

Background

- With the rapid growth of the elderly population, recent studies observed a greater number of geriatric depression diagnoses.¹
- Brain training applications have become a gateway to accessible digital tools that may support cognitive assessment and contribute to improved mental health.

Lumosity Application:

- An adaptive brain-training application that exercises cognitive processes through games reflecting five main cognitive areas: speed, memory, attention, flexibility, and problem solving.
- Gamification elements, such as milestones and rewards, facilitate consistent engagement.¹

Disillusion Game:

- Users are prompted to match tiles by either color or shape; specifications for matching change during each round.
- Users are encouraged to think flexibly as they process given information and switch between task demands accordingly.²

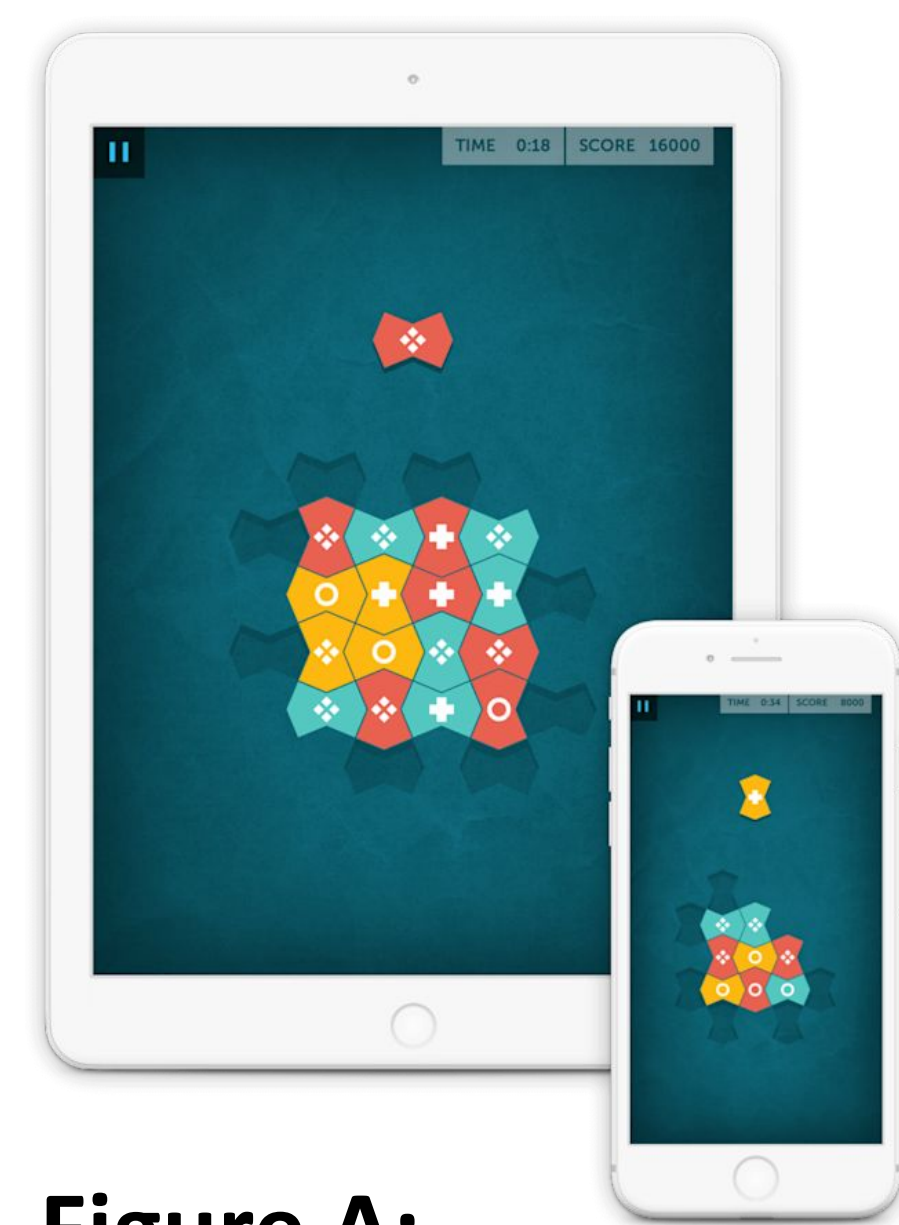


Figure A:
Dissolution User Interface²

Geriatric Depression Scale - Short Form (GDS-SF):

- 15-question screening test where a score of 5 and above indicates high presence of depressive symptoms.³

Methods

Objective:

Identify the correlation between depression scores on the GDS-SF and cognitive flexibility as measured by Lumosity's Disillusion game.

Study Population:

- Data was collected from 112 Boston University Alzheimer's Disease Research Center participants, of which 96 were analyzed. All participants completed a GDS-SF within three years of playing Disillusion on Lumosity.

Demographics Table	
Mean Age (SD)	69.7 (±10.1)
Sex	66.7% female, 33.3% male
Education (yrs)	16.8±2.2 years
Cognitive Impairment	72 not impaired, 8 Impaired-not-MCI, 16 MCI

Data Analysis:

Exposure Variable: Geriatric Depression Scale Score (GDS-SF)

Outcome Variable: Dissolution Game Score

Analysis Model: Linear Regression adjusted for age, sex, and education

- Strength of the linear relationship between variables assessed using the Pearson correlation coefficient (r). Statistical significance of the relationship was verified through the p-value ($p < 0.05$), ensuring that results were not heavily influenced by confounding variables.
- Data outliers were excluded using the interquartile range (IQR) method: calculating for the IQR using the first and third quartile values (Q1-Q3), participant data falling below $Q1 - 1.5(IQR)$ or above $Q3 + 1.5(IQR)$ was not included in the analysis.

Results

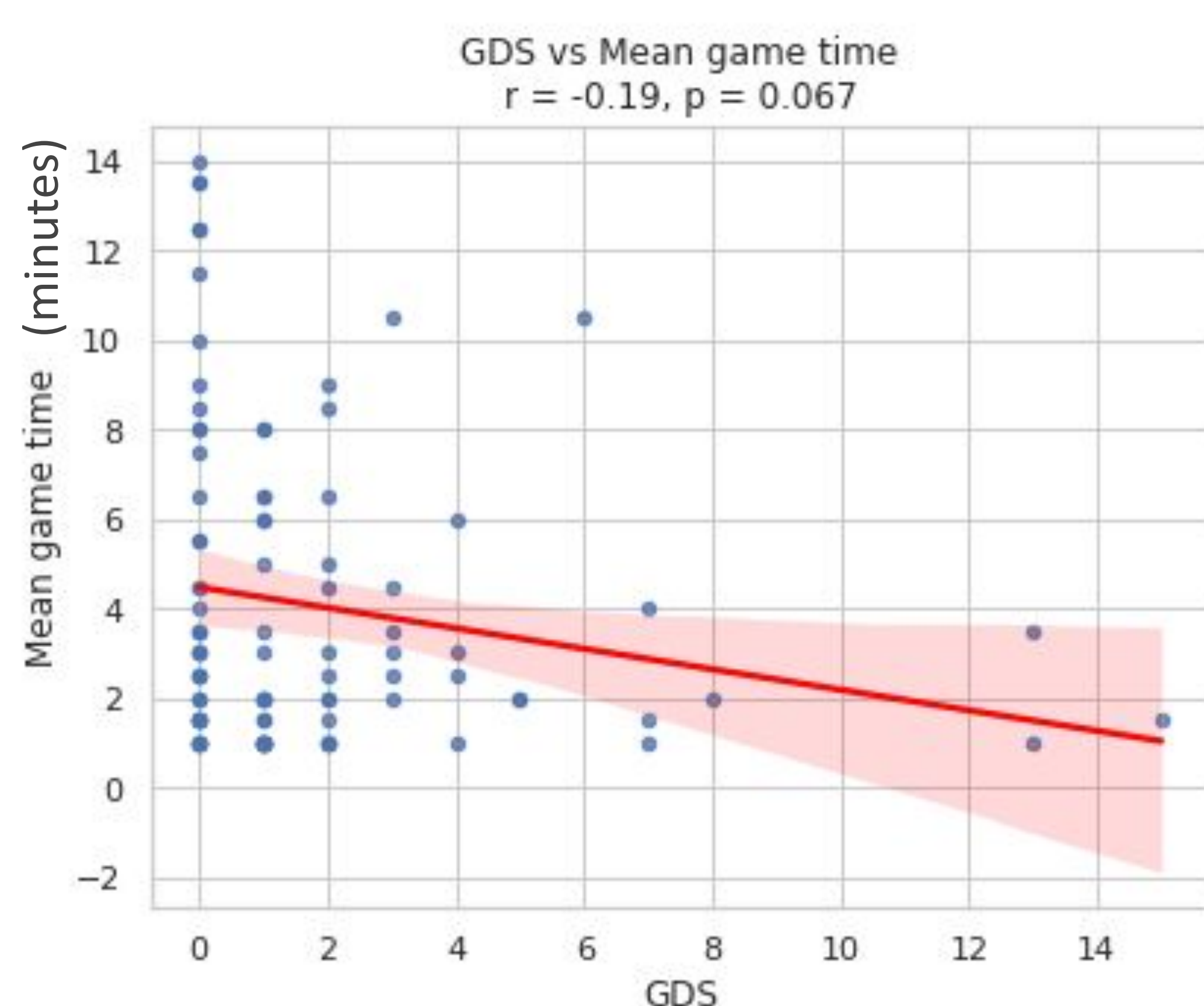


Figure B:
Linear Relationship between GDS-SF Score and Mean Dissolution Game Time ($r = -0.19$, $p = 0.067$)

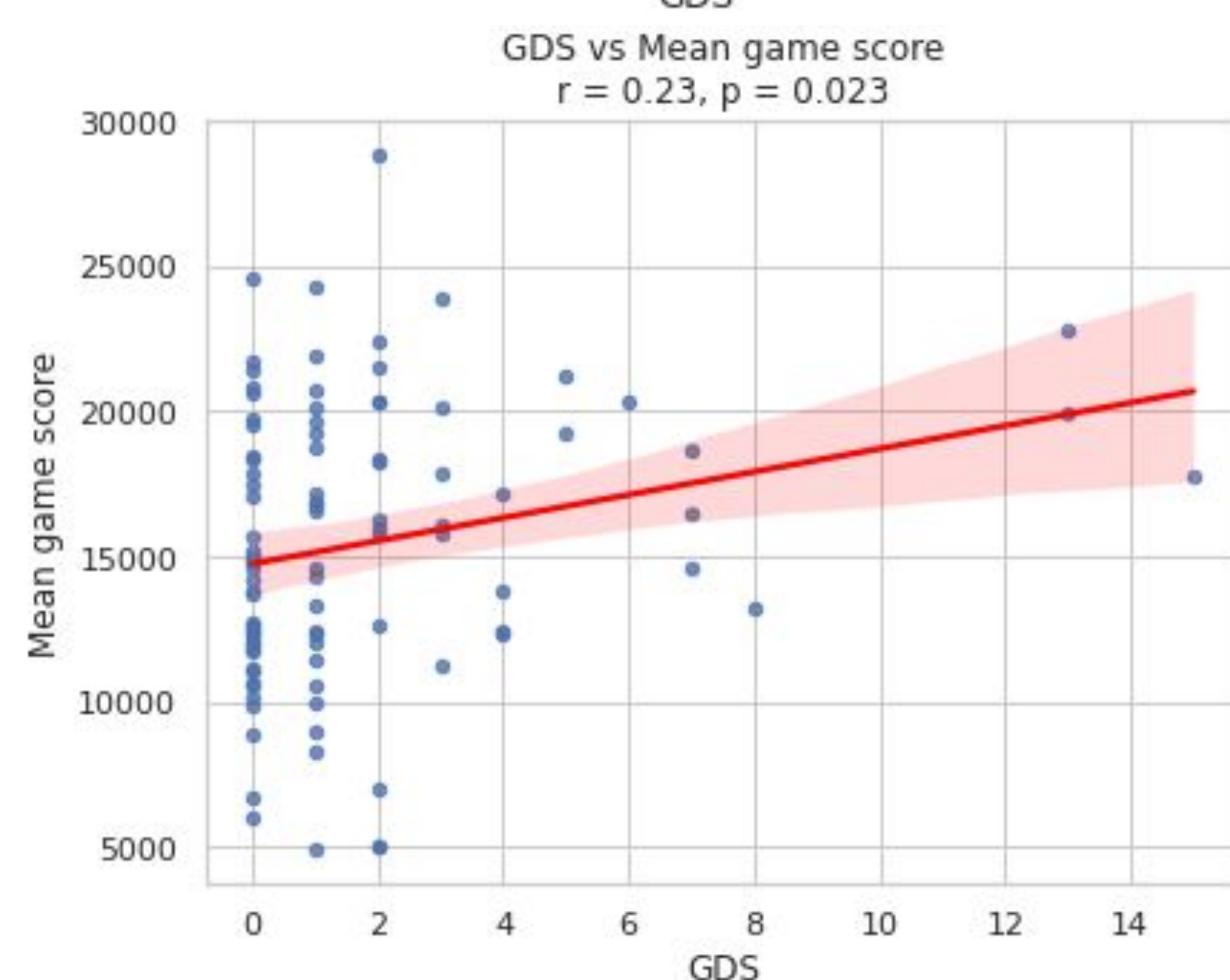


Figure C:
Linear Relationship between GDS-SF Score and Mean Dissolution Score ($r = 0.23$, $p = 0.023$)

Discussions/Conclusions

- Negative trend found between GDS scores and time spent completing a Disillusion round: higher GDS scores were associated with shorter game completion times. However, relationship was not statistically significant ($r = -0.19$, $p = 0.067$).
- Statistically significant, positive correlation found between GDS scores and mean Dissolution scores ($r = 0.23$, $p = 0.023$): higher GDS scores were associated with higher Disillusion scores and vice versa.
- Taken together, results suggest that increased depressive symptoms are associated with higher scores on Lumosity's cognitive flexibility measure.
- One plausible explanation is that individuals with greater depressive symptoms feel less inclined to engage in social interactions and, instead, spend greater time on their smartphones
- Future application development could be modeled after Lumosity to achieve similar levels of engagement with individuals demonstrating greater signs of depression

Limitations:

- More research is needed to determine the accuracy of Lumosity's cognitive scores in relation to clinical cognitive assessments
- Small sample size limits the generalizability of findings.

References



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