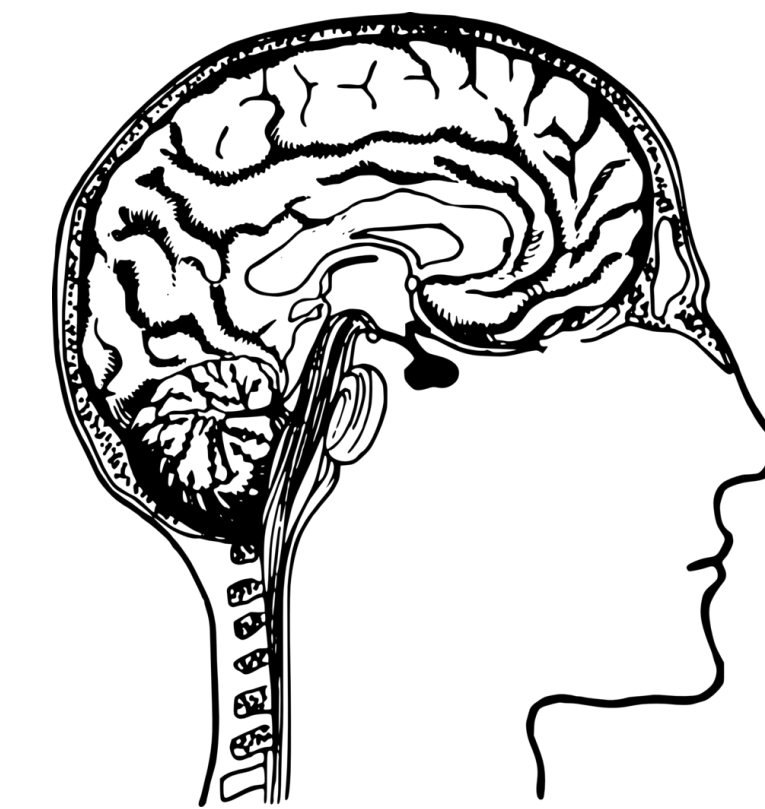




Effects of Technology on Memory and Cognition



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Abstract

One of the leading causes of death amongst the elderly is Alzheimer’s disease, a type of dementia that results in rapid neurodegeneration (Gornia et al. 2006). Our grand challenge consisted in finding a way to combat such disease. Our team focused on the relationship between technology/exercise and cognitive capabilities. Participants were assigned a cognitive exam, and the independent variables included the type of test that was administered and how much each participant exercised. The results show that less usage of technology may have a positive impact on the cognitive capabilities of the general population. The results of our study can be applied to mitigate the rate of cognitive decline in people with dementia.

Introduction

Society has become heavily intertwined with technology, and perhaps we are becoming too dependent on it. Notably, a study found that letter recognition was significantly better in children who learned to handwrite letters rather than those who depended solely on a keyboard (Longcamp et al. 2005). This study shows that there might be a reduction in learning due to technological implementations. Our study aims to determine if a technological-driven approach is better than a paper-based approach when it comes to taking tests. Our group expects to see participants score higher on paper tests than on computer tests. This hypothesis is based on prior research suggesting that technology can have negative effects on memory and cognition. We will also be analyzing exercise as a factor to see if there is any correlation with cognitive function. Prior research and studies have shown a positive relationship between physical exercise (Tseng et al. 2011). With this, we hypothesize seeing a trend of higher scores with higher levels of exercise per week (Ellemberg et al. 2009). With Alzheimer's and dementia affecting so many families, we want our study to provide data to help with the care and memory recovery of these individuals.

Paper vs Tech Data & Analysis

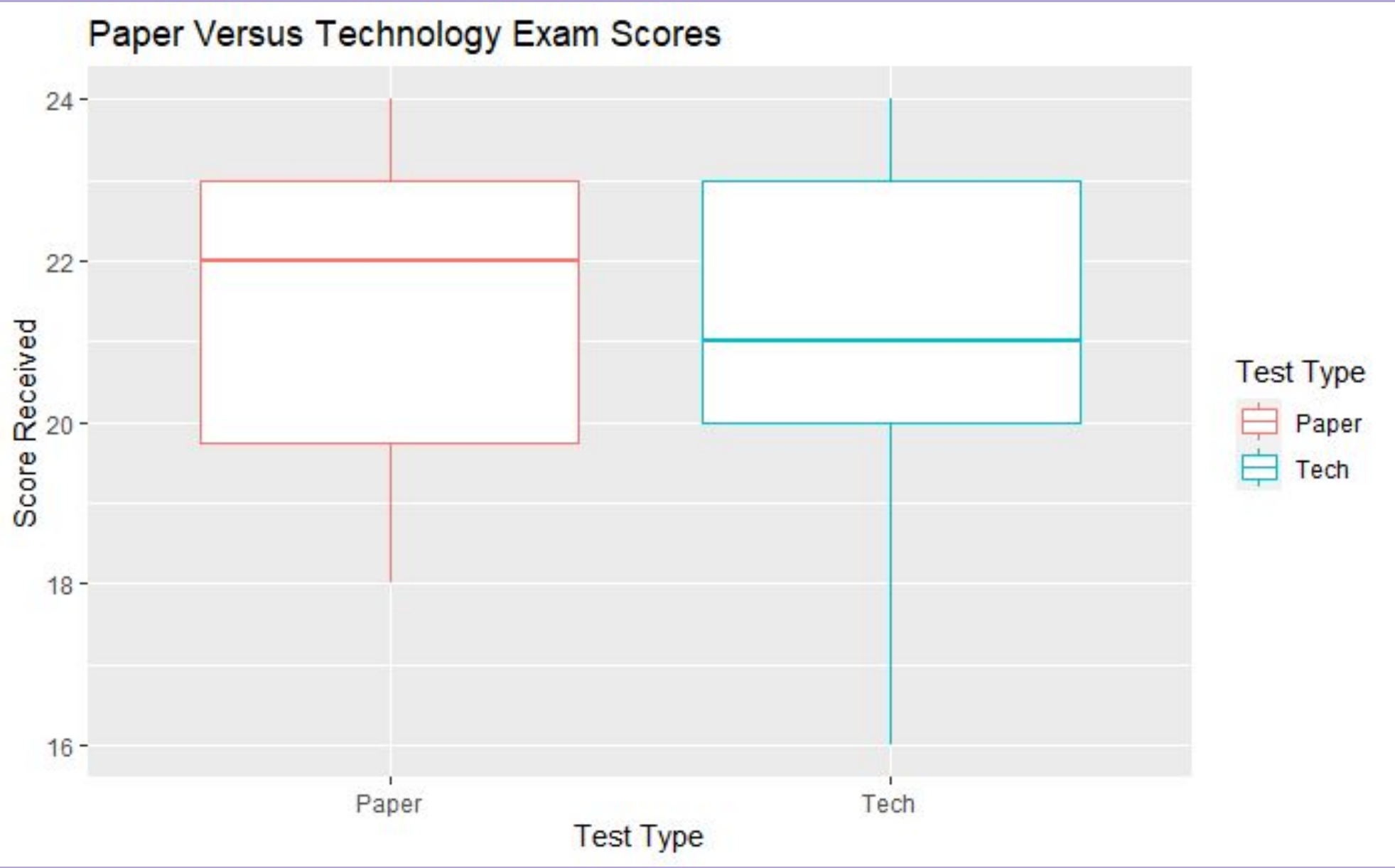


Figure 3: Paper test scores and technology test scores were measured. Two groups were given the exact same test in a technology format (google form) and a paper format. The tests were scored out of 24 points and scored the same way.

Statistical Analysis

Question Number/Type	Points Available	Average points received on paper	Average points received on tech	P Value
1.(cognition)	16	15.6	15.5	0.6421
2.(cognition)	1	0.917	1	0.1617
3.(cognition)	1	0.833	0.762	0.5644
4.(memory)	1	0.583	0.571	0.9375
5.(memory)	1	0.833	0.952	0.1994
6.(memory)	1	0.75	0.381	0.01254
7.(cognition)	1	0.667	0.571	0.5235
8.(memory)	1	0.375	0.476	0.5052
9.(memory)	1	0.708	0.81	0.4378
Total Score	24	22	21	0.7716

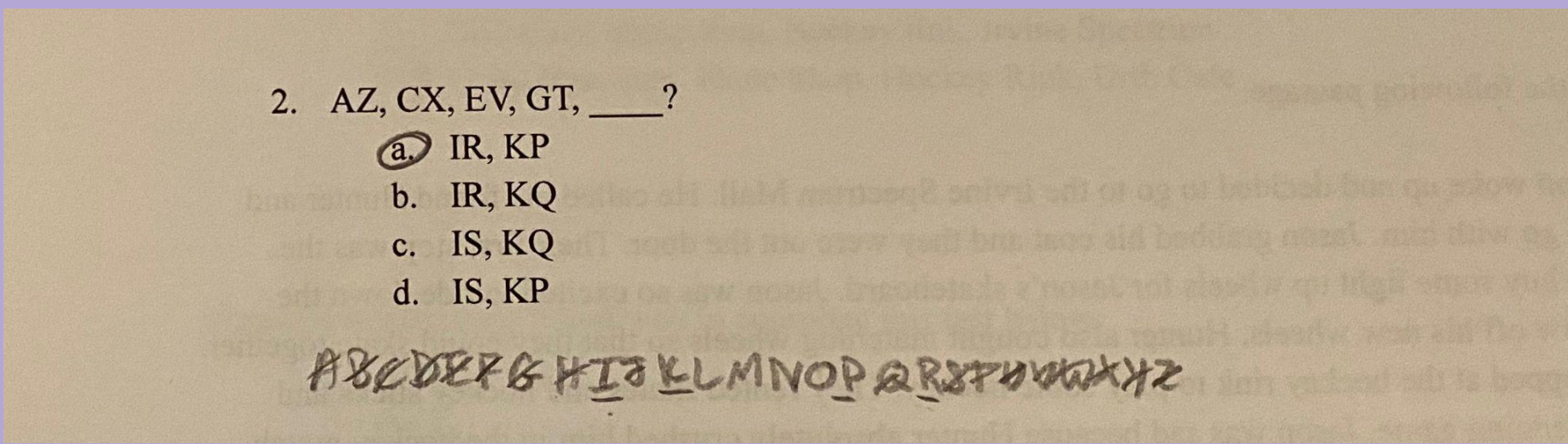
Table 1: This table lists out the averages of each individual question on the tech-based and paper-based memory and cognition exams. A t-test was performed for each question to determine if the values were significant. The type of question (memory or cognition) is also listed by the question number. The average scores and their significance are also recorded

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Themes

- Letter Patterns:
 - Recognized forward letter pattern, but did not recognize the same pattern backwards.
- Crossword Puzzle:
 - Answered common Halloween animal correctly on crossword puzzle.
 - Recalled a different animal not in the crossword on the next page.
- Remembering Names and Events:
 - When asked to recall names and order of events from the story, more people answered correctly on the tech test than the paper test.
- Shape recognition:
 - Similar results in correct and incorrect answers on both paper and tech tests.



What We Learned

- We have dedicated a lot of our research to Alzheimer’s Disease and how our study can be helpful to research in this field. With the paper-based test scoring higher in our study, we have applied this to the application of paper based cognitive activities in Alzheimer’s treatment centers.
- Applicable to the world of Alzheimer’s Disease because of the immense research on how exercise affects the progression of Alzheimer’s. It is proven that exercise is an effective way to decrease the rate of progression of Alzheimer’s (De Farias et al 2021).
- Patients that are affected with Alzheimer’s showed less interest in technology than people without Alzheimer's Disease (Jacobs et al 2019).
- Our study can aid with research in the Alzheimer’s care field to assist the development of effective memory and cognition techniques.

Exercise Data & Analysis

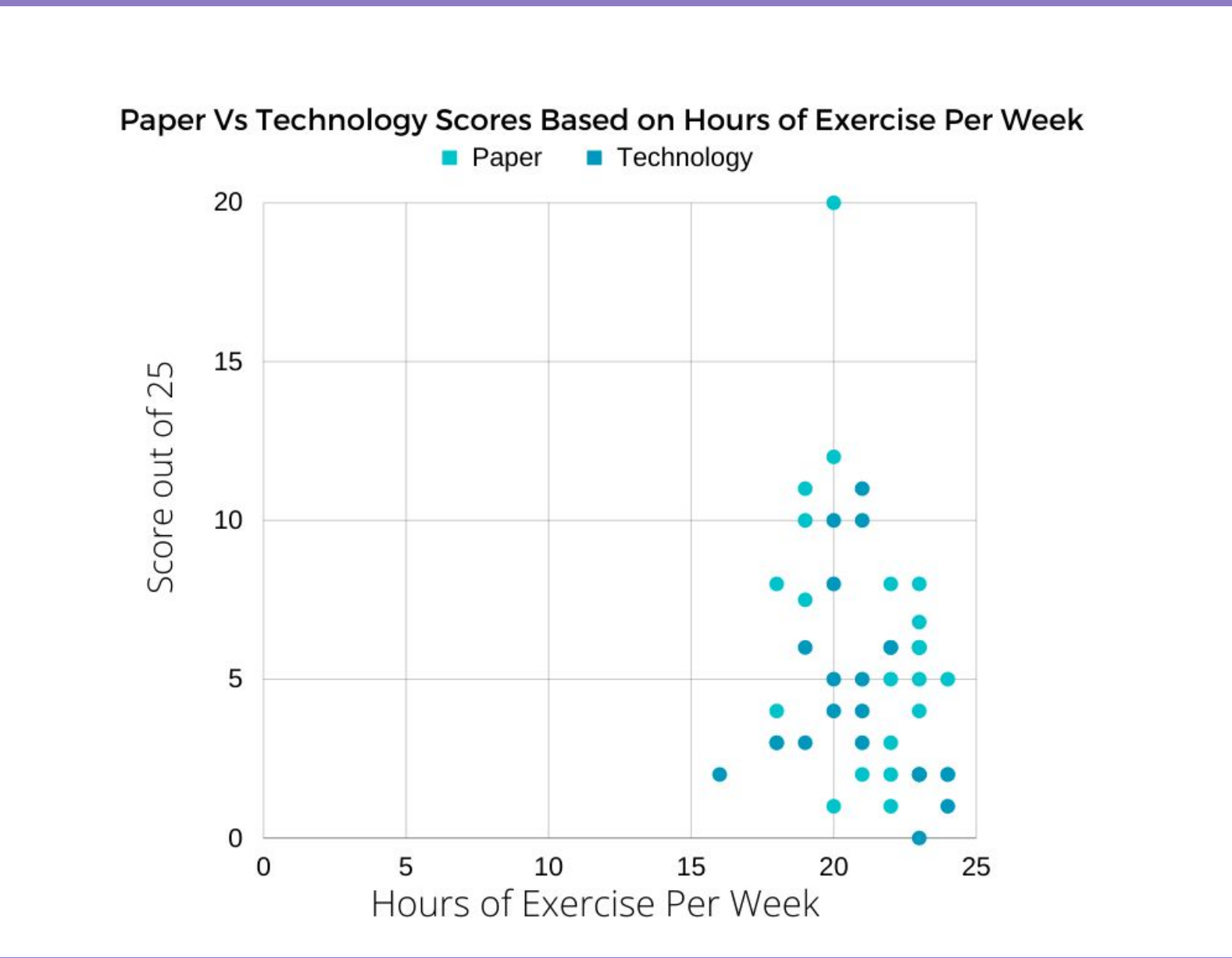


Figure 1: Shows the hours of exercise compared to the score each participant received. Hours of exercise was self reported by participant.



Figure 2: Exercise intensity compared to the average score for each category. 1= Low intensity, 2= Medium intensity, 3= High Intensity.

Methods

- Step 1: Timeline of the important goals.
- Step 2: CITI Training Certification.
- Step 3: Institutional Review Board Paper.
- Step 4: Created cognition exam.
- Step 5: Research on effects of technology on memory and cognition and hypothesis formulation.
- Step 6: Conducted study at Chapman through recruiting participants.
- Step 7: Analyzed results of cognition exams and drew conclusions.
- Step 8: Applied research findings to current Alzheimer’s treatments.

Author Contributions

Gabriella Suarez analyzed themes of the data and completed the methods. Azure Gilmore wrote the conclusion section, analyzed themes, and compiled the references. Avery Whyte and Lorenzo Pessi completed exercise data and analysis and wrote the abstract and introduction. Caroline completed the paper vs tech data and analysis and the acknowledgements.

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