Knowledge of Math-Specific Language and Fraction Mapping

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Introduction

Background

- Students struggle with fractions and these difficulties can persist into high school.
- Representing fraction quantities is a building block for fraction skills.
- Language is a known predictor of fraction skills (Vukovic et al., 2014)
- The goal of this study was to examine the link between math-specific language (i.e. math vocabulary and mathematical orthography) and early fraction knowledge.

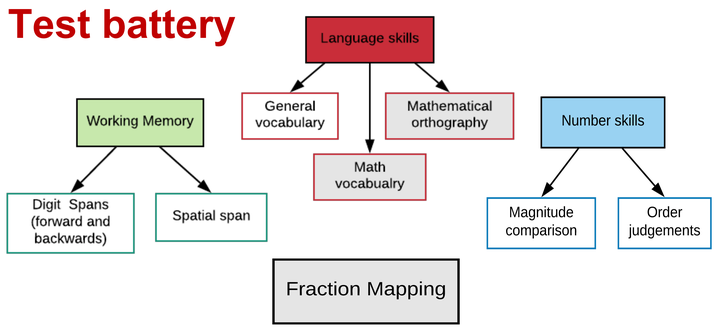
Research Questions

1. Will math-specific language skills uniquely predict performance on a fraction mapping task?
2. Will math-specific language skills will account for the relation between general vocabulary and fraction mapping?
3. Will the relation between math language and fraction mapping change as children's skills develop?

Method

Participants: 131 children in grades 4 (n=65) and 6 (n=66)

Test battery



Novel Measures

Math-Specific Language Skills

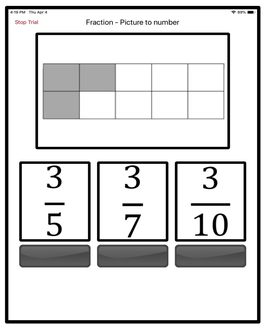
Mathematical Orthography-Symbol decision task (SDT)
Children judge the conventionality of mathematical symbols in this modified lexical decision task. (60 trials, Cronbach's α = 0.71)

Math Vocabulary
Children choose the image that best represents target math word. Words cover a range of concepts. (40 trials, Cronbach's α = 0.89)

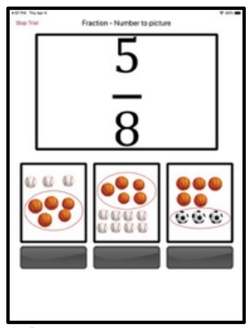
Screen shot of SDT iPad app

Stimuli for target word "dime"

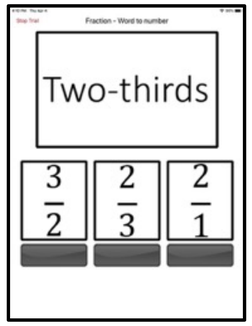
Fraction Mapping Task



Area representation



Set representation



word-to-number mapping

Children match fraction pictures, numbers and words.

4 mapping formats: word-to-number, word-to-image, number-to-image and image-to-number. Order of mapping formats randomized.

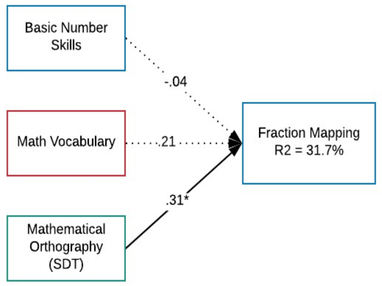
10 trials for each format randomly presented within the mapping format.

Set and area representations balanced (40 trials, Cronbach's α = 0.88)

Results

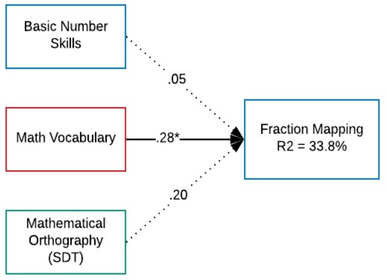
Linear regressions predicting performance on the fraction mapping task

Grade 4 (N= 65)



Indirect effect of math orthography on fraction mapping through PPVT ; β =0.07 [.01, .10]

Grade 6 (N= 66)



Indirect effect of math vocabulary on fraction mapping through PPVT ; β =0.12 [.02, .30]

- Control variables working memory and general vocabulary (PPVT)
- Math vocabulary fully mediated the PPVT/fraction mapping relation in Grade 6 students

Discussion

1. General vocabulary skills were correlated with fraction mapping performance, however, these correlations were partially mediated by orthography in grade 4 and fully mediated by math vocabulary in grade 6.
2. Knowledge of orthography was more strongly related to mapping skills in novice learners (grade 4); whereas math vocabulary was more strongly related to mapping skills in more experienced learners (grade 6).

Math-specific language skills are implicated in children's understanding of how fractions are represented. Based on these findings, we suggest instruction in math vocabulary and mathematical orthography may support fraction learning.

Acknowledgments

A special thanks to the *math cognition lab research team*: Brianna Herdman, Sanda Oancea, Emilie Roy, Jill Turner, Renee Whittaker,

Carleton UNIVERSITY
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
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