Longitudinal Effects of Spatial Training on Spatial and Math Outcomes in Preschoolers

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Introduction

- Early spatial skills → later spatial and math skills (Mix & Cheng, 2012) and possible achievement in STEM disciplines (Wai, Lubinski, Benbow, & Steiger, 2010)
- Low-income preschoolers have worse spatial skills than middle-income peers (Verdine et al., 2014), however, spatial skills are malleable (Uttal, et al., 2013)
- Benefits of spatial training on spatial skills persists up to 1 mo (Uttal et al., 2013). However, little is known about long-term impact (i.e., >1 mo) of these trainings on spatial and math skills, especially among low-socioeconomic (SES) learners

Research Questions

1. Can spatial training have a long-term impact on preschoolers' spatial and math skills?
2. Will SES moderate the long-term impact of the spatial training on spatial and mathematics achievement?

Participants

- 84 3-year-olds tested at Head Start and private preschools
- 43 girls, M_{age}= 42.65 mo, SD_{age}= 3.37 mo, 52% Low SES

Method

Week 1 Pre-Test → **Weeks 2-6** 5-week training (1x/week) → **Week 7** Post-test → **9-months** Follow-Up

Range: 8.25-13.34 mo
M = 9.62, *SD* = 0.81 mo

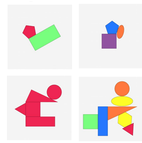
Type	Assessments
Spatial	2D TOSA Trials (Verdine et al., 2017)
Math	Woodcock-Johnson IV: Applied Problems
	TEMA Subset
Vocabulary	Woodcock-Johnson IV: Picture Vocabulary

Intervention

2D TOSA Training Conditions Embedded in Birthday Party

	Shape Familiarization	Demo Trial	Training Trials
Spatial Training	Child looks at/traces/hears spatial properties and names of the shapes	E shows/traces/uses spatial terms to describe the correct locations to place shape. Then E asks child to place/trace and place/describe location and place shapes	E fixes incorrect pieces by placing shapes in correct location/tracing correct shape location/naming incorrect shapes and describing correct locations
Control	No training during weeks 2-6		

Sample training puzzles

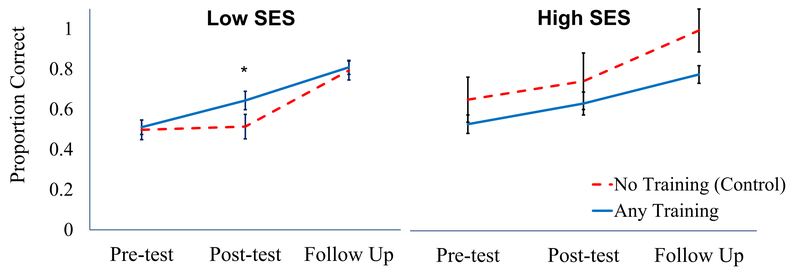


Results

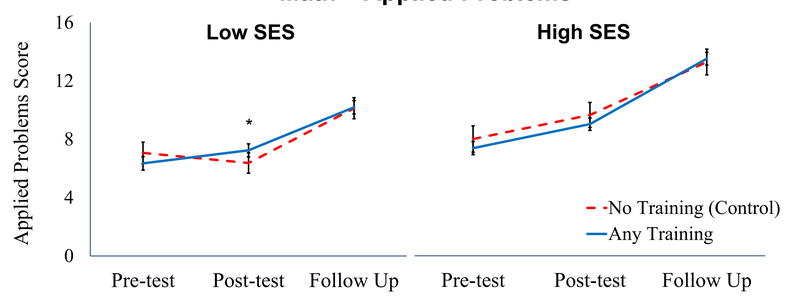
Longitudinal training effects? No

Moderation of SES on long-term impact? No

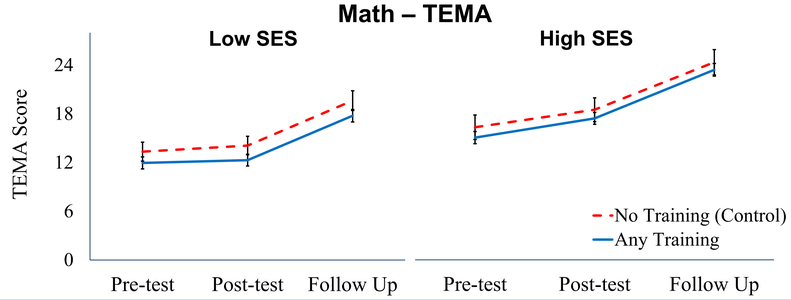
Spatial – 2D TOSA



Math – Applied Problems



Math – TEMA

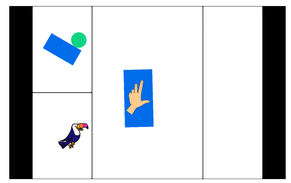


Discussion

- No long-term impacts of training on children's spatial and math skills with no moderation of SES
- Low-SES children's spatial and math skills benefited from spatial training at immediate post-test, but were not retained 9-mo later
  - Supports malleability of spatial skills (Uttal, et al., 2013), but not long-term durability
- Current training was low-intensity (15 min 1x/week for 5 weeks) so maybe this was not enough 'dosage' for long-term impacts

Future Directions

- Examine whether digital spatial training with an app has similar immediate posttest effects compared to the concrete spatial training



- Examine training effects on general cognitive processes (e.g., executive function) and other transfer spatial skills
- Identify/understand types and dosage of early spatial skill interventions and their influences on math achievement

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