The Role of Language in Math Problem Solving for Immersion and Non-Immersion Students

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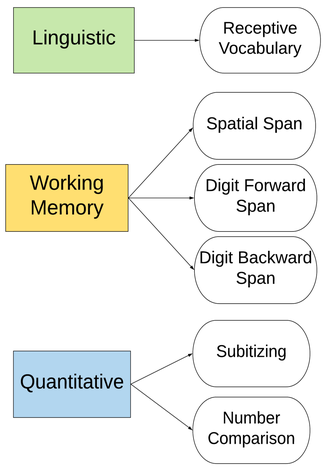
Introduction

- The *Pathways Model* suggests that there are three pathways the contribute to Children's symbolic number skills, linguistic ability, quantitative skills and working memory (LeFevre et al., 2010).
- Further, children's math-specific vocabulary mediates the relationship between their mathematical abilities and language abilities (Purpura et al., 2017).
- Educators are concerned that children learning math in immersion programs may be disadvantaged because they are learning math in their second language.
- **Research question**: Do the **pathways to math word problem solving differ** for children enrolled in **immersion programs** (i.e., learning math a second language – French) compared to children enrolled in **non-immersion programs** (i.e., learning math in their first language – English)?

Method

- **Participants:** Grade 2, no performance differences between groups
- **108 French Immersion**
  - Completed tasks in English and French
  - three 25-minute sessions.
  - M_{age}= 7y:9m
- **74 Non-Immersion**
  - Completed all of the tasks in English
  - two 25-minute sessions.
  - M_{age}= 7 y:8m

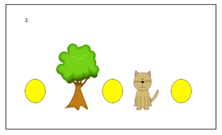
Cognitive Predictors



Math Outcomes

Math Vocabulary

Problem Solving

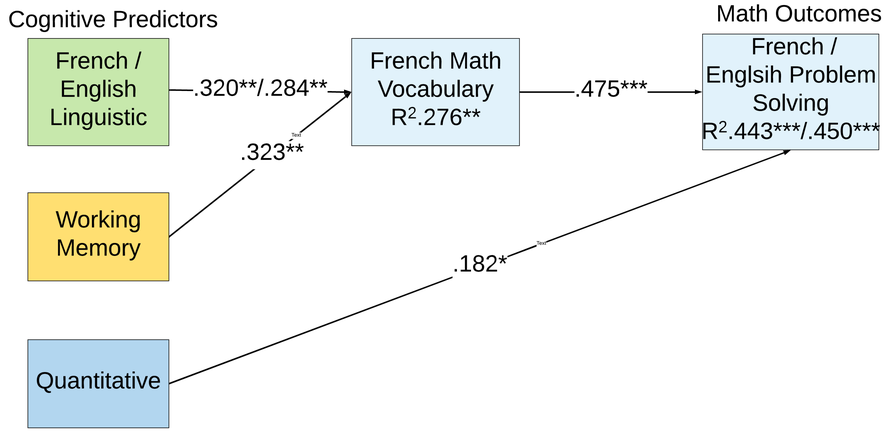


*Point to the dot that is **between** the cat and the tree*

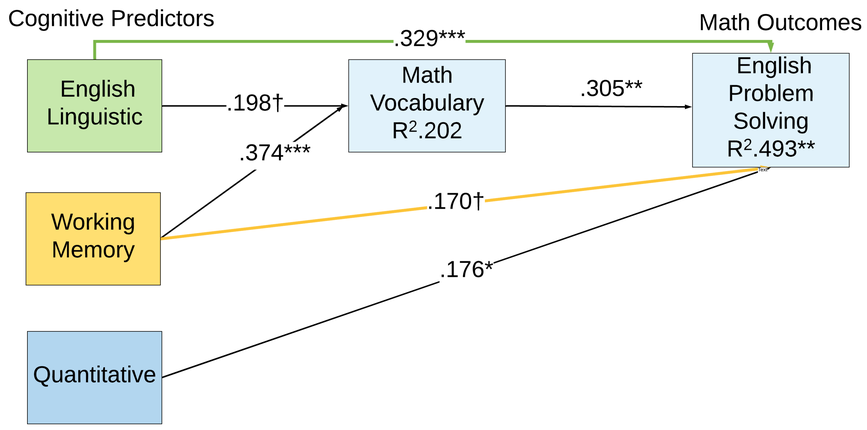
Results

Multiple Regression Analyses

Immersion



Non-Immersion



Note: Gender and mother's education were controlled for in the models

Discussion

Math Vocabulary

- The math vocabulary task assesses students' knowledge of mathematical and spatial terms (e.g., less than, tens column).
- For both **immersion and non-immersion students**, working memory and linguistic skill uniquely predicted math vocabulary

Problem Solving

- To problem solve a child must understand the overall content of the question and the mathematical operations they will need to use
- Math vocabulary directly predicts problem solving for both **immersion and non-immersion students**, which is consistent with Powell et al., 2017. For immersion students, it mediates the vocabulary problem solving relationship.
- **For non-immersion students,** there is an additional direct pathway from general linguistic to math problem-solving. In contrast, **for immersion students**, math vocabulary fully mediated the relationship between general linguistic and math problem-solving.
- Thus **for non-immersion students,** their prior knowledge of English may contribute to equal proficiency in both general linguistic skill and math vocabulary. **Immersion students** may not have prior knowledge of French, thus regardless of general linguistic skill, their knowledge of math vocabulary in the instructional language is predictive of their success in math problem-solving.
- A **limitation** to this study is this that French Immersion students knowledge of English Math Vocabulary was not collected. This is being addressed in the second year of testing.

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