Mathematics Performance of At-Risk First Graders with Limited English Proficiency

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Introduction

- A link between oral language abilities and mathematical development is well established, not only in the development of word-problem (WP) solving, but also in calculation (CA) skill.
- Many students struggle to make sense of numerals and symbols, as well as building a problem model from text.
- English Learners (ELs) face additional obstacles:
  - Conventions of the English language
  - Unfamiliar math vocabulary
  - Language structure of math WPs
- Important to distinguish between risk for math difficulty (MD) and second language learning challenges for proper early intervention.

Purpose

- To explore the interaction between students’ limited English proficiency (LEP) status and mathematical risk status on CA and WP solving ability.
- To provide insight into how the achievement gap between LEP students and native English-speaking students emerges during first grade.

Participants

- Southeastern metropolitan school district
- 1st grade
- 260 students, 118 classrooms, 25 schools
- No significant difference between at-risk (AR) and not at-risk (NAR) groups on race, gender, or socio-economic status.

Screening Measures

First-Grade Test of Computational Fluency: 25 items sampling the typical first-grade computation curriculum: adding and subtracting single-digit numbers, adding three single-digits, adding numbers without regrouping, and subtracting a 1-digit number from 2-digit number.

First-Grade Test of Mathematics Concepts and Applications: 25 items sampling the typical first-grade concepts/applications curriculum (i.e., numeral, concepts, geometry, measurement, applied computation, money, charts/graphs, word problems).

Wechsler Abbreviated Scale of Intelligence: WASI-Vocabulary & WASI-Matrix Reasoning

Calculation Performance

Test of Arithmetic Fluency: 25 addition problems with answers from 0 to 18, presented vertically on one page and 25 subtraction fact problems with answers from 0 to 18, presented vertically on one page.

Word-Problem Performance

Story Problems: 14 story problems involving sums or minuends of 9 or less, with change, combine, compare, and equalize relationships.

First-Grade Vanderbilt Story Problems: 18 problems sampling combine, compare, and change word-problem types.

Measures

Fall Grade 1 Measures

CA: Test of Arithmetic Fluency
WP: Story Problems

Spring Grade 1 Measures

CA: Test of Arithmetic Fluency
WP: First-Grade Vanderbilt Story Problems

Results

- Anticipated a main effect for risk status on CA and WP solving because students had been designated as AR for mathematics disability based on performance on screening measures.
- No main effect for LEP status on Fall CA; however, a main effect developed by spring.
- Interaction effect between LEP status and risk status on Fall WP solving
- Post-hoc analysis found a significant difference between NAR LEP and native-English speaking students, but no significant between AR LEP and native-English speaking students.

Method

- Results show the impact of LEP status on the development of early computation skills as well as an interaction between LEP status and risk status on word-problem solving skills.
- The emerging achievement gap between ELs and native English speakers suggests English language proficiency is a factor in CA skill development.
- In WP, the differing ES patterns could be attributed to academic language, with NAR students having stronger academic vocabulary and understanding than their AR peers.
- Future research should explore relationships between ELs math achievement and:
  - Performance on language placement assessments
  - Hours of language services per week
  - Generational status—first or second generation English Language Learner

Discussion

For Further Information

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