Validity Evidence Supporting the MindPrint Solution in Academic Contexts

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MindPrint's cognitive assessment[1] provides an understanding of a student's relative strengths and needs in the domains of long-term memory capability, executive functions (attention, working memory, and cognitive flexibility), complex reasoning (verbal, abstract, or spatial), and working efficiency. This can be used to make evidence-based recommendations for learning strategies to optimize student learning. Together with CAST, MindPrint has also developed a social and emotional (SE) skills assessment to evaluate students' self-awareness, self-efficacy, and self-regulation skills, and their level of engagement with their math instruction. This brief report provides an overview[2] of findings from Phase I of our NSF SBIR-funded research, in which we coupled the cognitive and SE skills assessments to predict math outcomes, specifically NWEA MAP Growth scores.

Method and Results

Study participants were 170 middle-school students who completed the MindPrint cognitive assessment, the MindPrint/CAST SE skills assessment, and the MAP Growth assessment.

Our analyses established the reliability of eight core SE skill constructs that support learning strategy recommendations. Not only did the assessments prove to be reliable (i.e., high Cronbach's alpha values were observed for each scale), but we also found validity evidence in terms of test content, internal structure, and test-criterion validity. The MindPrint cognitive data, in combination with demographic variables, accounted for over 52% of the variance in MAP Growth scores. Moreover, the addition of SE skills data to the regression model allowed us to explain nearly 64% of the variance in MAP Growth scores.

The structural equation model below depicts the interaction of cognitive and SE skill-related factors in predicting math outcomes. This provides a framework for identifying the more malleable factors impacting math achievement and thus the greatest opportunities for intervention. For example, based on our identification of students with similar cognitive and SE skills profiles but significantly different math achievement outcomes, we learned that of the students with strong reasoning skills (i.e., verbal and abstract), those who underperformed in math tended to have low motivation. Therefore, a goal should be to increase the underperforming students' motivation levels. In other cases, of the students with strong reasoning skills, those who underperformed in math had weaker executive functions, attention, or visual memory. Therefore, the focus for these students should be on using strategies reliant on other cognitive skills, such as verbal memory.

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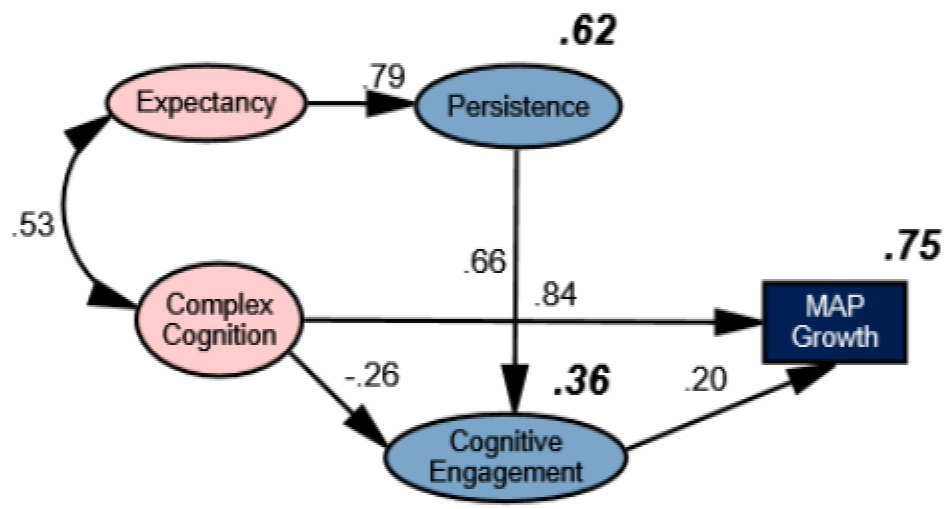
[1] Certain results from this study were generated using the web-based Computerized Neurocognitive Battery licensed from the University of Pennsylvania. The cognitive tasks have been extensively validated in previous large-scale studies (Moore et al., 2015).

[2] The full-length report can be obtained from the authors on request.



Conclusion

This study provides evidence for the validity of our assessments by demonstrating that the combination of cognitive factors, SE skills, and study strategies accurately predicts nearly two-thirds of the variance in math outcomes. The findings furthermore suggest that these assessments can be used to drive learning strategy recommendations that will promote the development of students' math skills.

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Dr. Robert Dolan is a Senior Innovation Scientist at CAST, Founder & Principal of Diverse Learners Consulting, and adjunct professor at Landmark College. Bob applies his expertise in neuroscience, learning science, assessment, instructional design, UX design, and programming to providing diverse learners with flexible and effective learning opportunities, and educators with the resources and supports to facilitate this. For over twenty years, Bob has designed, implemented, and evaluated technology-based learning and assessment solutions with emphases on cognition, accessibility, and usability, and Universal Design for Learning. He has served as principal investigator on research projects funded by NIH, NSF, DOE, and private foundations. Bob received a BS in Biology from Cornell and a PhD in Brain and Cognitive Science from MIT.

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