



Executive functions for reading and writing in typical literacy development and dyslexia

Leah E. Altemeier, Robot D. Abbott, and Virginia W. Berninger (2008)
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Presented by: Min Ji Kang



Introduction

Experiment 1

Investigate the development of executive functioning and its contribution to literacy outcomes for typically developing readers and writers

Hierarchical linear modeling (HLM)
Multiple Regression

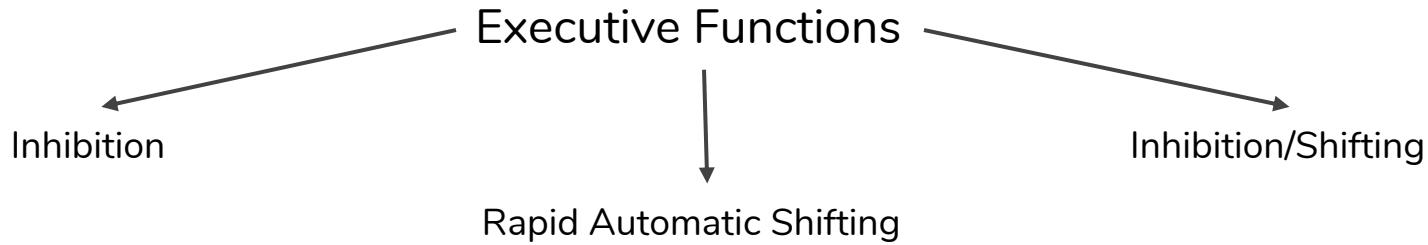
Experiment 2

Investigate the differences of the development of executive functions in children with and without dyslexia

Multiple Regression
Mean level of performance



Definitions

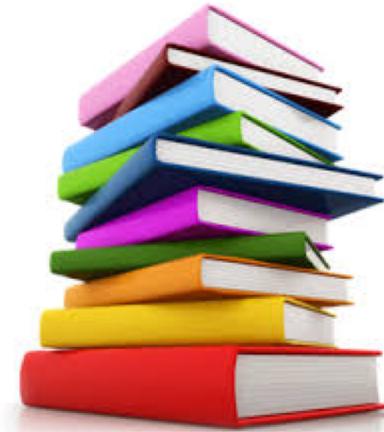


Literacy

Dyslexia
: reading and spelling disorder

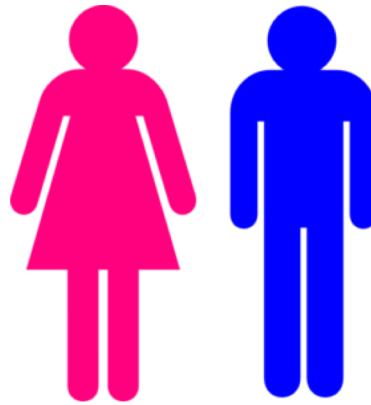
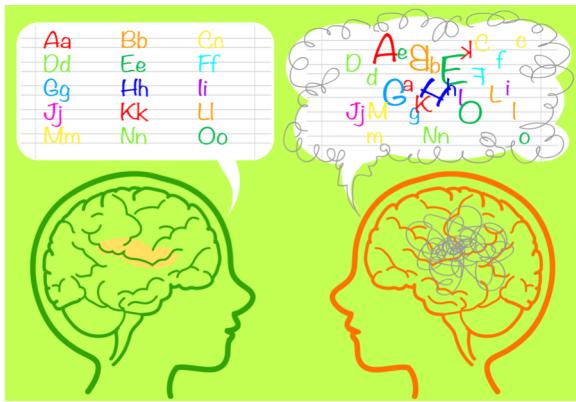


Hypotheses: Experiment 1





Hypotheses: Experiment 2





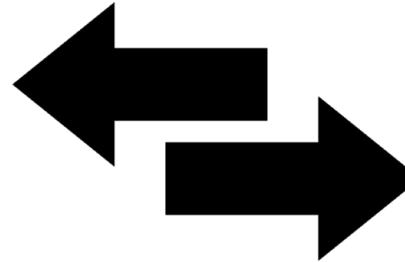
Methods: Experiment 1



- Self-reported ethnicity and parents' level of education
- Color-Word Interference Test
- Rapid Automatic Naming of Words and Letters Subtest (PAL RAS)
- Word Reading and Pseudoword Decoding Subtest
- Sight Word Reading Efficiency and Phonemic Decoding Efficiency Subtests (TOWRE)
- Reading Comprehension and Spelling Subtest
- Written Expression Performance



Methods: Experiment 2



- Word Identification and Word Attack Subtest
- Woodcock-Johnson Revised Passage Comprehension Subtest
- Wolf-Rapid Automatic Switching (Wolf-RAS)

Results: Hypothesis 1

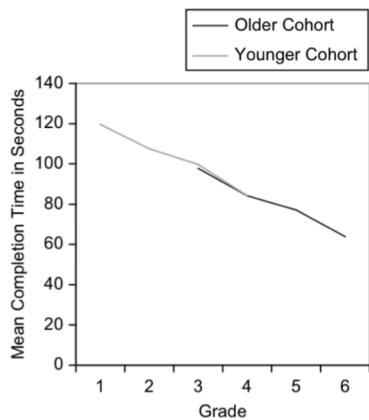


Figure 1. Trajectory of Delis–Kaplan Executive Function System (D-KEFS) Inhibition in typically developing readers and writers.

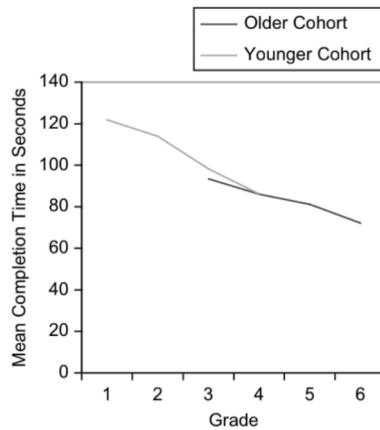


Figure 2. Trajectory of Delis–Kaplan Executive Function System (D-KEFS) Inhibition/Switching in typically developing readers and writers.

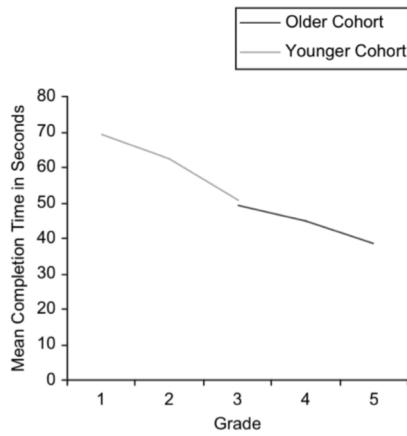


Figure 3. Trajectory of Process Assessment of the Learner, Rapid Automatic Switching (PAL RAS) in typically developing readers and writers.

Results: Hypothesis 2

TABLE 3
Comparing three models of executive functions in uniquely predicting concurrent literacy outcomes

Grade	Model	WIAT2		TOWRE		GORT3		WIAT2		
		Word reading	Pseudoword decoding	Word reading efficiency	Phonemic decoding efficiency	Accuracy	Rate	Reading comprehension	Spelling	Written expression
1	1	Inhib	Inhib	Inhib	Inhib	na	na	Inhib	Inhib	Inhib
	2	RAS	RAS	RAS	RAS	na	na		RAS	Inhib
	3	RAS I/S	RAS	RAS	RAS I/S	na	na	I/S	RAS	
2	1	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib
	2	RAS	RAS	Inhib RAS	RAS	Inhib RAS	Inhib RAS	RAS	RAS	RAS
	3	RAS	RAS	RAS	RAS	RAS	RAS	RAS	RAS	RAS
3	1	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib
	2	Inhib RAS	Inhib RAS	Inhib RAS	Inhib RAS	Inhib RAS	Inhib RAS	RAS	Inhib RAS	Inhib RAS
	3	RAS	RAS	Inhib RAS	Inhib RAS	RAS I/S	Inhib RAS I/S	RAS	RAS	Inhib RAS I/S
4	1	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib
	2	RAS	RAS	Inhib RAS	Inhib RAS	Inhib RAS	RAS	Inhib (RAS)	Inhib RAS	Inhib RAS
	3	RAS	RAS	RAS	RAS	Inhib RAS	RAS		RAS	Inhib RAS
5	1	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib
	2	RAS	RAS	RAS	RAS	RAS	RAS	RAS	RAS	
	3	RAS	RAS	RAS	RAS	RAS	RAS		RAS	

Note. Model 1: Inhibition (Inhib) only. Model 2: Inhibition +RAS. Model 3: Inhibition+RAS+Inhibition/Switching[I/S]. RAS=Rapid Automatic Switching. Significant predictors in each model for each literacy outcome listed in table. Scores that approached statistical significance have been included and are in parentheses.

Results: Hypothesis 3

TABLE 4
Predicting Grade 4 literacy outcomes from slope of executive functions in Grades 1–4

		R^2	B	SE	β	t	p
Slope of D-KEFS Inhibition predictor	TOWRE Phonemic Decoding Efficiency	.11	2.96	0.80	.32	3.69	.001
	TOWRE Word Reading Efficiency	.06	2.13	0.82	.23	2.60	.011
	WIAT-II Pseudoword Decoding	.05	1.48	0.60	.23	2.49	.014
	WIAT-II Word Reading	.07	1.90	0.63	.27	3.01	.003
	WIAT-II Spelling	.08	2.71	0.83	.29	3.26	.001
	WIAT-II Written Expression	.03	1.62	0.93	.16	1.75	.084
Slope of PAL RAS predictor	TOWRE Phonemic Decoding Efficiency	.43	1.29	0.14	.66	9.32	.001
	TOWRE Word Reading Efficiency	.27	1.01	0.16	.52	6.50	.001
	WIAT-II Pseudoword Decoding	.26	0.71	0.11	.51	6.36	.001
	WIAT-II Word Reading	.26	0.77	0.12	.51	6.40	.001
	WIAT-II Spelling	.27	1.04	0.16	.52	6.62	.001
	WIAT-II Written Expression	.21	0.97	0.18	.46	5.52	.001
Slope of D-KEFS Inhibition/Switching predictor	TOWRE Phonemic Decoding Efficiency	.12	1.57	0.39	.35	4.01	.001
	TOWRE Word Reading Efficiency	.05	0.97	0.41	.22	2.39	.018
	WIAT-II Pseudoword Decoding	.05	0.75	0.29	.23	2.56	.012
	WIAT-II Word Reading	.09	1.01	0.31	.29	3.29	.001
	WIAT-II Spelling	.05	1.02	0.42	.22	2.46	.015
	WIAT-II Written Expression	.06	1.16	0.45	.24	2.60	.011

Note. TOWRE=Test of Word Reading Efficiency. WIAT-II=Wechsler Individual Achievement Test–Second Edition.

Results: Experiment 2

TABLE 5

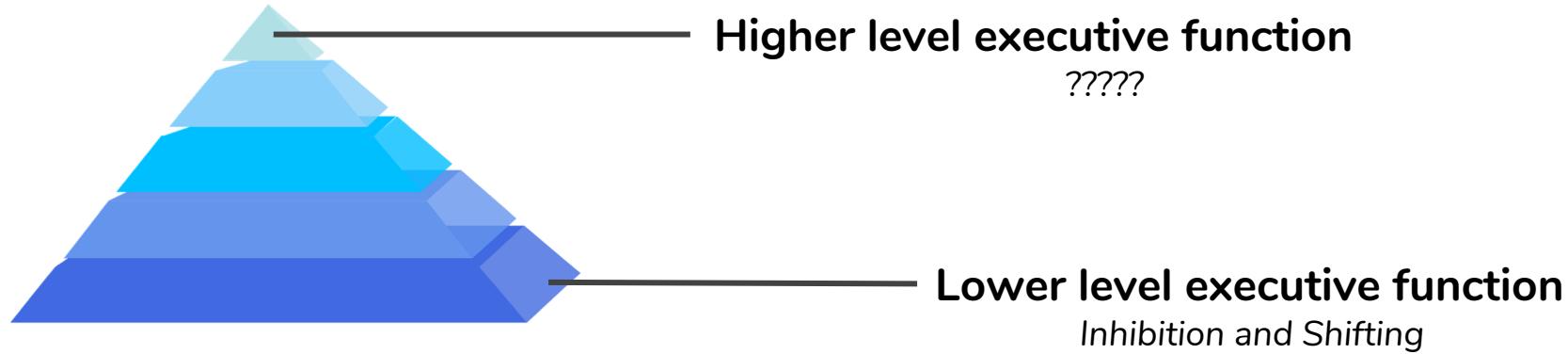
Summary of executive functions that significantly predicted literacy outcomes for children with dyslexia and typically developing readers and writers

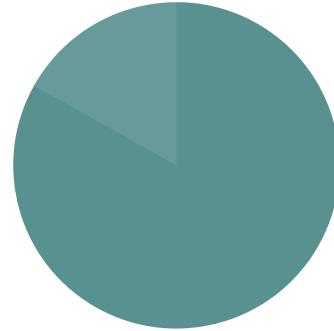
Model	WIAT2 Word Reading	WIAT2 Pseudo- word Decoding	TOWRE Word Reading Efficiency	TOWRE Phonemic Decoding Efficiency	GORT Accuracy	GORT Rate	WIAT2 Reading Comprehension	WIAT2 Spelling	WIAT2 Written Expression
			Inhib	Inhib	Inhib	Inhib		Inhib	Inhib
Children with dyslexia	1		RAS	(Inhib) RAS	RAS	RAS	(Inhib) RAS	RAS	RAS
	2	RAS	RAS	(Inhib) RAS	RAS	RAS	(Inhib) RAS	RAS	RAS
	3	(Inhib) RAS	RAS	(Inhib) RAS	RAS	RAS	(Inhib) RAS	RAS	RAS
Typically developing readers and writers	1	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib	Inhib
	2	RAS	RAS	RAS	(Inhib) RAS	RAS	RAS	RAS	(Inhib)
	3	RAS	RAS	RAS	RAS	RAS	RAS	(I/S)	RAS

Note. Scores that approached statistical significance have been included and are in parentheses. TOWRE=Test of Word Reading Efficiency. WIAT2=Wechsler Individual Achievement Test–Second Edition. GORT=Gray Oral Reading Test, Third Edition. RAS=Rapid Automatic Switching.



Future Direction





Thank you