



Bidirectional relations between preschooler's executive functions and math skills

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Abstract

Executive functions refer to cognitively-based abilities including short-term and working memory, attention, and behavior shifting (Diamond, 2013), which play a significant role in children's development and impact children's academic outcomes (Blair, 2007). Numerous studies show that children's executive functions are related to their math skills (Bull & Scerif, 2001). Evidence also indicates that preschoolers having higher levels of executive functions have better performance on math tasks (Willoughby, Kupersmidt & Voegler-Lee, 2012). However, the **bi-directionality** between children's executive functions and math skills has received limited exploration. This study used a longitudinal panel sample of 57 children (including 25 boys and 32 girls) who participated in the Lincoln Educare Program. Our final cross-lagged structural equation model shows that children's earlier math skills at wave 1 were positively related to their later math skills and executive function, both measured at wave 2. Implications of these findings for program interventions are discussed.

Research Questions

Study questions

- Do preschoolers' executive function (EF) scores predict their math scores?
- Do preschoolers' math scores predict their EF scores?

Hypotheses

- Preschoolers who have higher levels of EF will have higher math scores.
- Preschoolers who have higher math scores will have higher EF scores.

Lincoln Educare

Educare Lincoln is the third Educare school built in Nebraska. The program provides high quality childcare and education for children and their families with limited resources. They aim to help children from six weeks to five years achieve success in school.



Methods

Participants: 57 children (including 25 boys and 32 girls) who participated in Lincoln Educare Program from low-income families (Age Mean = 40 months)

Measures:

Preschooler's Woodcock-Johnson IV (Applied Problems): Applied Problems is one of the 20 tests which includes 56 questions. One properly trained and knowledgeable examiner assess children individually. Based on the child's age, the examiner selects the starting points. Basal: 5 lowest –numbered items administered are correct. Ceiling: 5 highest-numbered items administered are incorrect.

Procedures: This study used secondary data from Lincoln Educare evaluation from data collected individually from children Spring 2017 and Fall 2017 by trained data collectors.

Minnesota Executive Function Scale: MEFS is an objectively and reliably measure used to assess children's (up age 2) Executive Function skills. One properly trained and knowledgeable examiner uses the MEFS app to assess children individually. Based on the child's age, the system automatically select the starting level for the child.

Findings

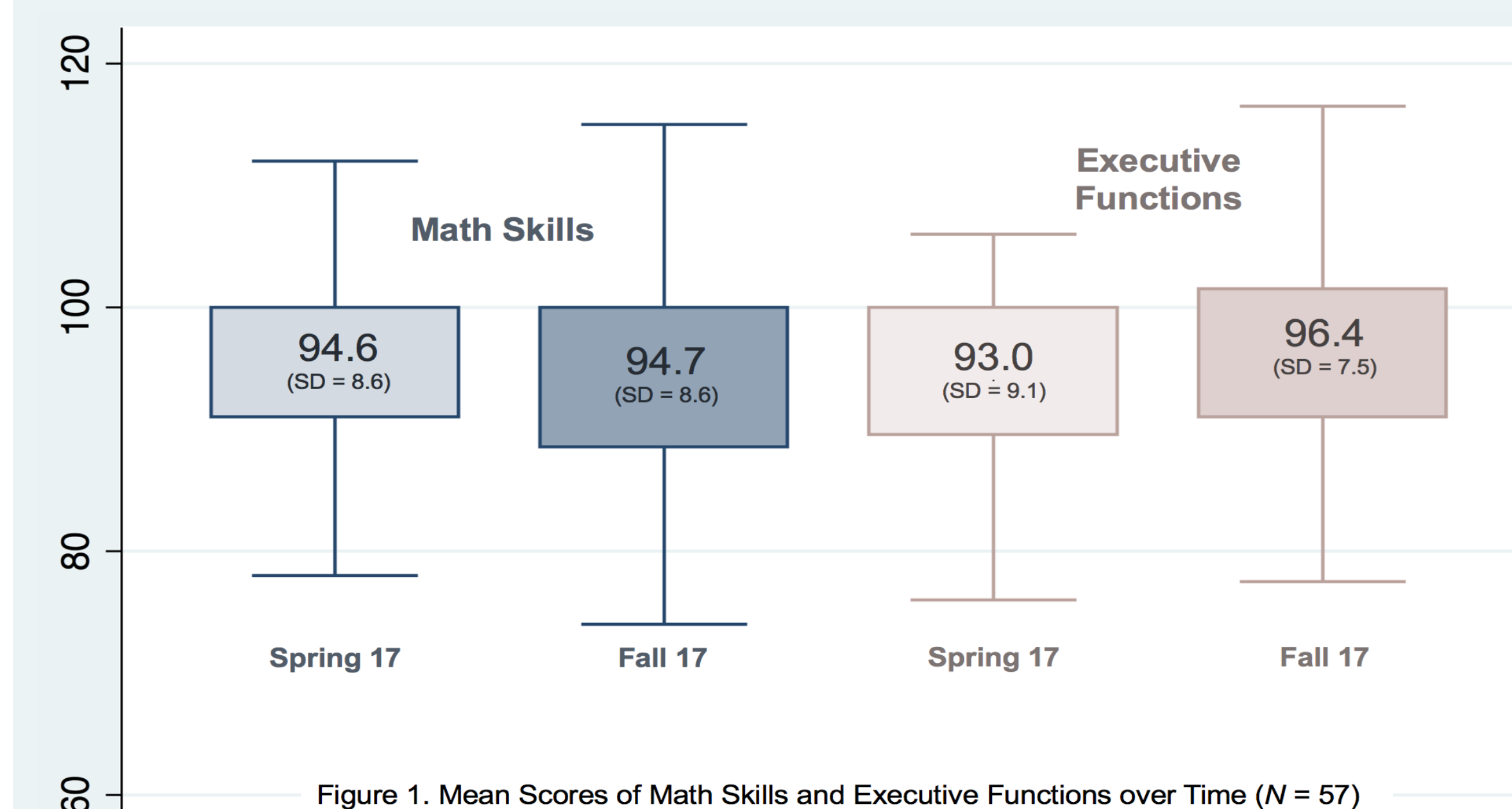
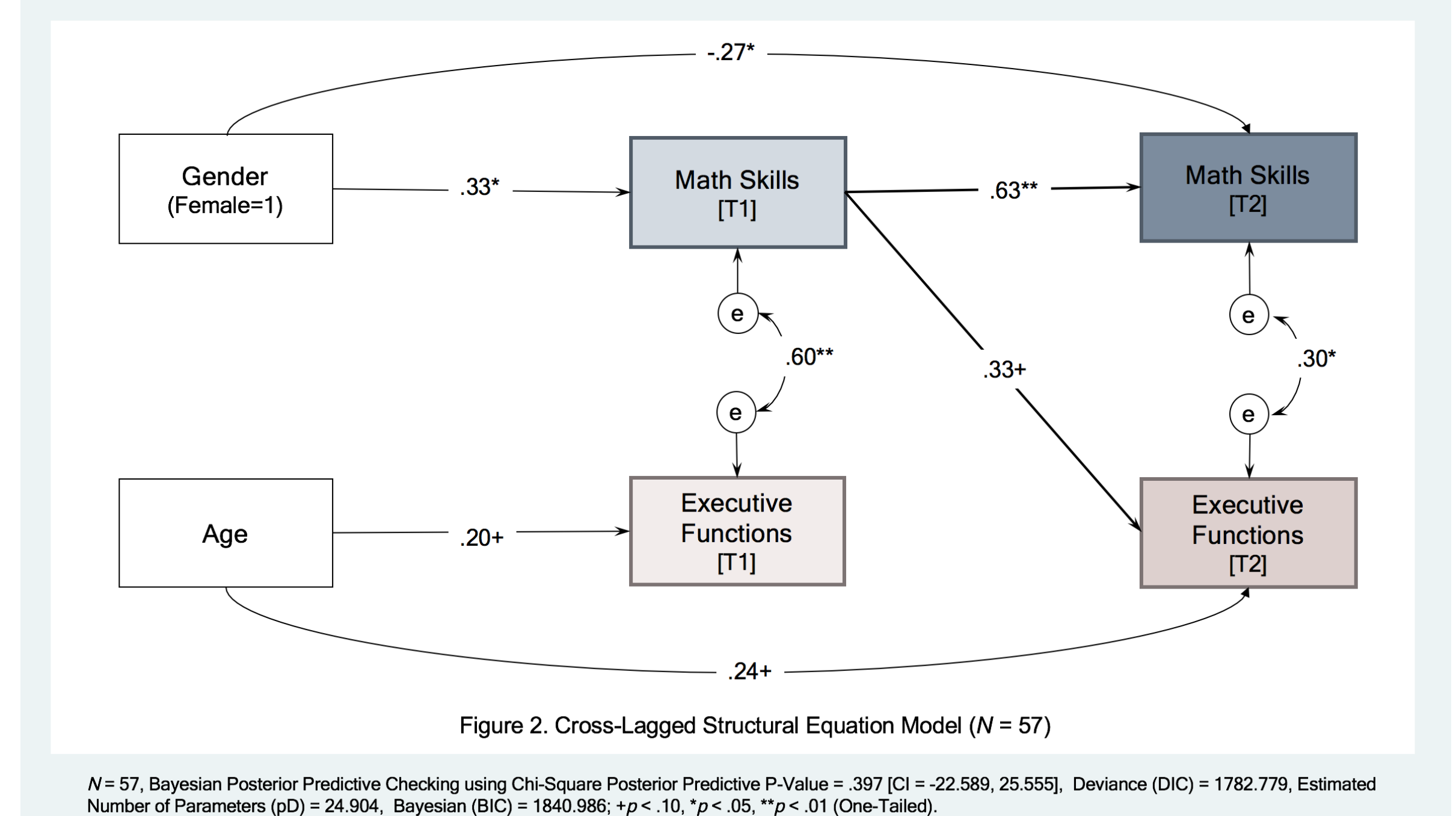


Figure 1. Mean Scores of Math Skills and Executive Functions over Time (N = 57)



Results

- Mean scores of children's math skills and executive functions were found to slightly increase from Spring 17 to Fall 17.
- Children's earlier math skills at wave 1 were positively related to their later math skills (beta = .63, p < .01) and executive function (beta = .33, p < .10)
- However, the children's executive function measured at wave 1 was not significantly associated with any outcomes measured at wave 2.
- With regard to the age and sex effects, older children were found to have higher levels of executive functions at both waves (beta = .24, p < .10; beta = .20, p < .10, respectively) than younger children. However, the child's age was not significantly related to math skills

Discussion

Implications

- early math education and interventions for young children would be beneficial to their cognitive development as well as academic achievement.

Limitations and Future Research

- The sample size is small
- Only 2 time points data
- Unequaled cohort



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