



Early Cognitive Predictors of Academic Skills in Grades 1 to 3

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Introduction

- There is no strict cut off between typical and atypical language, reading, and math learning.
- Cognitive predictors reported to be important in school learning.^{1,2}
 - vocabulary, sentence recall
 - phonological awareness, letter-sound identification, rapid naming
 - number comparison, number line estimation, addition/subtraction
- There is considerable overlap in the cognitive predictors associated with learning in different academic domains.^{3,4}
- Studying learning profiles and predictors across a wide range of skills might provide a more robust estimate of these complex relationships.
- Investigating cognitive predictors related to a range of academic skills might identify key factors supporting learning generally and specifically.
- Understanding important cognitive predictors of later school learning has the potential to inform early interventions.

Research Question

What cognitive skills best predict learning outcomes in language, reading, and math across grades 1 to 3, and are these relationships stable?

Methods

Phase I: Kindergarten Screening

Participants: 610 kindergarten children

Standardized Measures:

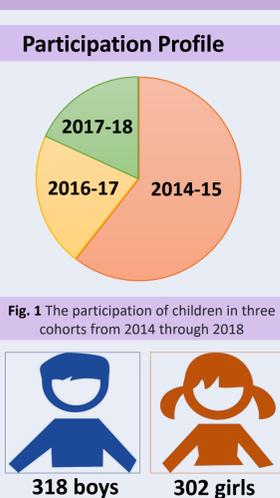
- Measures of vocabulary, sentence recall, phonological awareness, letter-sound naming, number naming, rapid automatic naming, magnitude comparison, number line estimation, addition and subtraction in a single 20-minute assessment.

Phase II: Follow up Grades at Grade 1, 2 & 3

Participants: 359 of original Phase 1 participants.

Measures:

- Academic grades for oral language, reading, math (all participants).



Results

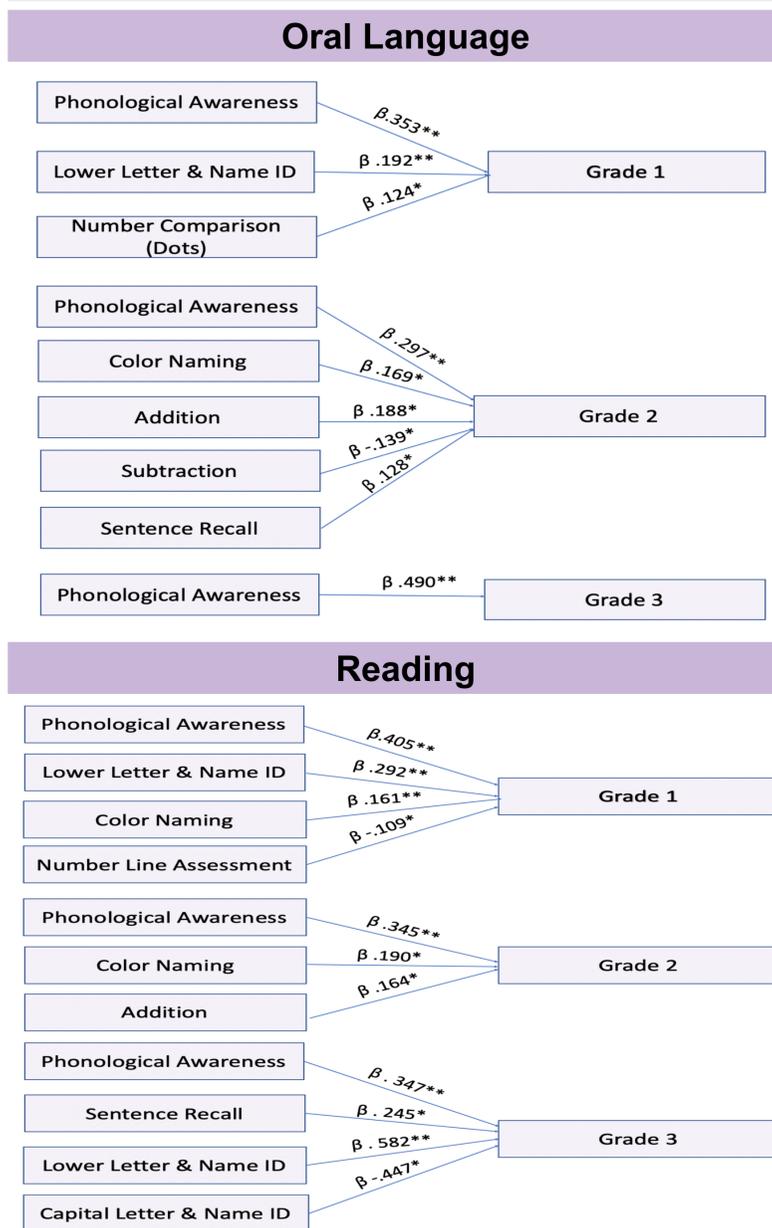
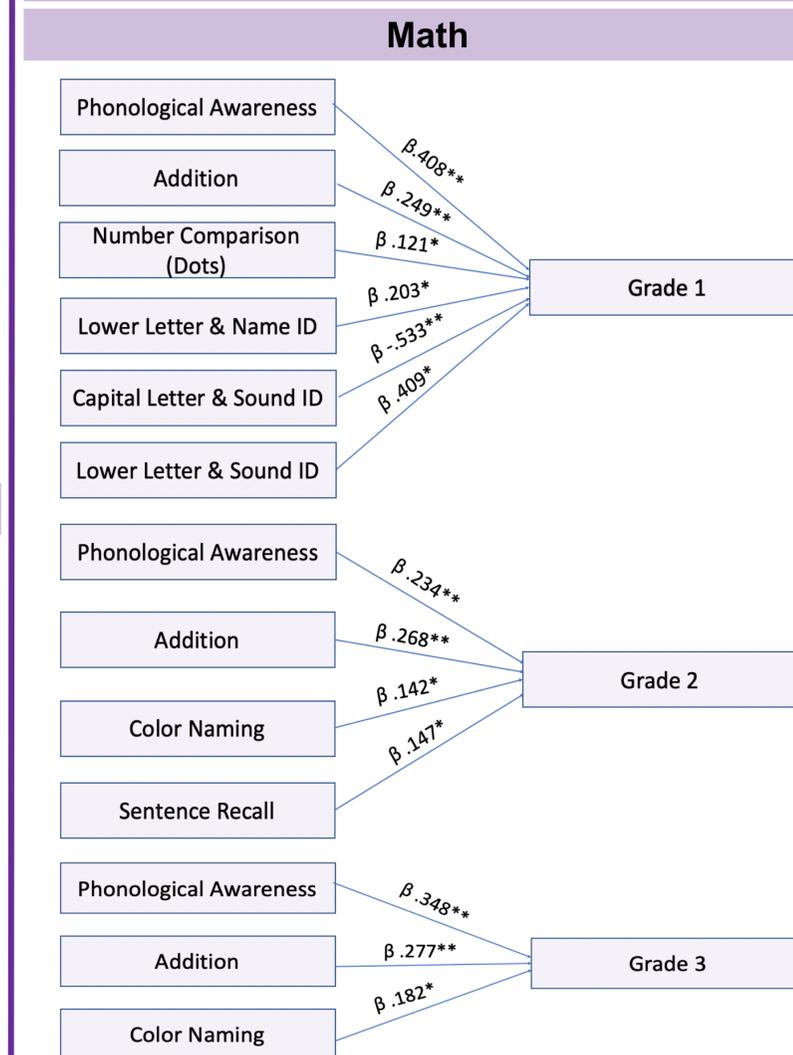


Fig. 2: Diagrams of cognitive predictors predicting learning outcomes for Oral Language, Reading, and Math grades in grade 1, 2 & 3 for Kindergarten children.
* $p < .01$, ** $p < .001$

Analysis

Stepwise multiple regression was conducted using SPSS 25.0.



References

- 1 Archibald, L., Cardy, J., Ansari, D., Olino, T., & Joanisse, M. (2019). The consistency and cognitive predictors of children's oral language, reading, and math learning profiles. *Learning and Individual Differences*, 70, 130-141.
- 2 DeSmedt, B., Taylor, J., Archibald, L., & Ansari, D. (2010). How is phonological processing related to individual differences in children's arithmetic skills?. *Developmental science*, 13(3), 508-520.
- 3 Peterson, R., Boada, R., McGrath, L., Willcutt, E., Olson, R., & Pennington, B. (2017). Cognitive prediction of reading, math, and attention: Shared and unique influences. *Journal of learning disabilities*, 50(4), 408-421.
- 4 Archibald, L., Cardy, J., Joanisse, M., & Ansari, D. (2013). Language, reading, and math learning profiles in an epidemiological sample of school age children. *Plos One*, 8(10), e77463.

Summary of the Results

- Both consistent and varying pattern in relationships between cognitive predictors and academic outcomes
 - **Phonological Awareness** predicted later grades in all areas and had the strongest effect across all measures.
 - **Letter naming & Sound ID** were important predictors of Grade 1 grades.
 - **Color Naming** predicted gr. 1&2 but not gr. 3 grades.
 - **Addition & Subtraction** predicted gr. 2 grades.