Preschool numeracy skills are most predictive of later math achievement

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1. Introduction
Research indicates that success in early math is the strongest enabler and predictor of later academic success.

Understanding which early math skills are most beneficial for later school outcomes has important policy implications, particularly low-income children and children in urban schools who are at risk for underachievement in mathematics.

Using longitudinal data from a low-income sample of preschoolers, we investigate what specific preschool mathematical competencies predict math achievement over the course of the elementary school years.

2. Methods
2A. DATA
Longitudinal data from the Building Blocks mathematics intervention for children in 43 low-resource schools (n=1375)

Used a subsample of children (n=781) who had valid mathematics achievement score data in pre-kindergarten and fifth grade

This subsample includes:
- 83% who qualified for free or reduced price lunch
- 45% male
- 53% African American
- 22% White
- 18% Hispanic

2B. MEASURES
Math achievement - Research-based Early Mathematics Assessment (preschool, K, 1st grades) and Tools for Early Assessment in Math (4th and 5th grades)

Preschool mathematical competencies - 4 skill measures based on the Massachusetts state-defined preschool math standards:
- Measurement and data
- Geometry
- Operations and algebraic thinking
- Counting and cardinality

Additional covariates - Prior math achievement (measured in the fall of preschool), preschool classroom fixed effects, individual child characteristics (gender, ethnicity, birthweight, age at first test, special education, English learner, free and reduced price lunch), and mother’s level of education

3. Results & Implications
Counting and cardinality, operations and algebraic thinking, and geometry are consistently predictive of later math achievement.

Measurement and data was the only skill category that lacked consistent predictive power across time points.

These findings lend support to developing effective math curricula that focus on precursory skills that empirical research has found to be most important for later mathematics achievement.

Results also suggest a need for a greater emphasis on mathematics than is currently the case in many preschool classrooms.

4. Limitations & Future Directions
We examined the non-experimental association between early math skills and later math achievement, so our data are subject to omitted variable bias.

Our data also lack measures of cognitive skills and detailed family characteristics that may be correlated with our key variables.

Analyses investigating whether preschool math skills might matter more for disadvantaged students using a second dataset are underway.

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