Examining the Influence of Neurocognitive Constructs on Mathematical Ability

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Objective: The purpose of this study was to investigate how specific neurocognitive constructs (Fluid Reasoning, Visual-Spatial Processing, Working Memory) of the NEPSY-II and Woodcock-Johnson III: Tests of Cognitive Abilities predict Mathematical Reasoning and Calculation as measured by the Woodcock-Johnson III: Tests of Academic Achievement. Method This study incorporated data from the School Neuropsychology KIDS, Inc. Post-Graduate Certification Program. Participants included 278 individuals ages 6–18 previously identified as having a clinical diagnosis (Neurological Impairment, ADHD, Learning Disability, or Autism). Three NEPSY-II subtests (Arrows, Design Copying, Memory for Faces) and eight WJ-III-COG NU subtests were utilized (Auditory-Working Memory, Numbers Reversed, Concept Formation, Analysis-Synthesis, Memory for Words, Planning, Spatial Relations, and Picture Recognition). To determine how these subtests predict mathematical ability, two multiple regression analyses were computed. Results Results confirmed a significant prediction for Math Reasoning, $F(11, 266) = 4.05$, $p < .05$, $R^2 = .143$, $R^2_{\text{Adjusted}} = .108$. Specifically, the Analysis-Synthesis subtest predicted Math Reasoning, $\beta = .21$, $t(11, 266) = 2.95$, $p < .05$. Results also confirmed a significant prediction for Math Calculation, $F(11, 266) = 4.29$, $p < .05$, $R^2 = .151$, $R^2_{\text{Adjusted}} = .116$. The Auditory Working Memory subtest predicted Math Calculation ($\beta = .2$, $t(11, 266) = 2.92$, $p < .05$) as well as the Numbers Reversed subtest, $\beta = .165$, $t(11, 266) = 2.27$, $p < .05$. Conclusion Neurocognitive tasks requiring working memory and deductive reasoning skills predict mathematical achievement, while tasks measuring visual-spatial thinking do not. The findings support that both fluid reasoning and working memory significantly influence mathematical abilities within a pediatric clinical population.