



Emotion Regulation and Working Memory in ADHD

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Background

- Approximately 48-54% children with Attention Deficit Hyperactivity Disorder (ADHD) exhibit difficulties with emotion regulation (Graziano & Garcia, 2016).
- Emotion dysregulation is resistant to the current gold-standard treatments for ADHD and portends risk for adverse outcomes, even into adulthood.
- Evidence from the cognitive literature suggests that working memory (WM) is a key mechanism underlying the ability to regulate and suppress the outward expression of strong emotions.
- Recent estimates indicate that approximately 62-85% of children with ADHD have WM deficits, and that these WM deficits may exert a causal influence on ADHD symptoms.
- Overall, research indicates that:
 - Many children with ADHD have difficulties with emotion regulation
 - WM may underlie the ability to regulate emotion.
 - Many children with ADHD have WM deficits.

Current Study

- To our knowledge, this is the first study to examine the relation between WM, emotion regulation, and ADHD symptoms in a carefully-phenotyped clinical child sample.
- We used bias-corrected bootstrapped conditional effects modeling (Hayes, 2013) to test the hypothesis that:
 - Better-developed working memory would predict better-developed emotion regulation abilities, and
 - That this association would occur over and above working memory's relation with ADHD inattentive and hyperactive/impulsive symptoms

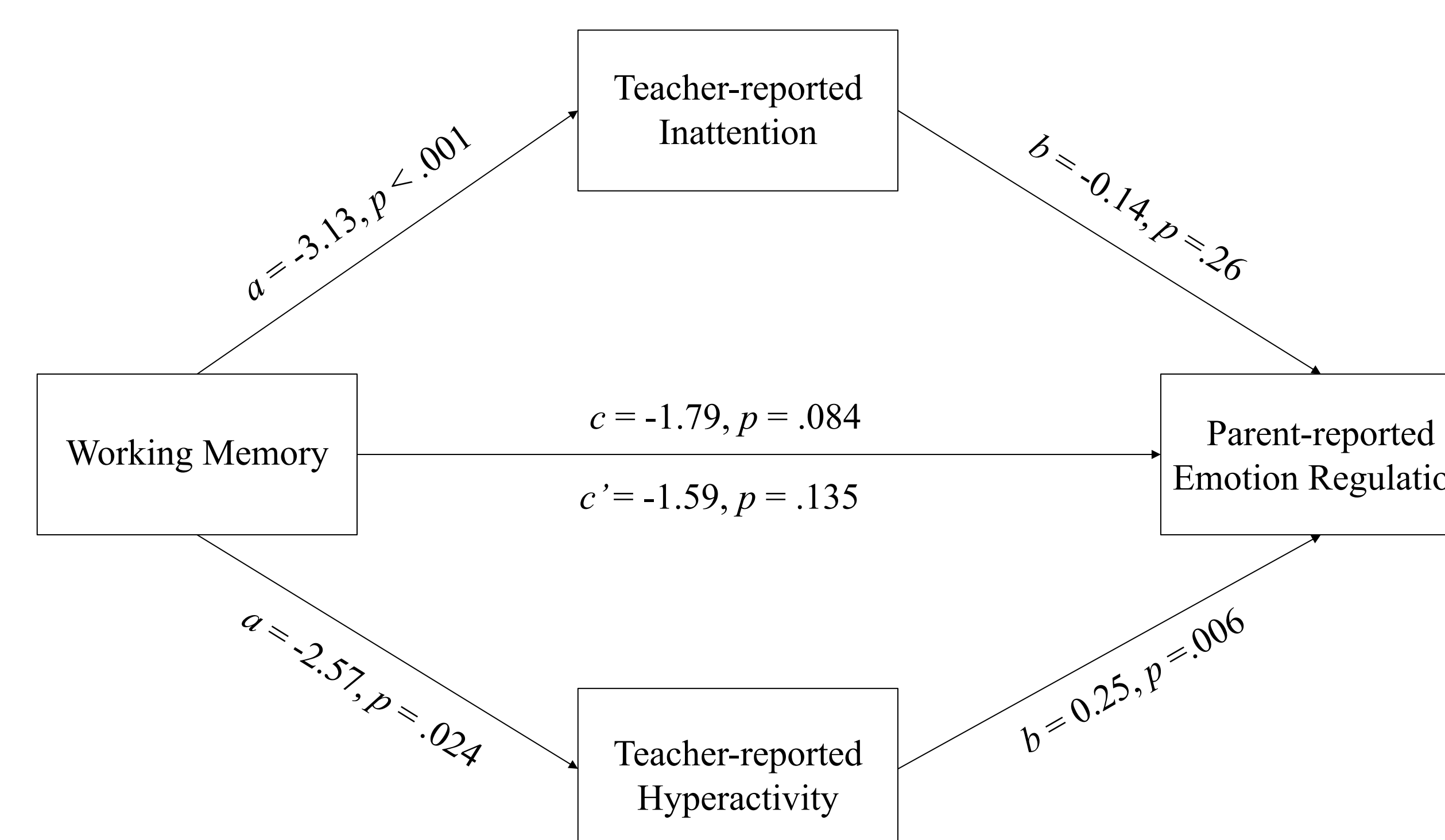
Participants

- 145 children aged 8 to 13 years ($M = 10.33$, $SD = 1.47$) recruited through community resources
- Sample characteristics :
 - 55 females (37.9%)
 - 100 White/Non-Hispanic (69%), 18 Hispanic (12.4%), 13 African American (9%), 10 Biracial (6.9%), 4 Asian (2.8%) children.
- Group Assignment
 - ADHD group ($N = 102$) included children with comorbid diagnoses, including anxiety (21.57%), oppositional defiant (13.86%), depressive (9.8%), and suspected learning (28.43%) disorders
 - Control group ($N = 43$) included typically developing ($N = 22$, 51.16%) children and children with psychiatric diagnoses other than ADHD ($N = 21$, 48.84%), including anxiety (41.86%), oppositional defiant (4.65%), depressive (6.98%), and suspected learning (2.33%) disorders.

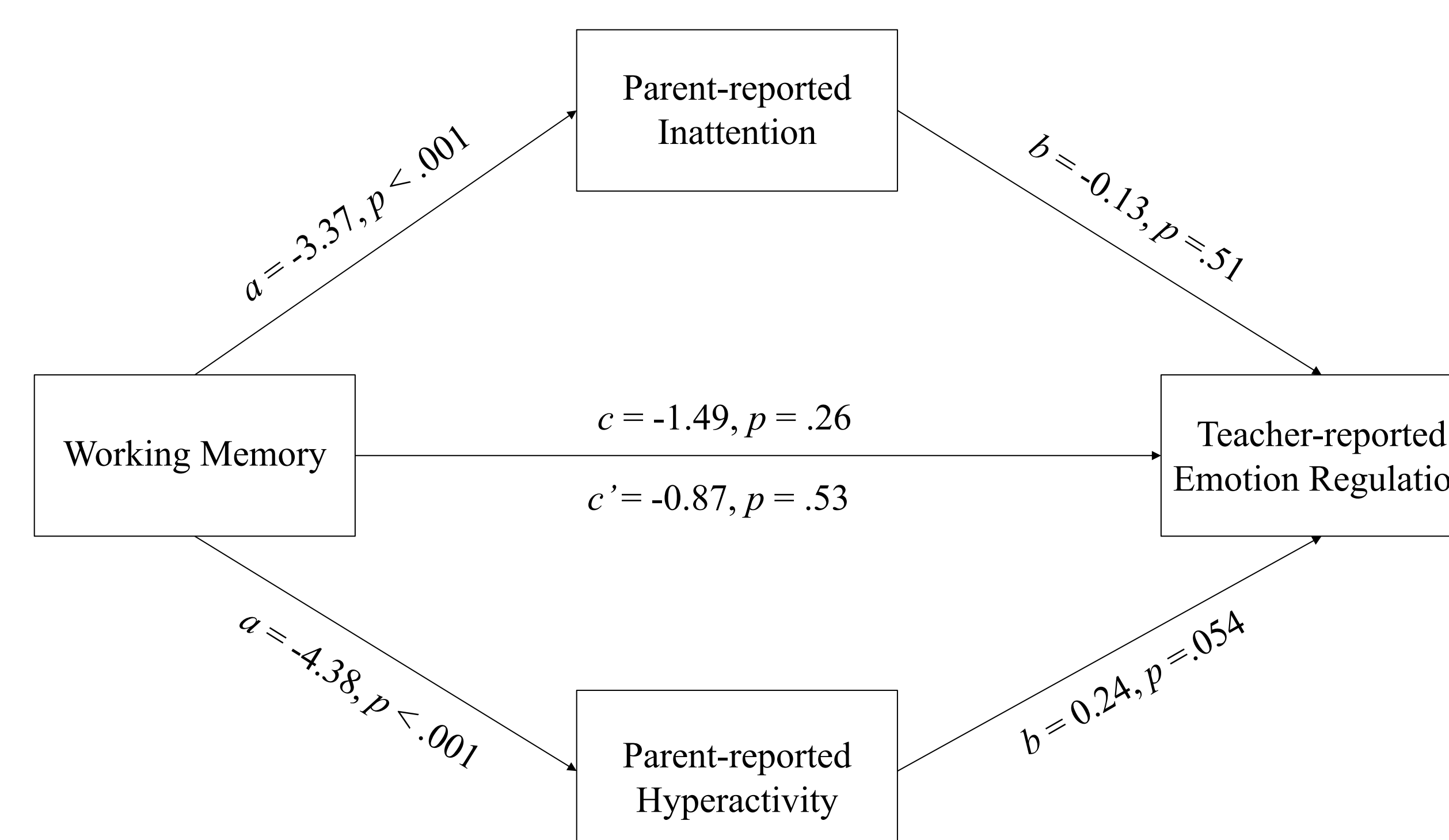
Measures

- Rappaport et al. (2009) computerized phonological and visuospatial reordering WM tasks. Used dimension reduction function of SPSS to create a single factor score (z-score) indicator of WM.
- Parent and teacher ratings from the Emotional Control subscale of the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000)
- Parent and teacher ratings form the Attention Problems and Hyperactivity subscales of the Behavior Assessment Scale for Children (BASC-2/3; Reynolds & Kamphaus, 2004, 2015)

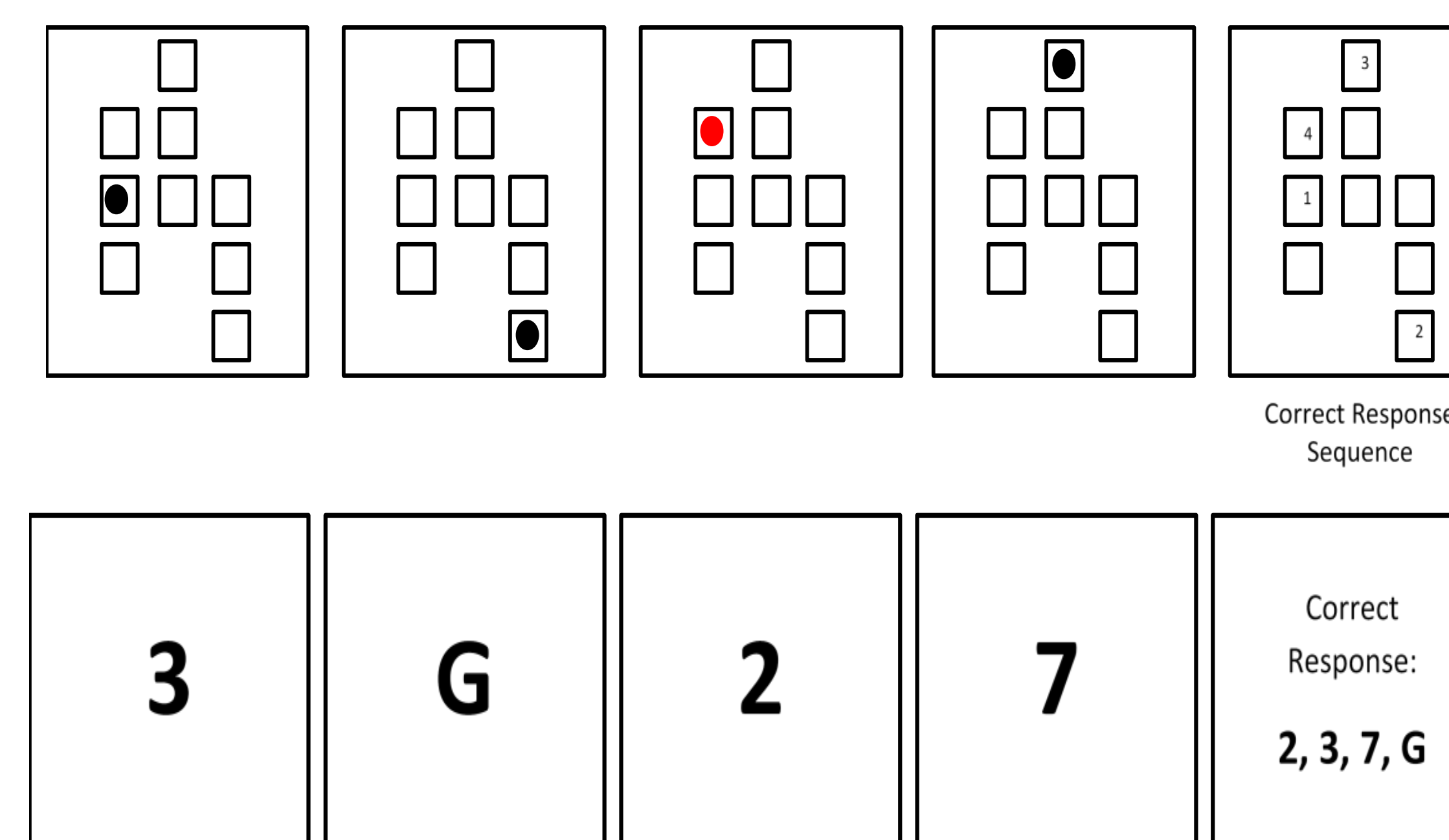
Model 1



Model 2



Working Memory Measures



Results

- Group Differences
 - The ADHD group ($M = -0.33$, $SD = 0.94$) had significantly worse WM than the control group ($M = 0.79$, $SD = 0.64$), $t(113.17) = 8.32, p < .001, d = 1.39$.
 - The ADHD group had significantly worse emotion regulation based on parent report ($M = 61.23$, $SD = 12$) than the control group ($M = 52.43$, $SD = 10.52$), $t(140) = -4.13, p < .001, d = 0.78$. The ADHD ($M = 59.5$, $SD = 15.33$) and control ($M = 56.05$, $SD = 14.87$) groups did not differ significantly on the measure of teacher-reported emotion regulation, $t(141) = -1.25, p = .22, d = 0.23$.
- Conditional Effects Models
 - There were significant indirect effects of WM on emotion regulation through hyperactive/impulsive symptoms for both Model 1 ($M_{\beta} = -0.64$, $S.E. = 0.36$, 95% CI = -1.47 to -0.05) and Model 2 ($M_{\beta} = -1.05$, $S.E. = 0.59$, 95% CI = -2.35 to -0.06).

Discussion

- In line with previous literature, the children with ADHD had poorer WM performance and more emotion dysregulation, per parent report. Surprisingly, the ADHD and control groups did not differ on teacher-reported emotion regulation.
- While these results suggest that WM does not directly predict emotion regulation, WM does indirectly affect emotion dysregulation through ADHD-related hyperactive/impulsive symptoms.
- Future research should continue to investigate potential mechanisms underlying emotion dysregulation in ADHD.