Executive Functioning Measurement: Are EF Rating Scales Ecologically and Construct Valid?

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Introduction

Executive Function (EF)

- Higher-order cognitive processing that regulates thought and behavior (Miyake et al., 2000)
  - Working Memory (WM)
  - Inhibition Control (IC)
  - Set Shifting (SS)
- Associated with academic functioning (Friedman et al., 2016)
- EF deficits may indicate behavioral ADHD phenotypes (Rapport et al., 2013)

EF Assessments

- Two forms of assessment
  - Rating Scales
  - Performance Tasks
- Recent studies indicate weak relations between EF rating scales and performance tasks (Toplak et al, 2013)
  - EF rating scales are often thought to be the more "ecologically valid" representation of EF, but often compared to traditional EF tasks criticized for poor specificity (Snyder et al., 2015)

Purpose

- To assess the construct and ecological validity of EF tasks and multi-informant ratings for predicting academic functioning measured via both tests and ratings

Participants

53 children in the eastern U.S.

- referred to an ADHD specialty clinic
  - behavioral treatment (*n* = 35)
  - cognitive training study (*n* = 15)
- 35 males, 18 females
- Ages 7-13 years old (*M* = 10.20, *SD* = 1.44)
- 42 met diagnostic criteria for ADHD based on multiple informants
  - Kiddie-Schedule for Addictive Disorders and Schizophrenia (KSADS)
  - Child Symptom Inventory - 4 (CSI – 4)
  - Behavior Assessment System for Children-2 (BASC – 2)
- 11 did not meet diagnostic criteria for ADHD
  - 4 met for a disorder other than ADHD

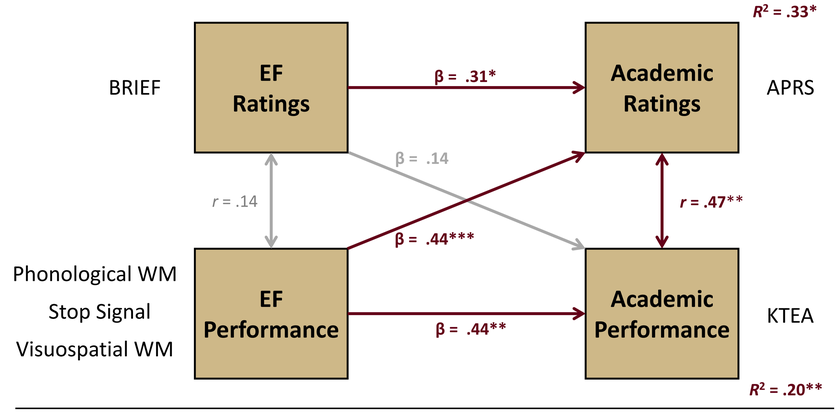
Measures

Academic

- Academic Ratings
  - ✓ *Academic Performance Rating* (APRS)
    - Completed by teacher
- Academic Performance
  - ✓ *Kaufman Test of Educational Achievement-2/3* (KTEA-2/3)
    - Comprehensive Academic Achievement/ Academic Skills Battery Composite Score
    - Completed by child

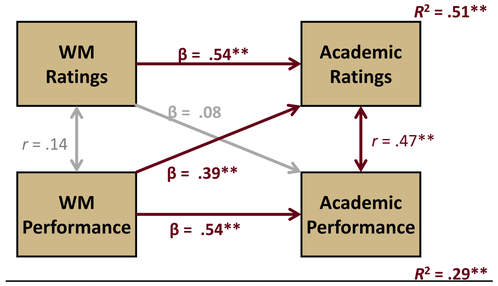
Results

Figure 1. Regression models between executive function assessments and academic measures.



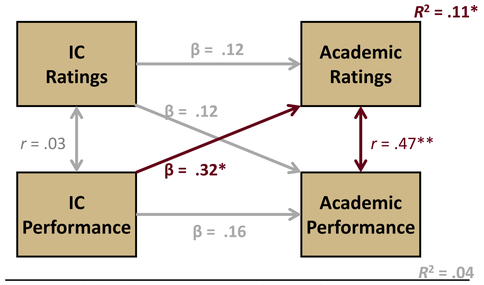
Note. Academic Ratings and Academic Performance ran as separate models
Significant path shown in **bold**.
*p < .05 **p < .01 ***p < .0005

Figure 2. Regression models between WM assessments and Academic assessment.



Note. DV's (Academic Ratings and Performance) ran as separate models
Significant path shown in **bold**.
*p < .05 **p < .0005

Figure 3. Regression models between IC assessments and Academic assessment.

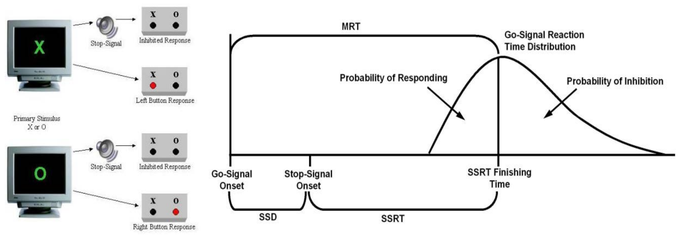


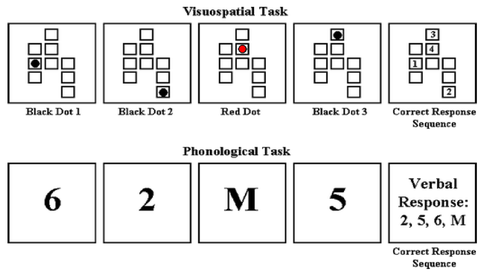
Note. DV's (Academic Ratings and Performance) ran as separate models
Significant path shown in **bold**.
*p < .05 **p < .0005

Measures

Executive Function

- EF Ratings
  - ✓ *Behavior Rating Inventory of Executive Function* (BRIEF)
    - Global Executive Composite, Working Memory Subscale, Inhibit Subscale
    - Completed by parent and teacher
  - EF Rating Scales composite score calculated using averaged Z-scores across raters
- EF Performance
  - ✓ *Rapport Phonological Working Memory Test* (24 trials, set sizes 3-6)
    - Child Phonological WM
    - Measured in stimuli correct per trial for each set
  - ✓ *Rapport Visuospatial Working Memory Test* (24 trials, set sizes 3-6)
    - Child Visuospatial WM
    - Measured in stimuli correct per trial for each set
  - ✓ *Stop Signal* (4 blocks of 32 trials each)
    - Child IC
  - EF Performance Test composite score computed by averaged z-scores for all performance tests





Results

Table 1. Descriptive statistics (*N* = 53).

Variables	*M*	*SD*
BRIEF GEC score (T-score)		
Parent	67.21	14.75
Teacher	66.68	14.33
Inhibitory Control (ms)		
Stop-signal delay (SSD)	267.69	62.03
Working Memory (stimuli correct/trial)		
PH	3.21	0.73
VS	2.57	0.84
Academic Achievement (standard score)		
KTEA-2/3 Academic Skills Battery	106.94	15.74
Academic Functioning (T-score)		
APRS Total	46.58	8.43

Discussion

EF Measures

- EF, WM, and IC Ratings variables were not significantly correlated with their corresponding Performance variables

EF Measures and Academic Measures

- Both EF and WM Performance variables uniquely predicted both Academic Performance and Academic Ratings
- Both EF and WM Rating variables failed to predict Academic Performance but predicted Academic Ratings
- IC Performance variables only uniquely predict Academic Ratings but not Academic Performance

Conclusions

Implications

- In a clinic-referred sample, replicates developmental evidence regarding importance of executive functions for children's academic attainment
- Contradicts previous claims regarding superior ecological validity of EF ratings over lab-based EF performance tasks
- Suggests concurrent validity of EF ratings for predicting academic outcomes may be limited to mono-informant, mono-method bias

Limitations

- Small but rigorously characterized clinical sample
- No measurement of set shifting