


Assignment 1

Within-VR Performance

Conditioned on Cognitive Function

1. Computing the descriptive statistics for assessment scores (i.e., Block Design). Report the results in APA format (1 point) and explain the rationale for your choice of descriptive statistics (1 point). – 2 points



```
assessments_file.dropna(subset=['Block_Design_Score'], inplace=True)

# Compute descriptive statistics for Block_Design_Score
descriptive_statistics = assessments_file['Block_Design_Score'].describe()
median_Block_Design_Score = assessments_file['Block_Design_Score'].median()
iqr_Block_Design_Score = assessments_file['Block_Design_Score'].quantile(0.75) - assessments_file['Block_Design_Score'].quantile(0.25)

# Extract values for APA format
mean_Block_Design_Score = descriptive_statistics['mean']
std_Block_Design_Score = descriptive_statistics['std']
min_Block_Design_Score = descriptive_statistics['min']
max_Block_Design_Score = descriptive_statistics['max']
print(descriptive_statistics)

# APA formatted output
print(f"Block Design Score: M = {mean_Block_Design_Score:.2f}, SD = {std_Block_Design_Score:.2f}, "
      f"Median = {median_Block_Design_Score:.2f}, IQR = {iqr_Block_Design_Score:.2f}, Range = {min_Block_Design_Score} to {max_Block_Design_Score}")
```

count	4.000000
mean	36.250000
std	10.012492
min	24.000000
25%	31.500000
50%	36.500000
75%	41.250000
max	48.000000

Name: Block_Design_Score, dtype: float64
Block Design Score: M = 36.25, SD = 10.01, Median = 36.50, IQR = 9.75, Range = 24.0 to 48.0

Results: The participants' cognitive function, as measured by the Block Design Score, had a mean of 36.3 (SD = 10.0), with scores ranging from 24.0 to 48.0. The median score was 36.5, and the interquartile range (IQR) was 9.8, indicating the spread of the middle 50% of scores.

Rationale: Given the small dataset, both the mean and median were calculated to capture central tendency accurately. The mean and standard deviation provide insight into overall trends and variability if the data is roughly symmetric. However, the median and interquartile range (IQR) offer a strong alternative, especially useful if outliers or skewness are present, as they focus on the middle 50% of scores. Including both sets of statistics provides a comprehensive view, ensuring reliable interpretation regardless of distribution shape.

2. Explaining the implication of #1. – 1 point

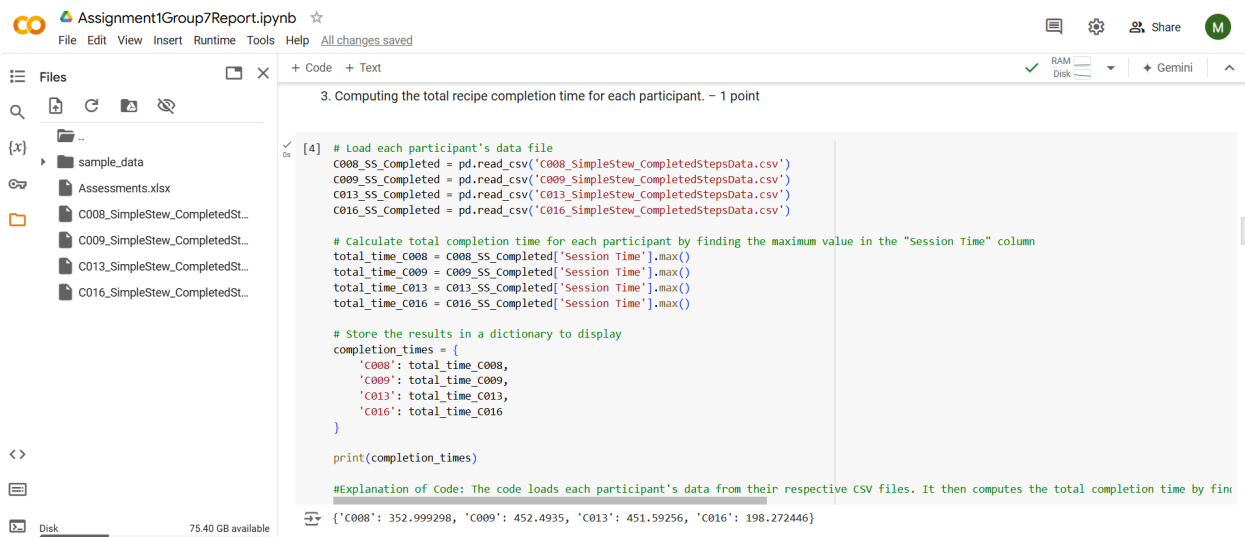
The descriptive statistics for the Block Design Scores give us a general idea of the cognitive abilities of the participants. The mean score of 36.3 shows that, on average, participants have a moderate level of cognitive function based on this test. The standard deviation of 10.0 tells us there's some variation, meaning while many scores are close to the average, some participants scored noticeably higher or lower. Reporting both the mean and standard deviation is important

because it gives us both the average level and the range of differences around that average. As Hesson-McInnis (n.d.) puts it, “a mean without a standard deviation is like a day without sunshine!” The scores ranged from 24.0 to 48.0, showing a wide variety in cognitive abilities, with some participants scoring well above or below the average. This spread suggests individual differences in cognitive skills, which could affect how participants perform in a VR environment. Additionally, including the median score of 36.5 and the interquartile range (IQR) of 9.8 gives us a fuller picture of the middle range of scores, especially if there are any extreme values. These variations in cognitive function are useful to know because they may impact task performance in VR. Recognizing these differences can help identify participants who might benefit from extra support or tailored approaches based on their cognitive strengths or needs.

3. Computing the total recipe completion time for each participant. – 1 point

The total recipe completion time for each participant was as follows:

- Participant C008: 353.0 seconds
- Participant C009: 452.5 seconds
- Participant C013: 451.6 seconds
- Participant C016: 198.3 seconds



```
Assignment1Group7Report.ipynb
File Edit View Insert Runtime Tools Help All changes saved

Files
sample_data
Assessments.xlsx
C008_SimpleStew_CompletedSt...
C009_SimpleStew_CompletedSt...
C013_SimpleStew_CompletedSt...
C016_SimpleStew_CompletedSt...

3. Computing the total recipe completion time for each participant. – 1 point

[4] # Load each participant's data file
C008_SS_Completed = pd.read_csv('C008_SimpleStew_CompletedStepsData.csv')
C009_SS_Completed = pd.read_csv('C009_SimpleStew_CompletedStepsData.csv')
C013_SS_Completed = pd.read_csv('C013_SimpleStew_CompletedStepsData.csv')
C016_SS_Completed = pd.read_csv('C016_SimpleStew_CompletedStepsData.csv')

# Calculate total completion time for each participant by finding the maximum value in the "Session Time" column
total_time_C008 = C008_SS_Completed["Session Time"].max()
total_time_C009 = C009_SS_Completed["Session Time"].max()
total_time_C013 = C013_SS_Completed["Session Time"].max()
total_time_C016 = C016_SS_Completed["Session Time"].max()

# Store the results in a dictionary to display
completion_times = {
    'C008': total_time_C008,
    'C009': total_time_C009,
    'C013': total_time_C013,
    'C016': total_time_C016
}

print(completion_times)

#Explanation of Code: The code loads each participant's data from their respective CSV files. It then computes the total completion time by fin
{'C008': 352.999298, 'C009': 452.4935, 'C013': 451.59256, 'C016': 198.272446}
```

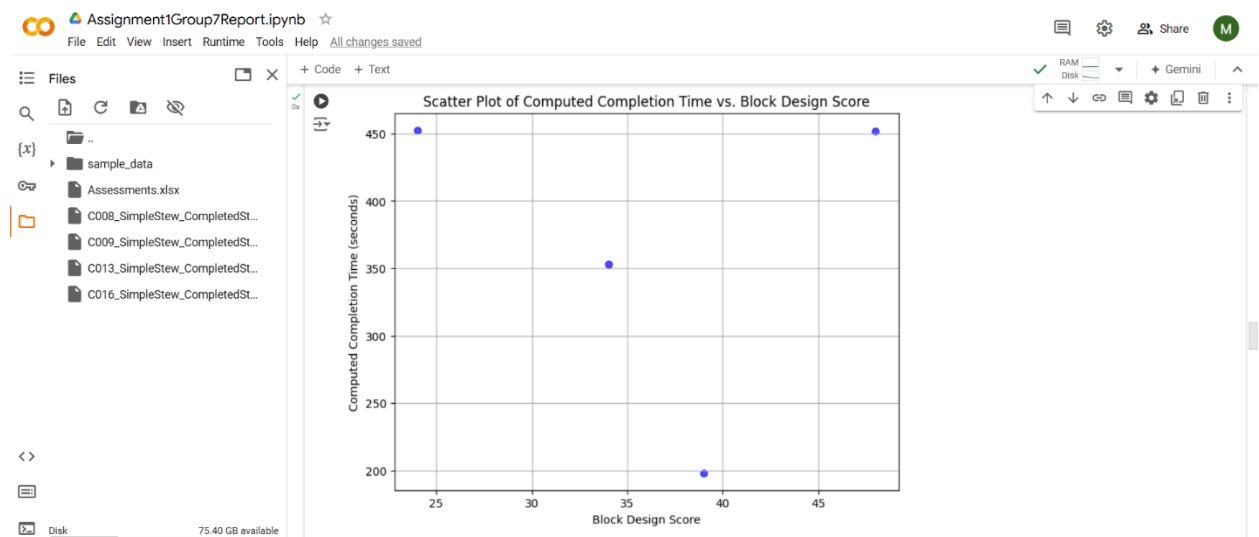
4. Conducting a Spearman correlation analysis and computing a correlation coefficient. Report the results in APA format. – 1 point

The Spearman correlation between Block Design Scores and Completion Time is Correlation coefficient = 0.20, $p = 0.800$.

Interpretation: Although a moderately positive relationship is shown by the Spearman correlation coefficient of 0.20, the high p-value ($p=0.800$) shows that there is no statistically significant association between Block Design Scores and Completion Time. This shows that participants' cognitive scores and the time required to complete the recipe task in this dataset do not significantly correlate.

5. Drawing a scatter plot with the computed completion times vs. Block Design scores. – 1 point

We plotted a scatter plot between the computed completion times in question 3 and block design scores.



6. Explaining the implications of #4 and #5. – 1 point

Implication of #4 (Spearman Correlation Analysis): The Spearman correlation coefficient = 0.20 with a p-value of 0.800 indicates a weak positive association between Block Design Scores and Completion Times; however, this relationship is not statistically significant. This result suggests that, within this sample, higher cognitive function (as measured by the Block Design Score) does not correspond to significantly faster or slower completion times for the VR recipe task. The

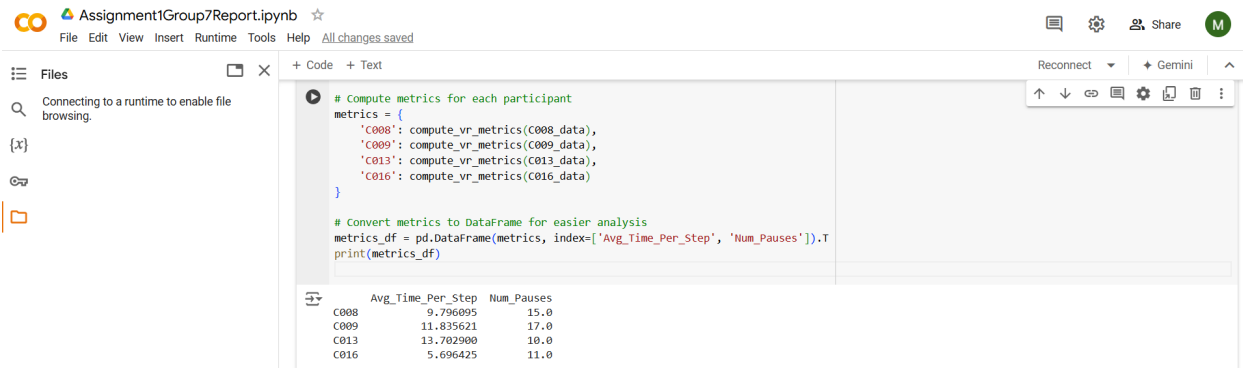
non-significant p-value implies that any observed relationship is likely due to chance, and thus, we cannot conclude a meaningful association between cognitive function and task completion time. The absence of correlation implies that either the sample size may be too small to identify a meaningful relationship, assuming one exists, or that variables other than cognitive scores may affect how long it takes to do tasks in the VR environment. To investigate this association further, it could be helpful to take into account more variables or a larger sample.

Implication of #5 (Scatter Plot): The association between Block Design Scores and Completion Times is visually shown by the scatter plot. Observing the plot, we can see that there is no clear trend or pattern, which aligns with the weak and non-significant correlation coefficient calculated in the Spearman analysis. Data points are scattered without a visible upward or downward trend, supporting the conclusion that there is no strong relationship between cognitive scores and task completion time within this dataset. The scatter plot thus serves as a useful tool for visually confirming the lack of correlation suggested by the statistical analysis, reinforcing that cognitive function as measured by Block Design Score does not appear to predict completion times in this VR task setting.

7. (Extra Points) Devise quantitative measures that describe within-VR performance of study participants that show good correlation with their cognitive function. – 3 points

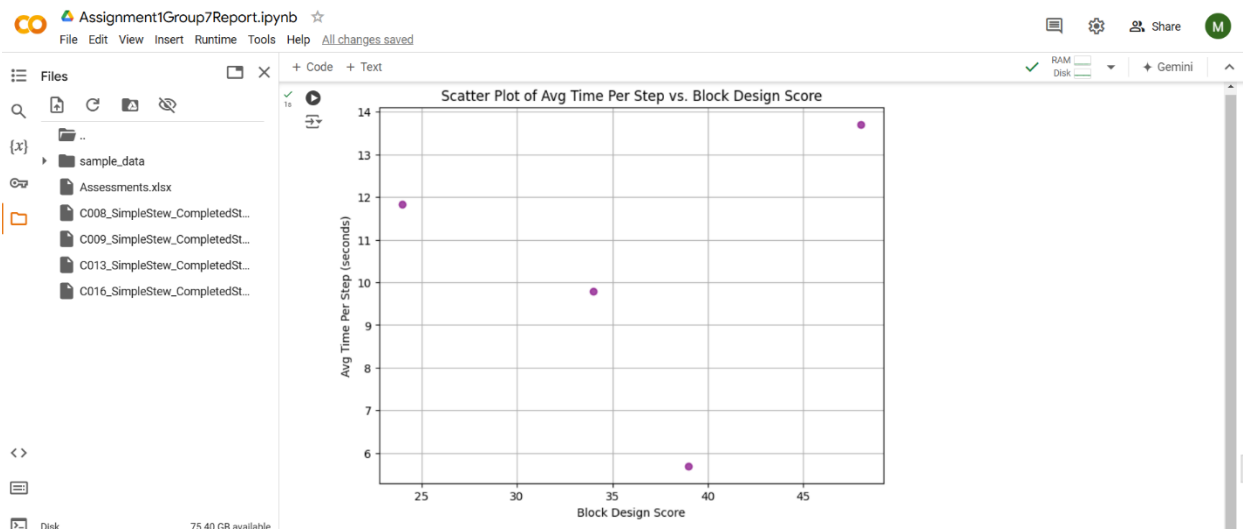
- **Propose and compute quantitative measures that go beyond simple total recipe completion time. – 1 point**
- **Conduct a Spearman correlation analysis and compute a correlation coefficient to show a positive or negative relationship.
Draw the scatter plot. – 1 point**
- **Explain the implications. – 1 point**

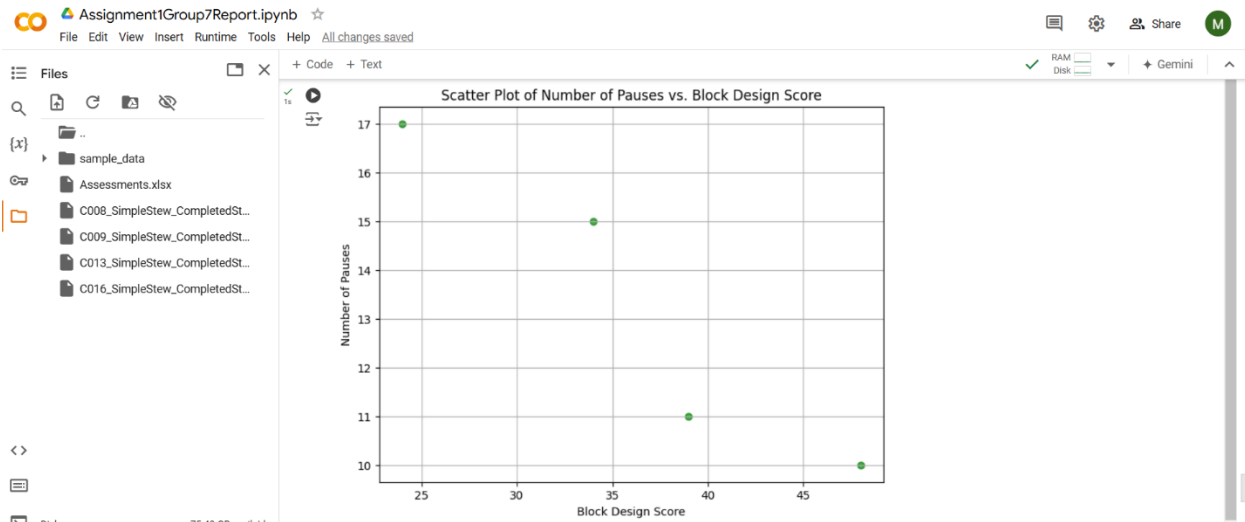
- a) To better understand how participants work through the VR recipe task, we propose looking at two additional measures:
- (i) Average time per step: This shows the average time each participant spends on each step of the recipe. Instead of just looking at the total time, this metric gives us a sense of their pacing throughout the task. If someone takes longer per step, they might be more careful or find certain steps challenging. On the other hand, shorter times per step could mean they're familiar with the task or find it easy.
 - (ii) Number of pauses: Pauses that last more than a certain amount of time (like 5 seconds) can hint at moments where participants are hesitating or struggling. Counting these pauses can reveal if there are specific steps that cause difficulty. More pauses might mean a participant is unsure or needs more time to complete certain parts.



b)

Spearman correlation between Block Design Score and Avg Time Per Step: correlation coefficient = 0.20, $p = 0.800$
Spearman correlation between Block Design Score and Number of Pauses: correlation coefficient = -1.00, $p = 0.000$





c)

Implications: Average Time Per Step: The Spearman correlation (correlation coefficient = 0.20, $p = 0.80$) indicates a weak, non-significant relationship between Block Design Score and Average Time Per Step. The scatter plot shows no clear trend, suggesting that cognitive function does not reliably predict how quickly participants complete each step. This metric may be influenced by factors other than cognitive ability, such as comfort with VR gear or similar external influences.

Number of pauses: The strong negative correlation (correlation coefficient = -1.00, $p = 0.00$) reveals a significant relationship between Block Design Score and Number of Pauses. Higher cognitive scores are associated with fewer pauses, suggesting that participants with better cognitive function complete the VR task more fluidly. This measure appears to effectively capture the impact of cognitive function on task performance.

Conclusion: "Number of Pauses" is a valuable metric for assessing VR performance relative to cognitive ability, while "Average Time Per Step" does not show a meaningful correlation.

Reference

Hesson-McInnis, M. (n.d.). Reporting statistics in APA style.

<https://about.illinoisstate.edu/mshesso-test2/reporting-statistics-in-apa-style/>