Manic Symptoms and Working Memory as Predictors for Applied Mathematical Problem-Solving

Brittny Arias, B.S., D'Shawn Harrigan, M.A, M.S., Zachary Peart, B.S., Sophia Perez, B.S., Brittany Heavens, B.S., & Charles J. Golden, Ph.D.

College of Psychology, Nova Southeastern University

NSU Florida
NOVA SOUTHEASTERN UNIVERSITY

INTRODUCTION

- Most research examines the predictive nature of sleep and medication effects on cognitive performance.
    - Researchers have suggested that prolonged wakefulness induces adverse changes in cognitive functioning, such as impaired attention and working memory (Alhola & Polo-Kantola, 2007).
- Many recent studies support the notion that working memory span performance is an essential predictor of mathematical problem-solving abilities (Allen et al., 2021; Raghubar et al., 2010).
- However, limited research demonstrates the role of working memory and manic symptoms for mathematical problem-solving abilities in adults.
    - One article found no empirical evidence for better academic performance in Mathematics for people with a hypomanic temperament. Instead, evidence suggested that worse performance was associated with high scores on hypomanic measures (Meyer & Krumm-Merabet, 2003).
- Nevertheless, it is currently unclear how strongly manic symptoms and working memory are associated with and able to predict applied mathematical problem-solving abilities.
- Further, it is uncertain if hypomania and working memory measures will provide valuable information for predicting applied mathematical problem-solving abilities after controlling for specific demographic factors shared within the general population.

OBJECTIVES

- To determine the extent to which manic symptoms and working memory predict applied mathematical problem-solving abilities after controlling for age, gender, and education.

Author Contact:
Brittny Arias
ba717@mynsu.nova.edu

METHODS

Setting
- The participants were drawn from an ongoing de-identified adult clinical database collected from a neuropsychology clinic at a private university.

Procedures
- Each participant completed the entirety of the Key Math 3, MMPI-2, and WAIS-IV.
- A hierarchical linear regression was estimated to test whether the MMPI-2 Hypomania Scale would predict significant incremental variance on the Key Math 3 Applied Problem-Solving Subtest above and beyond the WAIS-IV Working Memory Index (WMI) when controlling for age, gender, and education.

Participants
- N=136
- Caucasians (N=65, $M_{edu} = 13, 41.5\%$ male)
- African Americans (N=19, $M_{edu} = 12, 47.3\%$ male)
- Hispanics (N=39, $M_{edu} = 13, 43.5\%$ male)
- Other (N=13, $M_{edu} = 13, 38.4\%$ male)

RESULTS

- For the initial model, age, gender, and education were not significant predictors of Applied Problem-Solving subtest $F(3, 134) = 1.548, p =.205, R^2 = .033$.
    - The addition of WMI accounted for significant incremental variance for control variables of the first model $\Delta F(1, 133) = 6.442, p = .012, \Delta R^2 = .045$.
- The final model was also significant, $F(5, 132) = 3.712, p =.004, R^2 = .123$.
    - The addition of Hypomania Scale accounted for significant incremental variance over WMI $\Delta F(1, 132) = 6.793, p = .010, \Delta R^2 = .045$.
    - WMI was a significant predictor, b= .180, se= .074, $p = .017$, accounting for approximately 3.8% of the variance and the Hypomania Scale was a significant predictor, , b = -.222, se = .085, $p = .010$, accounting for approximately 4.4.% of the incremental variance.
- Overall, both the Hypomania Scale and WMI account for 12.3% of the variance, adding an additional 4.5% of the variance over gender, age, and education.

CONCLUSIONS

- The current study indicates that participants' endorsement of increased energy and working memory predict a small role in applied mathematical problem-solving.
- The findings highlight differences between the mental computations needed for the WMI and the ecological validity associated with applied computational skills.
- Previous studies have examined the effect of sleep and medications in the assessment process (Alhola & Polo-Kantola, 2007).
- However, the current study highlights the importance of accounting for energy level and working memory when assessing applied mathematical ability.
- Future research could use larger neuropsychological batteries designed to investigate various areas of cognitive abilities and hypomania measures in mathematical abilities.

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