

# **College Students' Ability to Read Analog Clocks: Performance Under Temporal Constraints.**

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# Problem Statement

- At a young age, students are taught how to read analog clocks. However, in this modern era, digital clocks have become more widespread and popular
- It is not clear to what extent this skill persists into young adulthood, or whether misconceptions regarding time-telling become permanent, particularly in the case of students who had difficulties in math, or those who have to perform this task under time constraints
- These subjects has received little scholarly attention

# Background Research

- Some younger students have issues with time telling, or have inchoate skills and have difficulties that inhibit their abilities <sup>1,2</sup>
- These issues seem to persist into adulthood. In a recent study, college students were asked to read the time on nine paper-printed analog clocks. They were given no time limit to complete the task. The average score was about 7.72 out of 9, or 86% <sup>3</sup>
- Given the persistence of time-telling misconceptions, the way clock reading is taught may need to be critically reexamined <sup>4</sup>

# Background Research

- Another factor that may affect the extent to which a task can be successfully completed is the addition of time constraints, or "time pressure"
- This "choking under pressure" phenomenon has been demonstrated to negatively affect students' performance on classroom tests and college entrance exams <sup>5-7</sup>
- The effect seems to be worse for students who already experience test anxiety, particularly in the context of math assessments <sup>8</sup>

# Research Questions

- To what extent can young adults correctly display specific times using an analog clock?
- What factors may statistically affect the time-telling proficiency of young adults?
- Is there a significant difference in performance for timed and non-timed clock reading exercises?

# Variables

- The independent variables were class rank, sex, racial group, ethnic group, participating in sports, growing up in a house with an analog clock, owning an analog wristwatch, opinion about the importance of reading analog clocks, and performance in a non-timed clock exercise (from a previous study)
- The dependent variable was the number of correct times that students displayed specific times in an online clock app

# Methodology – Clock App



# Methodology - Sampling

- The sample consisted of 49 adult undergraduate students enrolled in Morehead State University. They were approached in various common areas and dining halls across campus
- After consenting to participate, students completed a short survey to collect information about the independent variables
- Then, students received a tablet with a clock app and were asked to follow the directions. The first attempt helped students become familiar with the app. The score on the second attempt was recorded for analysis



# Methodology- Statistical Analysis

- A non-parametric test called Mann-Whitney U was used for pair-wise comparisons
- This test can compare the performance of two groups without assuming normally distributed scores or a large sample size
- A significance cutoff point of 0.05 was used to differentiate between similar and significantly different average scores
- The tests were performed using a free, online calculator

## Mann-Whitney U Test Calculator

Sample 1

Sample 2

Significance Level:

.01

.05

1 or 2-tailed hypothesis?:

One-tailed

Two-tailed

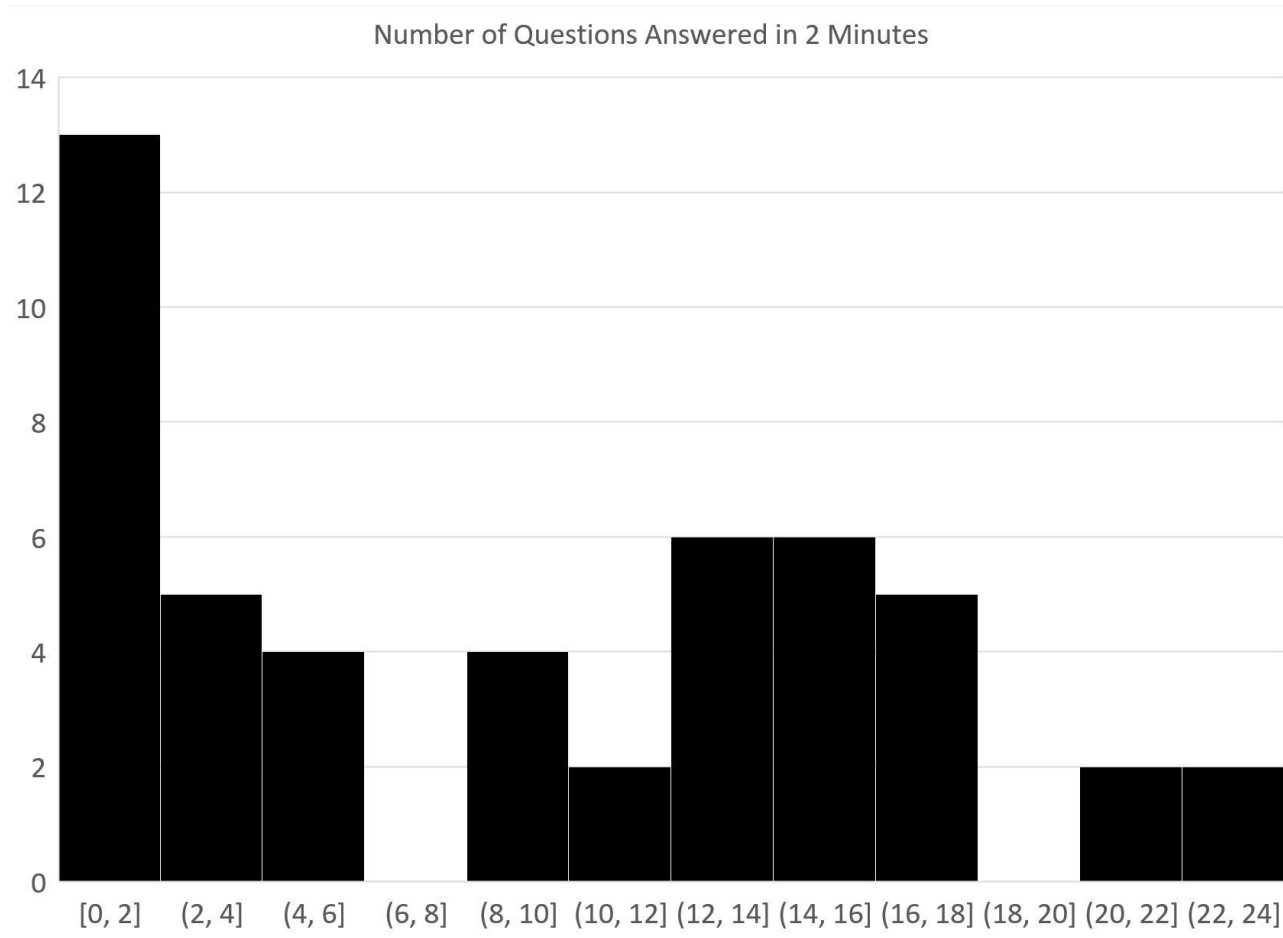
Calculate U

Reset

# Findings

- Class rank: 71.4% underclassmen, 28.6% upperclassmen
- Sex: 59.3% male, 40.8% female
- Race: 77.6% White, 22.4% nonWhite
- Sports: 55.1% do not play, 44.9% do
- Analog clock at home: 85.7% have one, 14.3% do not
- Wristwatch: 36.7% have one, 66.3% do not
- Half of the participants considered reading analog clocks as a "very important" skill
- There were only 2 Latino participants

# Findings



# Findings

- The Mann Whitney test showed no significant differences in the number of correct answers in the clock app when participants were compared by college rank, sex, sports participation, having a clock at home, using a wristwatch, and opinions about the importance for reading clocks.
- White students obtained an average score of  $10.97 \pm 7.10$  points, compared with  $4.45 \pm 4.39$  points for nonWhite students, a significant difference ( $U = 102.5$ ,  $z = 2.558$ ,  $p = 0.011$ ).

# Findings

- In a previous study, 138 participants were asked to read nine clocks without any time limitation. Their average percentage score was 85.8%.
- In this study, with 49 participants, percentages were calculated based on defining the highest participant score as 100%. Their average percentage score was 39.6%.
- These percentages are significantly different ( $U = 644$ ,  $z = 8.616$ ,  $p < 0.0001$ ).

# Conclusion and Future Work

- There was a score difference associated with race. This might be due to disparities in schooling opportunities, or a lack of access or need to read analog clocks
- Additionally, students performed worse on the clock app than they did on the paper test. This might be due to the extra difficulty of the task, manipulating the clock hands, under time pressure. Other explanations may include being distracted by banners on the app or around it, or being unsure how to use a tablet.
- We will collect data until April 2022, and we expect to have a final sample size of at least 300 students.

# Acknowledgments

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