



ECR Hub
EDU Core Research

Panel Discussion

Early Math Learning: Translating Between Basic Insights and Applied Research

Columbia B

Wednesday, 10:00 – 11:15 am

2026 ECR:Core and ECR:BCSER Awardee Meeting

Presenters

Panelists

- Bethany Rittle-Johnson, Vanderbilt University
- Geetha Ramani, University of Maryland at College Park
- Melissa Gresalfi, Vanderbilt University

Moderator

- Nancy Jordan, University of Delaware

Leveraging Numerical Patterns in a Modified Board Game

*PI's: Bethany Rittle-Johnson (Vanderbilt), Elida Laski (Boston College), Emily
Fyfe (Indiana Univ.)*

*Key Personnel: Shang (Irene) Li, Shakira Abdul-Rauf
Aaron Dustin*

[NSF Grant #2400562: Leveraging Numerical Patterns in a Modified Board Game to Improve Numeracy Knowledge](#)

Background: Base-10 and Patterning

- The base-10 number system is notoriously difficult for young children to master ((Mix et al., 2014; Yuan et al., 2019).
- Our number system is grounded in place value and recursively repeating numerical patterns, using only the digits 0–9 to represent all numbers.
- Could playing a number board game help young children learn about this foundational concept?

Board Games



Treatment: Highlighting Patterns



Control: Mimic Chutes & Ladders

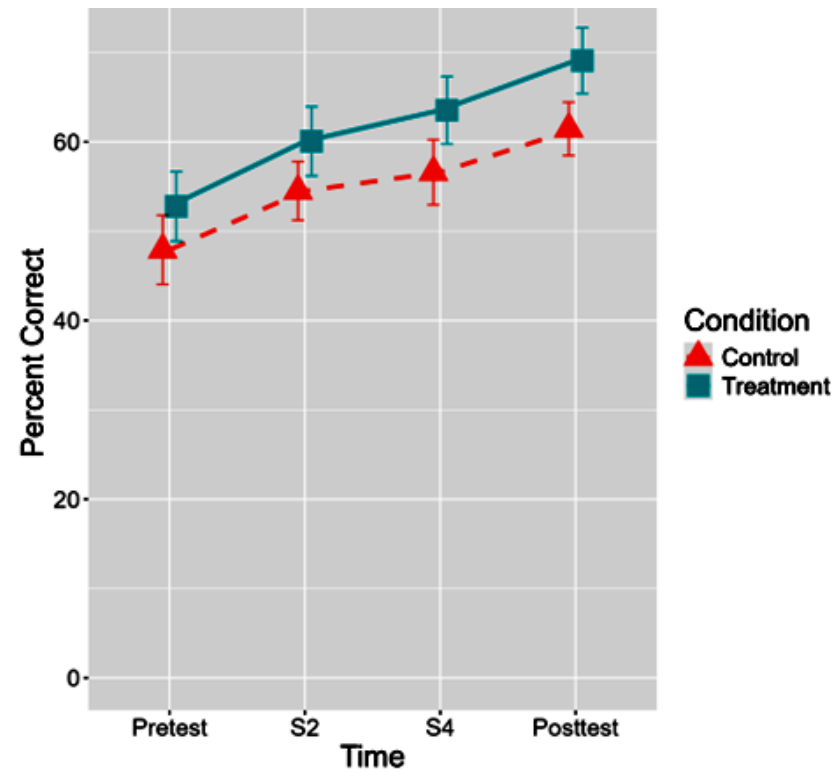


Method

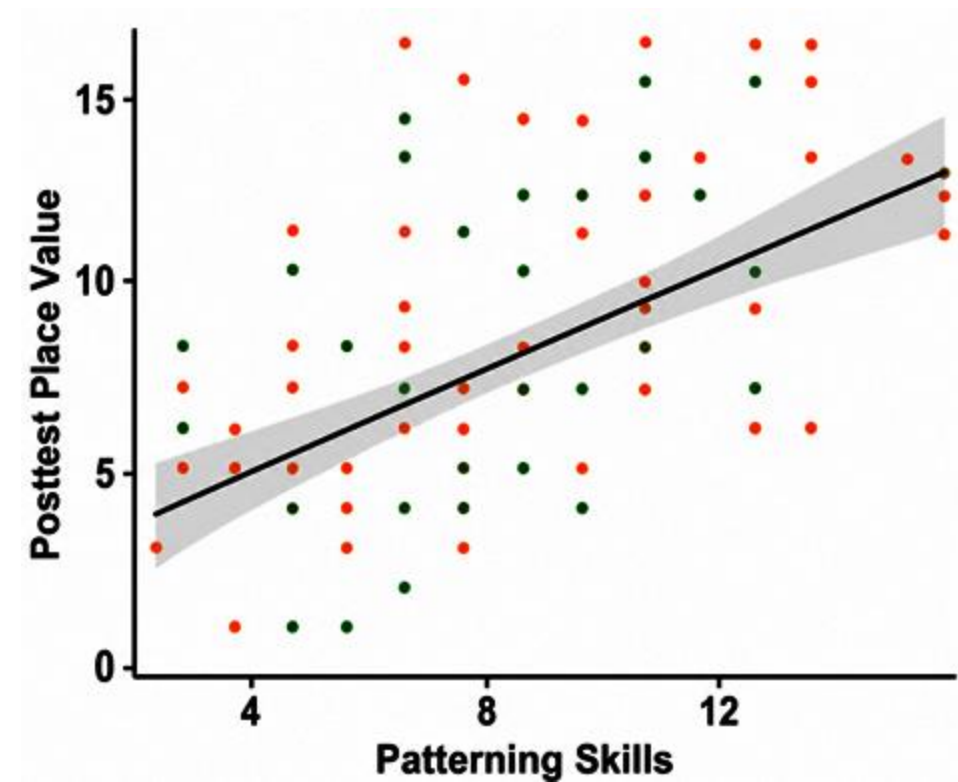
- Collected measures of place value and patterning from 96 kindergarteners (ages 5–7) from Greater Nashville and Boston.
- Pretest-posttest experimental design: 4 gameplay sessions with patterning lens (treatment) or control condition.

Results

Place Value Knowledge over time



Patterning Predicts Place Value



What's Next?

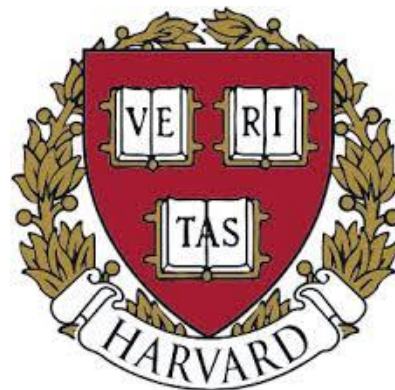
- Follow-up study with an active control condition that answers the same question cards while playing a card game.
- In both conditions, we increased use of question cards and scaffolding.



Promoting Math Skills through Playful Communication in the Home Environment

Pis: Geetha Ramani & Meredith Rowe

University of Maryland, College Park and Harvard University



Home Math Environment

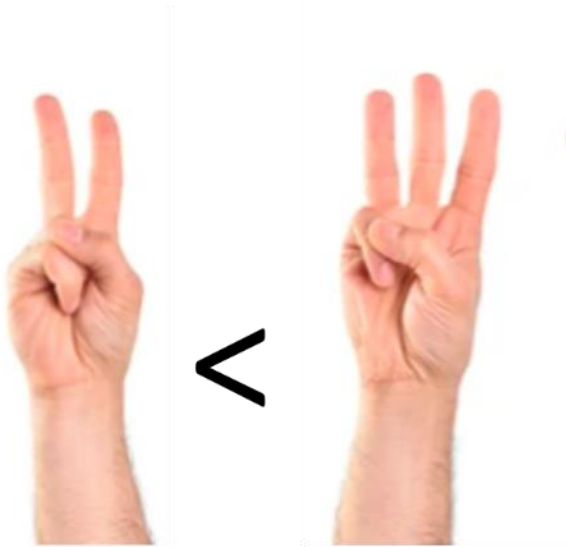
- Parents provide opportunities for children to engage with math during everyday activities.
- Greater parent-child math talk has been linked to stronger math skills in young children.

(Eason et al., 2022; Levine et al, 2010; Ramani et al., 2015; Skwarchuck, 2009)



Role of Gestures in Math Learning

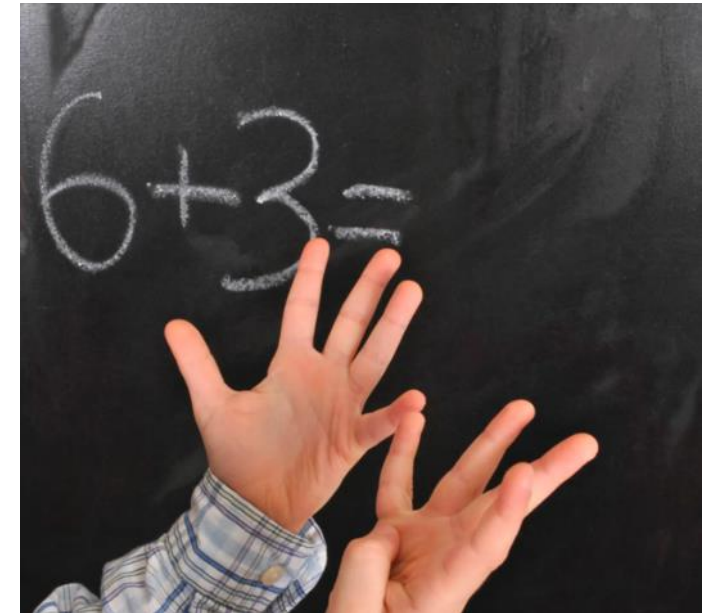
Gestures can enhance mathematical learning



Lighten cognitive load



Direct attention



Support abstract concepts

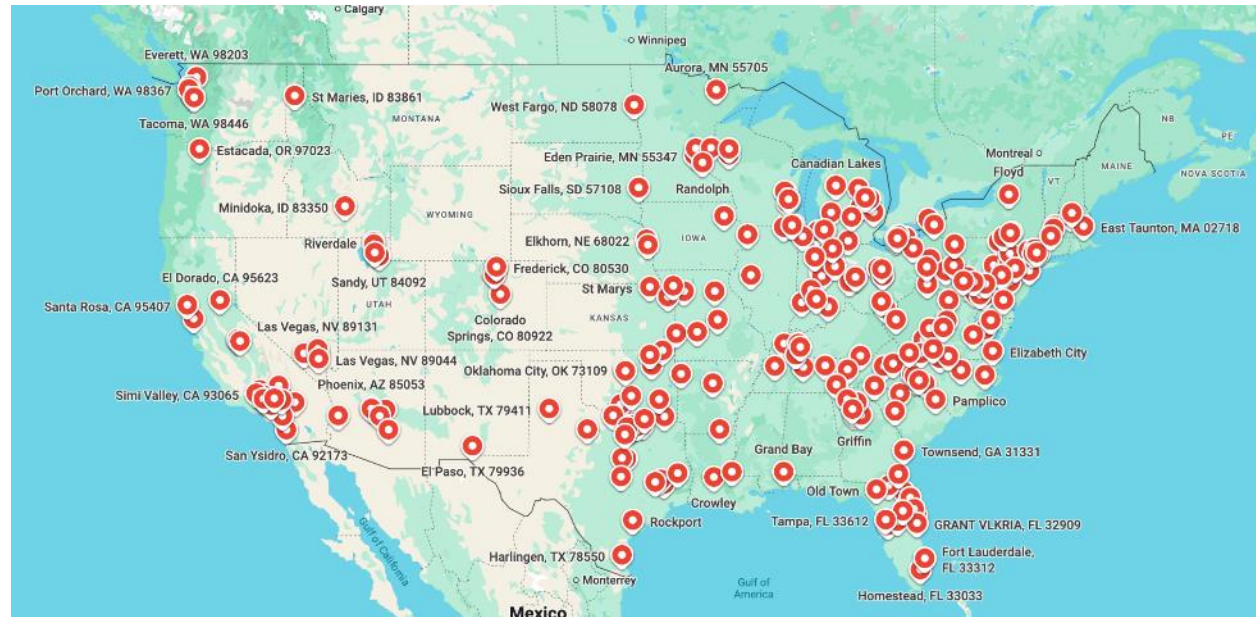
(Goldin-Meadow et al., 1992; Goldin-Meadow et al., 2001)

Research Questions

- 1) How much variability is there in parents' and preschoolers' math talk and gestures in a large, diverse American sample?
- 2) Do math communication focused trainings have an effect on parent and child math talk and gesture?
- 3) Does the training have an effect on children's math knowledge?

Study Participants

- Families with preschool age children (3.5-5.5 years old)
- Inclusion criteria: Parent without advanced degrees; Families could be multilingual but should speak at least 75% English at home
- Entire sample = 294



Methods

- Participated in four virtual sessions
 - 3 parent-child interactions with mailed materials (12 minutes)
 - Child math measures
- Families were randomized into one of three conditions
 - 10-minute information video during Session 2
 - Pamphlet with information related the condition
 - Weekly text messages for 3 months



Experimental Conditions

Math Talk + Gestures

MATH CHATS



C - Count and point
H - How many?
A - Add and subtract using fingers
T - Talk and gesture about math daily
S - See math all around!

Math Talk

MATH CHATS



C - Count
H - How many?
A - Add and Subtract
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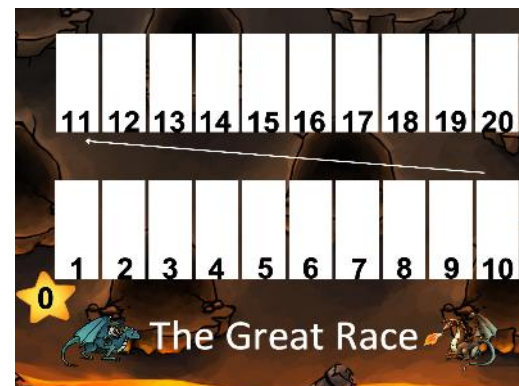
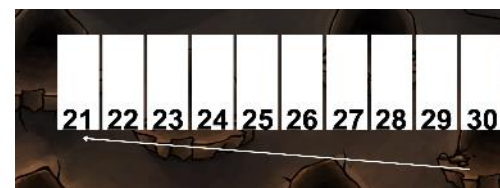
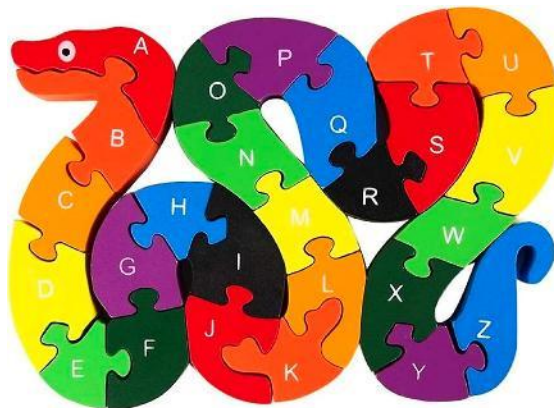
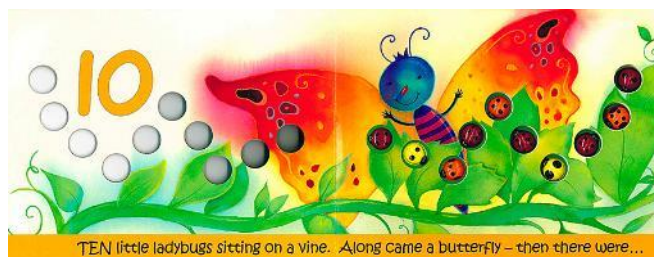
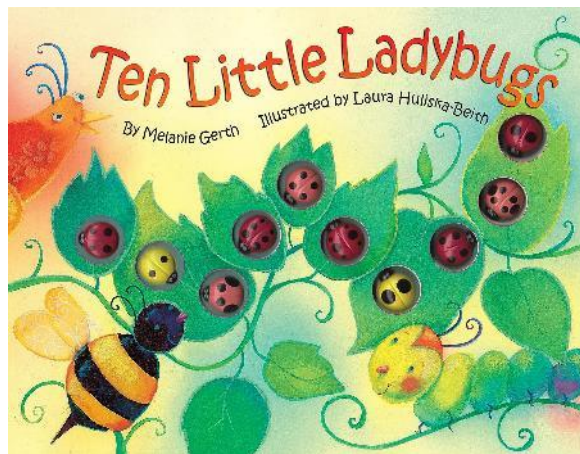
Control/Play

PLAY



P - Play is important
L - Let them guide you
A - Appreciate time together
Y - You can make a BIG difference

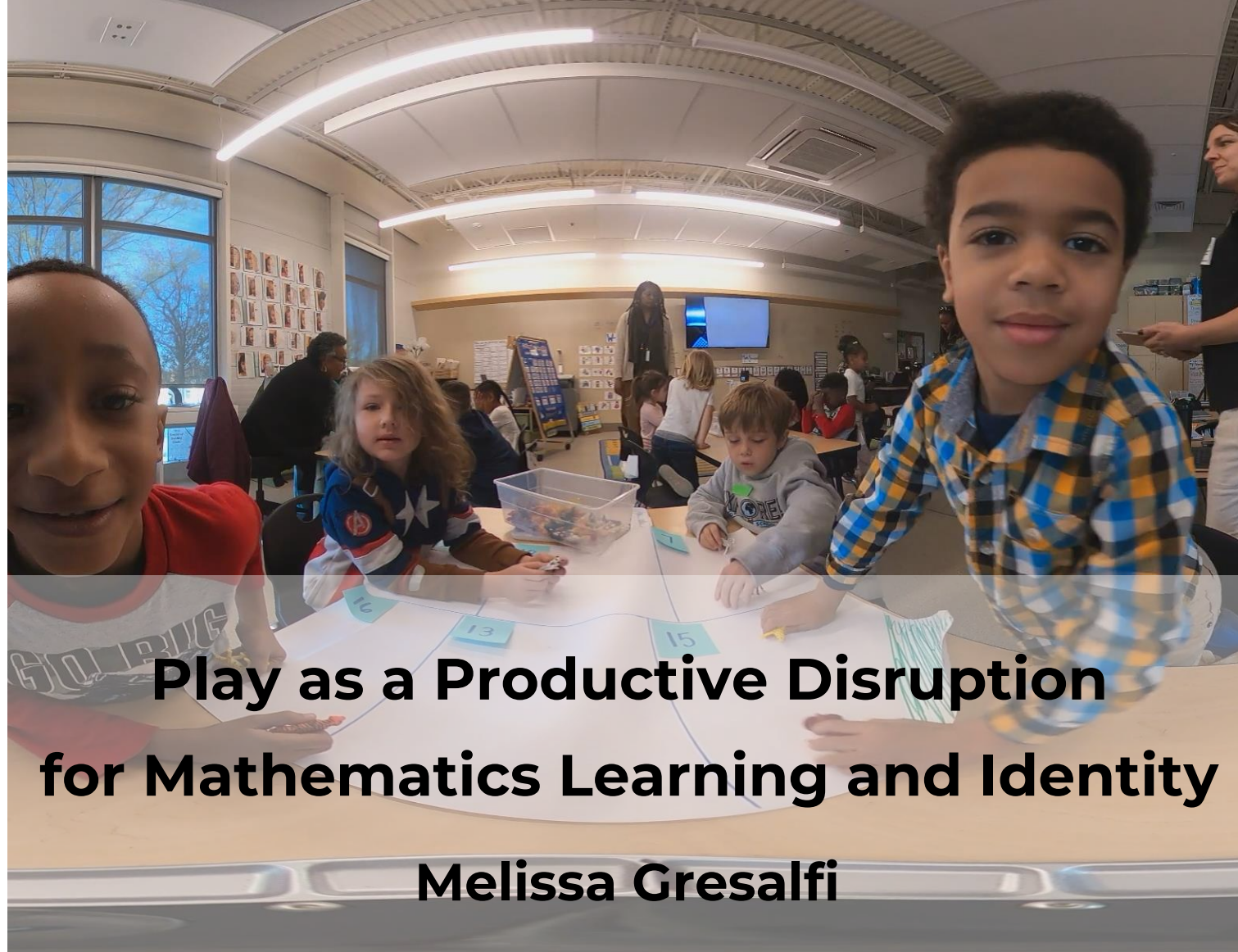
Parent-Child Interaction Activities



Transcripts Parent-child Interactions

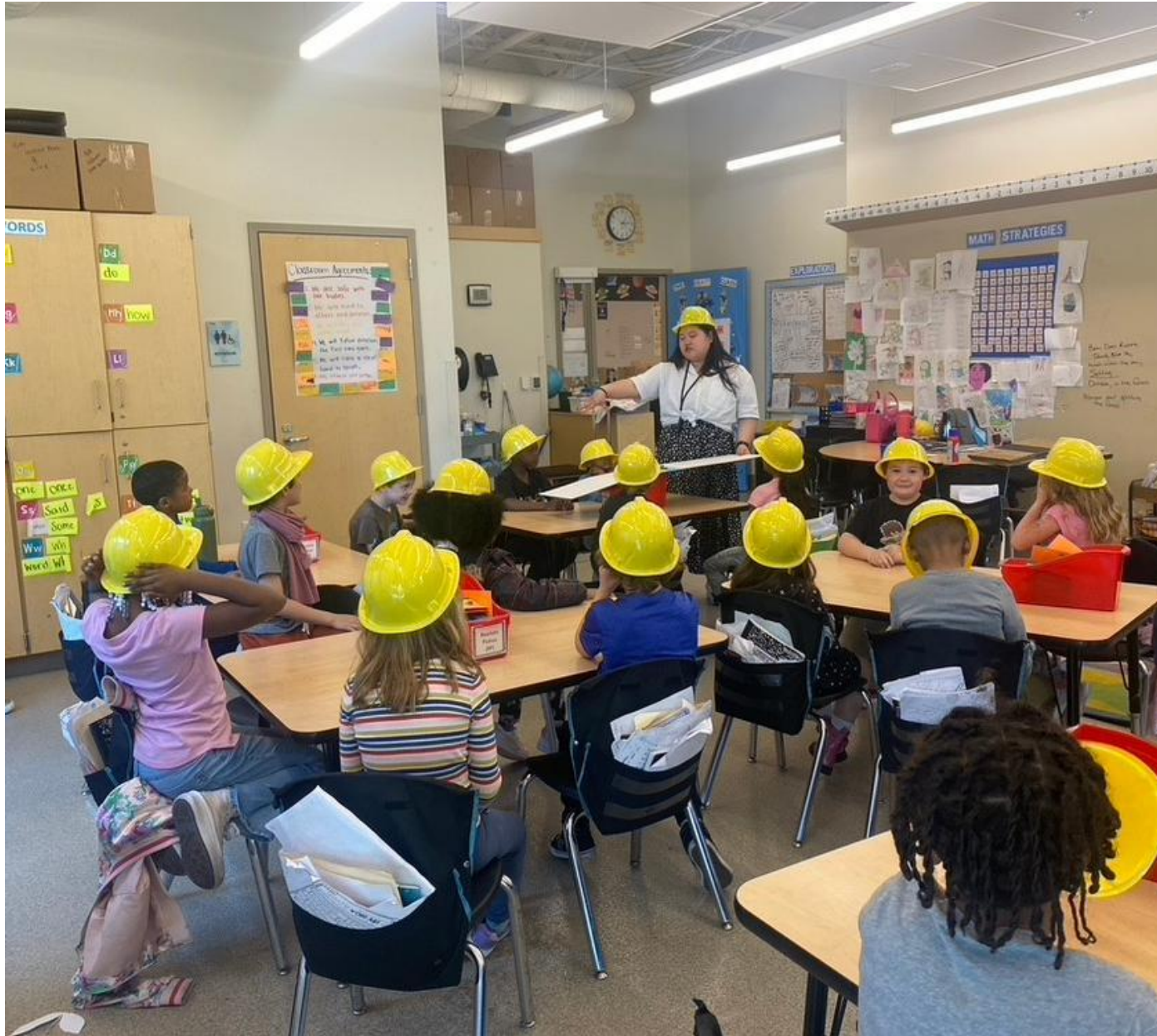
Transcribers used CHAT conventions of the Child Language Data Exchange System to transcribe all speech, actions, and gestures (CHILDES, MacWhinney, 2000).





Play as a Productive Disruption for Mathematics Learning and Identity

Melissa Gresalfi



Many aspects of schools are organized for the convenience of adults, but their major impact is on children.

What *could* learning and identity look like if we did things differently?



PLAYFUL LEARNING PROJECT



**Co-designed lessons with teachers to focus
on mandated content in playful ways**

2022-2023

Kindergarten Teachers

Kindergarten students

2023-2024

1st grade Teachers

Follow students into 1st Grade

2024-2025

**2nd grade
Teachers**

Follow students into 2nd Grade

Disruption 1: Posing your own mathematical question

“how tall is it?”



Disruption 2: Different answers, no judgement

"I thought it was eight levels"



Disruption 3: Determining problem parameters

"the roof don't count"



Brooklynn: One, two, three, four, five, six, seven, eight.

Disruption 4: Who is mathematically competent



Laura



Brooklyn



Max



Quentin

Thank you!

Jingyi Chen, Vanderbilt University
Madison Knowe, Vanderbilt University
Candice Love, University of Maryland
Amy Parks, Michigan State
Jamie Vescio, Vanderbilt University
Anita Wager, Vanderbilt University





Leveraging Numerical Patterns in a Modified Board Game

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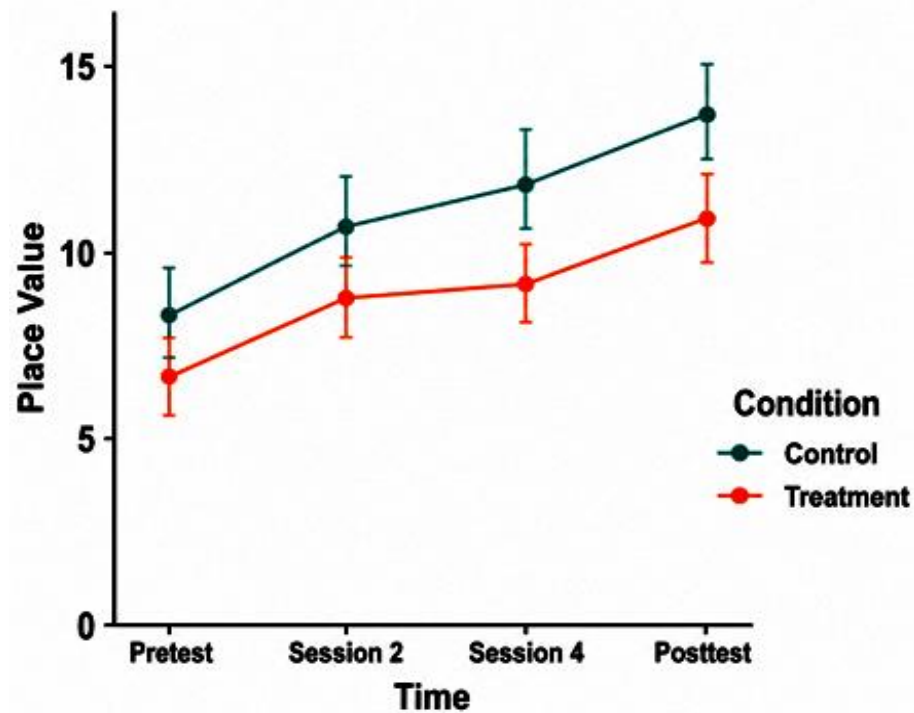


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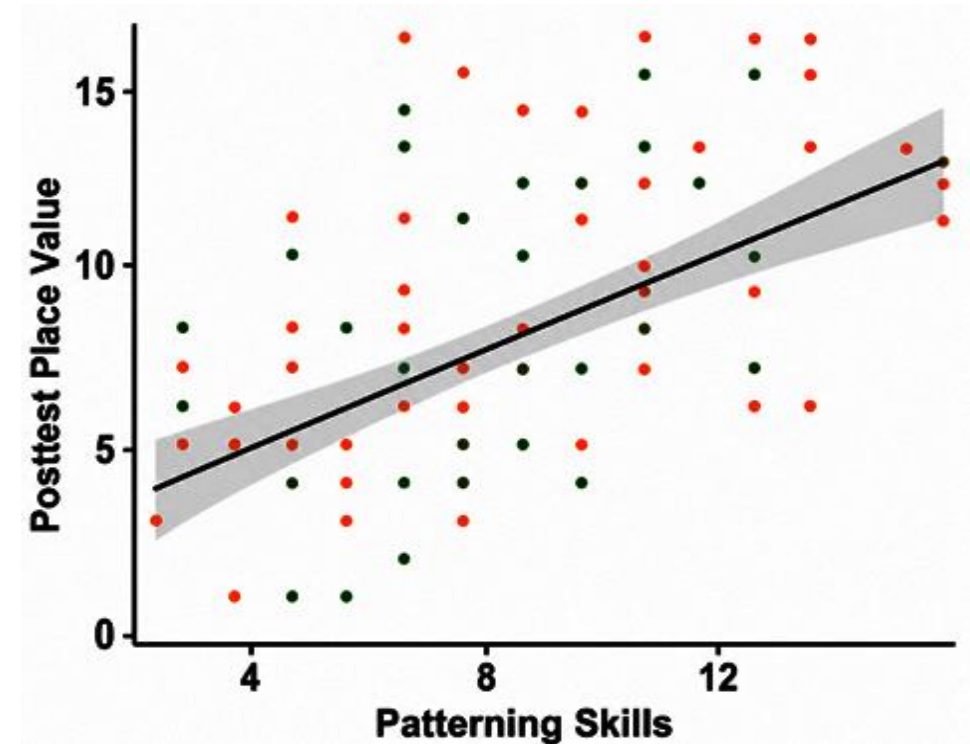
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PLACE VALUE KNOWLEDGE
OVER TIME



PATTERNING PREDICTS
PLACE VALUE





What's Next?

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Fraction Learning Starts Early: Building a Strong Foundation in First and Second Grades

NSF ECR: 2500289

Nancy C. Jordan
Nora S. Newcombe
Ethan McCormick
University of Delaware
Alexandra Viegut
University of Wisconsin-Eau Claire

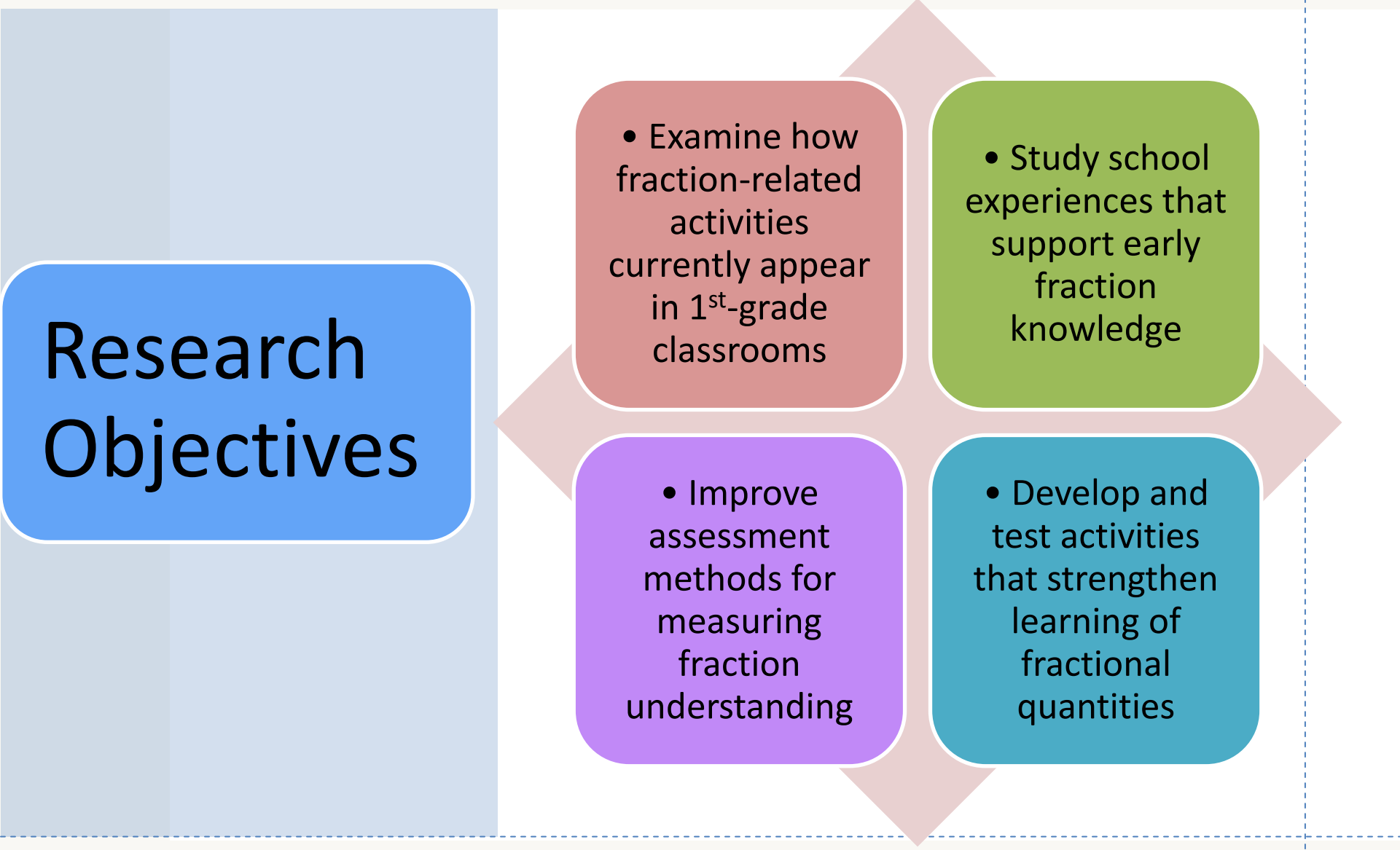
Most children enter first grade with some informal understanding of fractions but considerable variation

Goal: Integrate fraction concepts before formal instruction in fractions occurs in later grades

Bridge the transition from whole numbers to fractional quantities

Potential importance of developing integer and fraction knowledge in tandem, providing a more holistic view of early number learning

Research Objectives



- Examine how fraction-related activities currently appear in 1st-grade classrooms

- Study school experiences that support early fraction knowledge

- Improve assessment methods for measuring fraction understanding

- Develop and test activities that strengthen learning of fractional quantities

METHODS

- Analyze textbooks and interview teachers
- Conduct a longitudinal study with an experimental training component using playful learning activities
- Measure effects of training on fraction knowledge and mathematics development

IMPACT

Combined approach will contribute to describing the current state of fraction-related learning activities

Develop meaningful approaches that can be used to teach fraction concepts in the early grades

Supporting early understanding of fractional quantity alongside formal teaching of operations with integers



Early Math Learning: Translating Between Basic Insights and Applied Research

Discussion Questions

- For those of you conducting more basic research on early mathematical cognition, what is a concrete example of a finding about children's thinking that you believe has clear implications for instruction or intervention design—even if you have not directly tested it in an applied setting?
- For those of you working on intervention studies, how did insights from more foundational or descriptive research on children's reasoning shape the design of your instructional approach (e.g., fractions learning, playful learning practices)?
- Looking across your projects, what does “translation” look like in practice—from basic insight to applied design, or from intervention findings back to theory refinement—and where does that translation break down or become non-linear?
- What do we still need to know about how young children learn math?
- What are some issues or problems you have encountered while conducting research in schools and what suggestions do you have to address them?