

Prompt

Overview of prompt:

After reading about a study conducted on concussed student-athletes, you think you've identified a possible problem in the setup of the concussion study. In order to confirm your intuition, you use two datasets available to you. After exploring the data, and performing the appropriate statistical analysis using RStudio, you are asked to write a letter to the editor of the concussion study that clearly explains your statistical findings.

Background(Motivation): Recovery curve after concussion for student athletes

The (fictitious) Midwest Journal of Medicine recently published a study of the recovery curve after concussions for student athletes. Student athletes complete a computer-based neurocognitive assessment when they first enter their university and are given a baseline concussion score. If a student athlete becomes concussed, they are asked to perform the assessments again and again until their neurocognitive assessment score returns to their baseline score.

You believe that hand dominance may have an impact on the study results and observe that this wasn't controlled for in the original study. To show the importance of controlling for hand dominance when performing computer-based evaluations, you decide to conduct your own study among undergraduate students at UM.

Your Study: Effects of hand dominance on various computer-based activities for undergraduate students at UM.

You have two different datasets available to you coming from a random sample of undergraduate students at UM. Each student was asked to perform a series of two computer-based activities that measure [reaction time](#) and [memory](#). Each student performed each activity twice; first using their dominant hand and again using their non dominant hand. You will be using these study results to evaluate if hand dominance has an effect on reaction time and memory when measured through these two computer based activities. Below is a summary of the data collected for each activity:

Table 1: Experiment 1- Reaction Time Activity

	Completion time (Dominant Hand)	Completion time (Non-Dominant Hand)	Difference in completion time (Dominant - Non-Dominant)
Number of observations	1491	1491	1491
Sample mean	0.4259	0.482	-0.056
Sample standard deviation	0.153	0.191	0.140

Table 2: Experiment 2 - Memory Assessment Activity

	Completion time (Dominant Hand)	Completion time (Non-Dominant Hand)	Difference in completion time (Dominant - Non-Dominant)
Number of observations	1421	1421	1421
Sample mean	41.962	52.043	-10.080
Sample standard deviation	10.202	14.234	12.747

Your Task

Write a 500 - 700 word letter to the editor of the concussion study published in the Midwest Journal of Medicine (according to these two guidelines, [guideline 1](#) and [guideline 2](#)). Your letter to the editor should clearly explain your concern with the original concussion study, your experiments, and the findings from your experiments. Using your statistical findings, comment on the impact of hand dominance on both reaction time and memory assessment.

Be sure to include the following:

- The motivation for your letter. Specifically, state the concern with the original concussion study.
- An introduction to the outline of your experiment including:
 - The type of experimental design
 - The type and role for each of the experimental variables: hand used (dominant versus non-dominant) and completion time
 - Explain how we use dependent data when evaluating how hand dominance affects reaction time and memory assessment through the two computer based activities
 - Should randomness have been used in the hand dominance experimental design? If so, at what point? Refer to the screenshots at the end of the prompt for a reminder about how the survey questions were presented.
- For one of the experiments (reaction time or memory assessment), perform a hypothesis test to assess whether there is a difference in completion time, on average, when undergraduate students at UM use their dominant vs. non-dominant hand, using a 5% significance level. Be sure to include:
 - Define the parameter of interest in context
 - Your hypotheses and results of your test. You can include either a screenshot from R or a table of important values (test statistic, distribution, and p-value) calculated by hand.
 - An evaluation of the p-value and conclusion in context
 - Define alpha and power **in context**
 - Explain two ways in which you could increase the power of this test

- For the other experiment, compute the 95% confidence interval to estimate the mean difference in completion time for all undergraduate students at UM when they use their dominant vs. non-dominant hand. Be sure to include:
 - Define the parameter of interest in context
 - Your confidence interval.
 - An explanation to the editor regarding whether or not the *method* for creating a confidence interval is reliable. This explanation shouldn't depend on your specific sample, but is for the *method* in general.
 - A clear explanation of how the confidence interval can be used to assess if hand dominance has an effect on completion time, on average, for all undergraduate students at UM
 - An explanation to the editor about how you would make your interval more precise
- A brief conclusion including:
 - A summary about whether there is a difference in performance, on average, when undergraduate students at UM use their dominant vs. non-dominant hands during reaction time and memory tests
 - Recommendations to the original concussion researchers about how they can adjust a similar future study on concussions.

Student Survey Screenshots

Test your reaction time.
 Go to the [Reaction Time Test](#). Click "Start". Then, click "Stop" as soon as the box changes color.
USE YOUR DOMINANT HAND TO CLICK (i.e., if you're right handed, use your right hand).
 Record your reaction time as a decimal below.

Test your reaction time.
 Go to the [Reaction Time Test](#). Click "Start". Then, click "Stop" as soon as the box changes color.
USE YOUR NON-DOMINANT HAND TO CLICK (i.e., if you're right handed, use your *left* hand).
 Record your reaction time as a decimal below.

Test your memory. How quickly can you uncover all the pairs of pictures?
 Go to the Memory Test. Click "Start" and then click on squares to uncover their pictures. Only matching pairs of pictures will remain uncovered. Keep clicking until you have uncovered all the pairs.
USE YOUR DOMINANT HAND TO CLICK (i.e., if you're right handed, use your right hand).
 Record your time in seconds as a number below.

Test your memory. How quickly can you uncover all the pairs of pictures?
 Go to the [Memory Test](#). Click "Start" and then click on squares to uncover their pictures. Only matching pairs of pictures will remain uncovered. Keep clicking until you have uncovered all the pairs.
 This time, **USE YOUR NON-DOMINANT HAND TO CLICK** (i.e., if you're right handed, use your *left* hand).
 Record your time in seconds as a number below.

5 pts complete

4 pts -

- Major misconceptions (incorrect parameter (proportion, difference in pop means (independent data) or single pop mean) or incorrect output (independent t.test)
- Missing between 25% and 50% of bullet point items

Initial draft will be graded primarily for completeness but the final revision is graded for correctness and worth 30 pts. Here's a breakdown of the 30 points

Introduction: A brief introduction to the experiment	7 pts
Hypothesis Test: Hypothesis test to assess whether there is a difference in completion time, on average, which includes all items stated in the Prompt.	7 pts
Confidence Interval: Interval to estimate the mean difference in completion time which includes all items stated in the Prompt.	7 pts
Conclusion: Summary of results which includes a reiteration of your findings and recommendations to the original concussion study.	2 pts
Reflection on the revision process: <ul style="list-style-type: none">• How Peer Review helped you• Summarize changes you made	4 pts
Revision: Grammatical/Sentence structure	2 pts
Structure: Memo format & word count	1 pt

Peer Review Questions for Prompt 2

Introduction

This letter to the editor should first state the concern with the original concussion study and then it should outline the experiment conducted by the student. Does the letter provide a logical explanation of how this experiment uses dependent data? Can you follow their discussion of whether/when randomness should have been used in the experimental design? Comment on the rest of the introduction. Is anything missing? How else could it have been improved or made clearer? What did the author do well in their introduction?

Hypothesis Testing

This letter to the editor should provide a conclusion for the hypothesis test. Does the author give a concluding statement either in favor or against the alternative hypothesis? Does the author use objective and balanced language in their concluding statement and do they provide enough context for their statement? Is there enough detail in the definition of alpha and power in context so that an audience without statistical knowledge can understand these statements? What is one thing that could be improved in the definition of alpha and power? How could the author improve the description of two ways to increase power? What has the author done exceptionally well in their hypothesis testing section of the letter?

Confidence Interval

This letter to the editor should include a confidence interval and a discussion of what we can learn from it. Does the author explain if the general *method* for creating the confidence interval is reliable, without mentioning the specific computed interval from our sample? Is this explanation clear? How might the author improve their description of how to use the confidence interval to assess if hand dominance has an effect on completion time, on average? Are the suggestions for making an interval more precise consistent with our statistical knowledge about confidence intervals? Is there enough detail that the audience can generally follow the author's justifications? What is one thing that can be improved? What has the author done well in the confidence interval section?