

Introduction

- Attention Deficit Hyperactivity Disorder (ADHD) is a heterogeneous neuropsychological disorder characterized by excessive inattention, impulsivity, and hyperactivity (American Psychiatric Association, 2013).
- 89% of children with ADHD have deficits in at least one executive function (EF; Kofler et al., 2018).
- Research in typically developing children suggests that core aspects of executive functioning are related to math abilities (e.g., St. Clair-Thompson & Gathercole, 2006; Swanson & Jerman, 2006)
- Working memory is correlated with poor math outcomes in children with ADHD and typically developing children (Brankaer et al., 2013; Gerst et al., 2015)
- Inhibition is correlated with various math skills in typically developing children and may underlie math learning disabilities (Bull & Sceriff 2001; Friso-Van Den Bos et al., 2013)
- There is a paucity of evidence regarding the relation between set-shifting and math performance (Thompson, 2006).
- The current study attempted to address some of the current gaps in the literature by examining relations among ADHD symptoms, EF, and math performance in a clinical child sample.
- We hypothesized that general EF, along with each EF independently, would predict math performance over and above ADHD symptoms and that working memory would have the strongest relation to math performance.

Methods

- Participants included children ($N=116$) between the ages of 8 and 13 years old who were referred via clinical and community resources.
- Measures
 - *Math performance*: KTEA-3 Math Composite Standard Score, including tests of math concepts and applications and math computation.
 - *ADHD Symptoms*: Parent ratings on BASC-3 Attention Problems and Hyperactivity scales
 - *Working Memory*: Counting Span Task
 - *Inhibition*: Go-no-go Task
 - *Shifting*: Global-Local Task

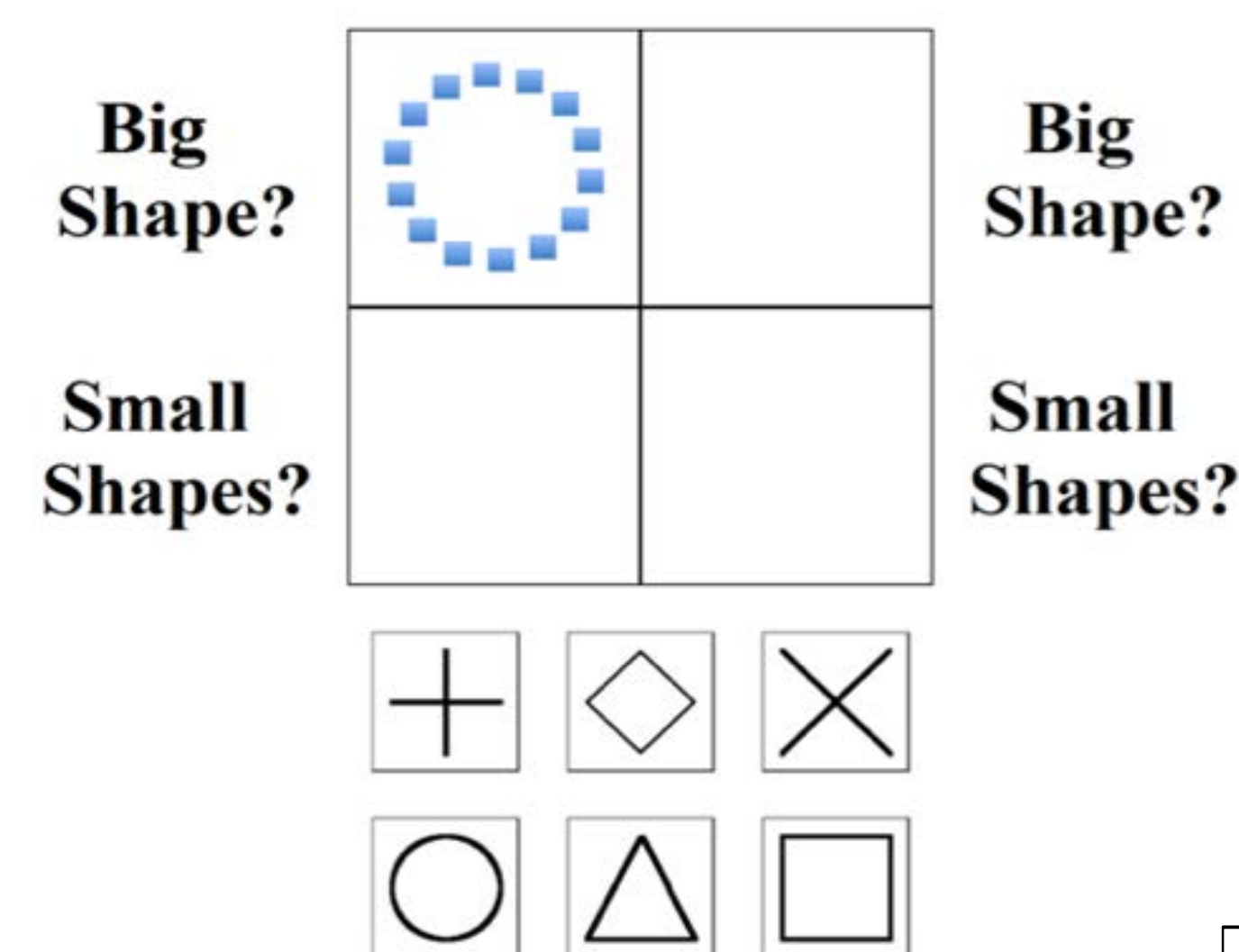


Figure 1. Global-Local Task

Results

- A series of hierarchical regressions were performed; socioeconomic status, gender, ethnicity, and age were controlled for in all models.
- EF (working memory, inhibition, and set-shifting combined) predicted math performance over and above ADHD symptoms ($\Delta R^2 = .192$; $p < .001$).
- Working memory predicted math performance over and above inhibition, set-shifting, and ADHD symptoms ($\Delta R^2 = .189$; $p < .001$).
- Inhibition ($\Delta R^2 < .001$; $p = .779$) and set shifting ($\Delta R^2 < .001$; $p = .885$) did not account for a significant amount of variance in math performance over and above ADHD symptoms and other executive functions.

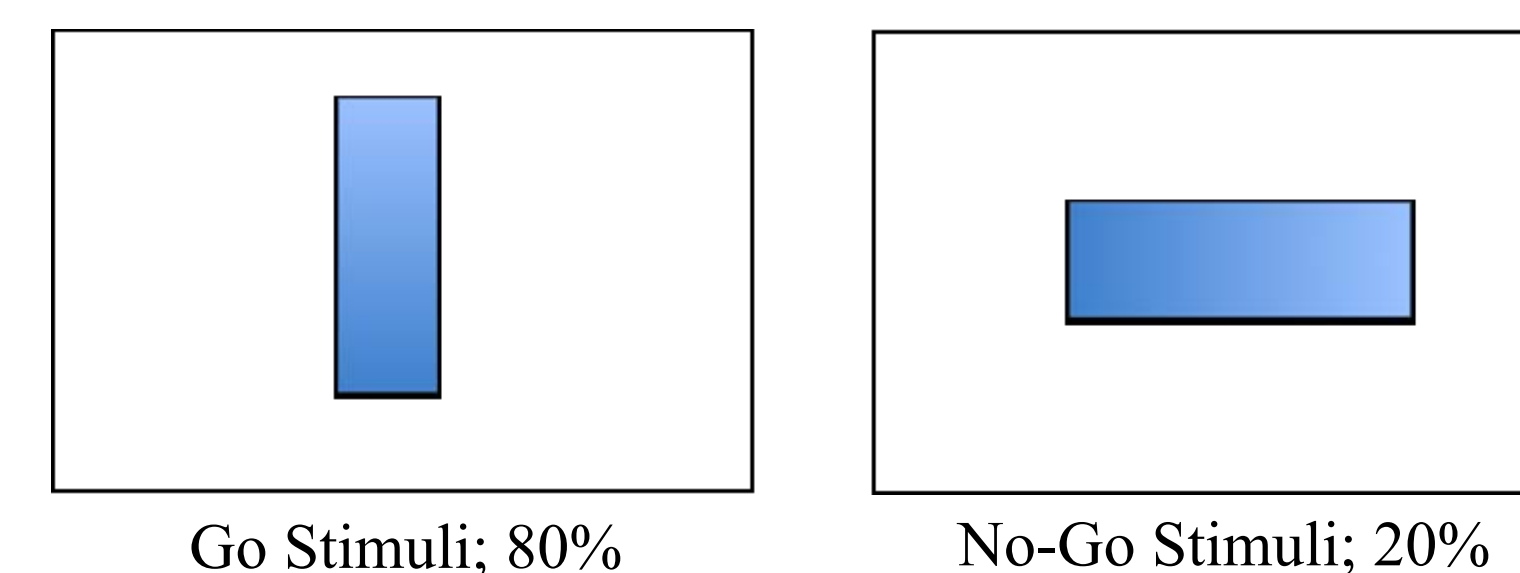


Figure 2. Go-No-Go Task

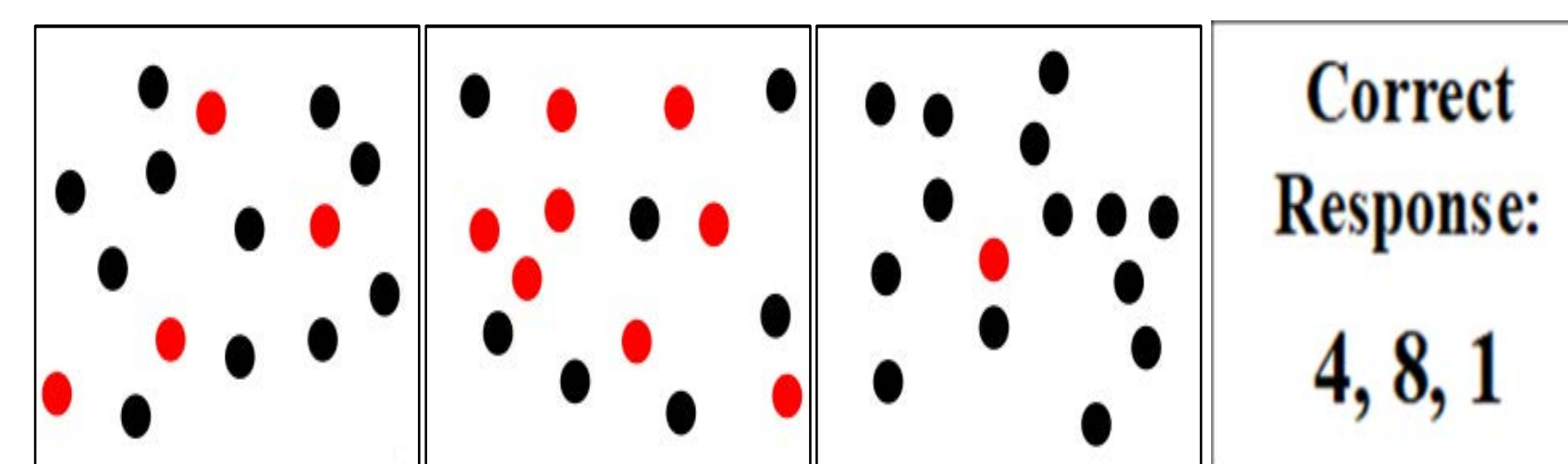


Figure 3. Counting Span Task

Discussion

- These findings suggest that targeting working memory in interventions for children with ADHD may improve their math performance.
- Children with EF deficits improve their math skills when taught how to use EF strategies while solving math computations (Iseman & Naglieri, in press; Naglieri & Gottling, 1995, 1997; Naglieri & Johnson, 2000).
- Training working memory also improves math performance in children with mild-borderline intellectual disabilities (Van der Molen et al., 2010).
- Our results also indicated that inhibition and set-shifting did not account for a significant amount of variance in math performance over and above ADHD symptoms. This may be due to the fact that inhibition and set shifting account for a lower proportion of EF deficits in children with ADHD (27% and 38% respectively; Kofler et al., 2018) than working memory.

Limitations and Future Directions

- Cross-sectional study design
- Excluding math fluency in the measures of this study may have undermined the effects of set-shifting and inhibition on math performance.
- Looking at specific math skills in correlation with EF rather than overall math skills is an important direction for future research.