*\* insert your data table for each of the four treatments that you performed \*\*\*\*\*\*\*

 (+,+) (+,-) (-,+) (-,-)

\*\*\*\* BE SURE TO HAVE AVERAGES OF EACH OF THE FOUR CATEGORIES\*\*\*\*

|  |
| --- |
| ?? Standards |
|  |  |  |  |  |  |  |  |  |

Don’t forget to discuss range of standards here. Also, compare the range of standards to the OVERALL variability (range) of the data.

Scatter plot of standards:

NOTE: The standards should not show any patterns over time. Graph the standards in the order in which they occurred and comment on any pattern or lack thereof. Be sure to block standard trials too when appropriate. Remember that these are the basis of comparison as to whether or not things are statistically significant, so critically think about what your standards are telling you.

**FACTOR:**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

![[image]]()Draw a line segment connecting the average for\_\_\_\_\_\_\_\_- and the average for \_\_\_\_\_\_\_\_+.

|  |
| --- |
| Variable |
| (-) Amt | (+) Amt |
|  |  |
|  |  |
| Avg = | Avg = |

On average, as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ increases, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (increases/decreases) by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

NOTE: Be sure the scales are the same in ALL three of these figures.

**FACTOR:**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

![[image]]()Draw a line segment connecting the average for\_\_\_\_\_\_\_\_- and the average for \_\_\_\_\_\_\_\_+.

|  |
| --- |
| Variable |
| (-) Amt | (+) Amt |
|  |  |
|  |  |
| Avg = | Avg = |

On average, as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ increases, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (increases/decreases) by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

NOTE: Be sure the scales are the same in ALL three of these figures.

**TWO FACTOR INTERACTION**

INTERACTION OF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AND \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (two segments) (horizontal axis)

\*\*\* remember here you can decide which of the predictor variables will be the x axis and which will be the two segments \*\*\*

![[image]]()

|  |  |
| --- | --- |
|  | *Variable* |
| *(-) Amt* | *(+) Amt* |
| *Variable* | Solid Segment | (+) *Amt* |  |  |
| Dotted Segment | (-) *Amt* |  |  |

Calculate the interaction effect of \_\_\_\_\_\_\_, \_\_\_\_\_\_\_ with the formula: slope \_\_\_\_\_\_+ minus slope \_\_\_\_\_\_\_ -.

Comment on what the graph implies about the possible interaction:

**NOTE: Be sure the scales are the same in ALL three of these figures.**

Comparative analysis of interaction effect:

In this section, you should look at whatever variable you chose for your segments in the interaction graph. Compare the numbers that you used to graph the high segment in the interaction with the high average that you found when looking ONLY at that variable. Follow the same process for the low segment and the low average. Critically think and write about what this analysis means for your experiment.

DOT PLOT OF EFFECTS:

**Dot Plot:** Plot all 3 effects on a number line. Label them. Include fences.

Test of significance

Recall that to set up your fences, you should take your range of standards and multiply by two. This is the distance away from zero that you want to graph each fence. Be sure to put a fence up to the right AND the left of zero on the number line. Then graph each of the three numbers. Anything inside of the fences is NOT considered to be statistically significant, while anything outside IS statistically significant, meaning that this did not happen by chance alone. NOTE: This is one way to show statistical significance.

Another of these tests is to divide the effect by the range of the standards. If the absolute value of this quotient is greater than or equal to 2, then the effect should be considered “one of the vital few.” Mrs. Cybulski uses this test in tenth grade.

It may not obvious what effects are considered the “vital few”. Several tests may be conducted. You can use the following guidelines in identifying the “vital few”.

1. Put in all effects that clearly stand out from the crowd (aka practical significance).

2. Generally speaking, if a main effect is on or near the borderline of the fences, put it in.

3. If a two-factor interaction is borderline, put it in if both of its constituents are in, otherwise, leave it out.

Having said that you are doing scientific research. The math is only used as evidence to support your claims. This means that these are only guidelines to help you, rather than laws or rules that MUST be followed. At the end of the day, you must decide whether or not each of the three values played a significant role in your research. Please see Mr. Estapa or Mr. Acre if you need any assistance with this.

**PREDICTION EQUATION Y** =

(use grand average, all 3 effects

above, and “noise)

Show a check of your work here:

**PARSIMONIOUS PREDICTION EQUATION:** (Include only the vital few as decided above.)

 **Y** =

Make a prediction of your work here: (interpolate)

\*\*\* this is where you plug in values that are in between the values that you used for the experiment \*\*\*

 \*\*\* in class we used + ½ and – ½ when making these predictions \*\*\*

INTERPRETATION: Think of this as the “putting it all together” section. What was statistically significant? What is the likelihood that this happened by chance alone? Also consider practical significance here. If nothing was found that was statistically significant, you can still discuss what “mattered,” even if it doesn’t pass the statistical test. Remember that this will be the last thing that you leave your reader with as they move to the conclusion of your research paper, so make sure that you spell out what they should know as they leave the data analysis and interpretation section of the paper. ☺