The Evolution and Evaluation of a Play-Based, After-School Curriculum That Improves Executive Function, Visuo-spatial and Math Skills for Disadvantaged Children

Symposium Justification

A great deal of national attention has been focused on addressing achievement score gaps in U.S. schools. Improving mathematics achievement is of particular importance (Benbow, 2008). The predominant strategy for improving math scores has been to devote more classroom time to formal math instruction (Miller & Almon, 2009). Approaches that target skills foundational to mathematics achievement, such as executive functioning and visuospatial skills, are less common. This symposium presents a series of papers that describe the development of Minds In Motion, an early elementary after-school intervention, which effectively impacts math achievement by promoting executive functioning and visuospatial skills.

This symposium exemplifies the theme of this fall’s conference, Interdisciplinary Synthesis in Advancing Education Science, by demonstrating how integration of knowledge across disparate fields, can strengthen educational practice. These papers demonstrate how cognitive science theory and measures can be used at several stages of the intervention development process: from conceptualizing the intervention, to developing a theory of action, to obtaining experimental results that establish a causal relationship between the intervention and cognitive and academic outcomes. The authors describe how theory in cognitive science helped to modify an ineffective intervention into one with significant practical effects, and provides strategies for effective use of cognitive science throughout the development of Minds In Motion.

Using three large-scale longitudinal datasets, the first paper describes a robust association between fine motor measures and later academic achievement. Interestingly, in the only dataset that contains scores for the individual fine motor measures, the design copying task is a much stronger predictor of later achievement than other motor measures. This paper sets the stage for the development of Minds In Motion by identifying early skills important to later achievement, particularly math achievement.

The second paper attempts to further explore the nature of the association between fine motor skills and achievement by examining the construct validity of the design copying task as a predictor of mathematics achievement. This paper provides empirical guidance to resolve a disconnect between the cognitive science literature and the educational literature on how to interpret performance on the design copying task. The major conclusion of this paper is that executive functioning and visuospatial skills appear to be better than fine motor skills at explaining the association between design copying and mathematics achievement.

The third paper describes how the insight garnered from the first two papers helped to transform the initial conceptualization of Minds In Motion into an engaging, effective after-school intervention. The paper describes our experience creating the Minds in Motion intervention, including lessons learned from its first ineffective implementation and the subsequent successful implementation with children in three high risk schools.

The fourth paper describes the causal effects of Minds In Motion and demonstrates how this intervention helps evaluate cognitive constructs in an authentic academic setting. This paper also demonstrates that executive functioning and visuospatial skills, which are foundational to later math achievement, are amenable to intervention.
References:
