

CAREER: Investigating Young Children's Opportunities to Learn Mathematics in Early Childhood Classrooms

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Background

- Early math predicts later life and learning outcomes (Rittle-Johnson et al., 2017; Watts et al., 2018)
- Current policies are expanding access to publicly funded preschool (e.g., CA Department of Education)
- Classroom research documents variability in how individual children's experiences in the same classroom (Battey, 2013; Parks, 2020; Shalaby, 2017)
- This project examines individual children's learning and participation in mathematics over time in early childhood

Table 1. Following focal children across three years of early schooling

Preschool (age 3-4)	classroom A1	classroom B1	classroom C1
Transitional Kindergarten (age 4-5)	classroom A2	classroom B2	classroom C2
Kindergarten (age 5-6)	classroom A3	classroom B3	classroom C3

Central Constructs

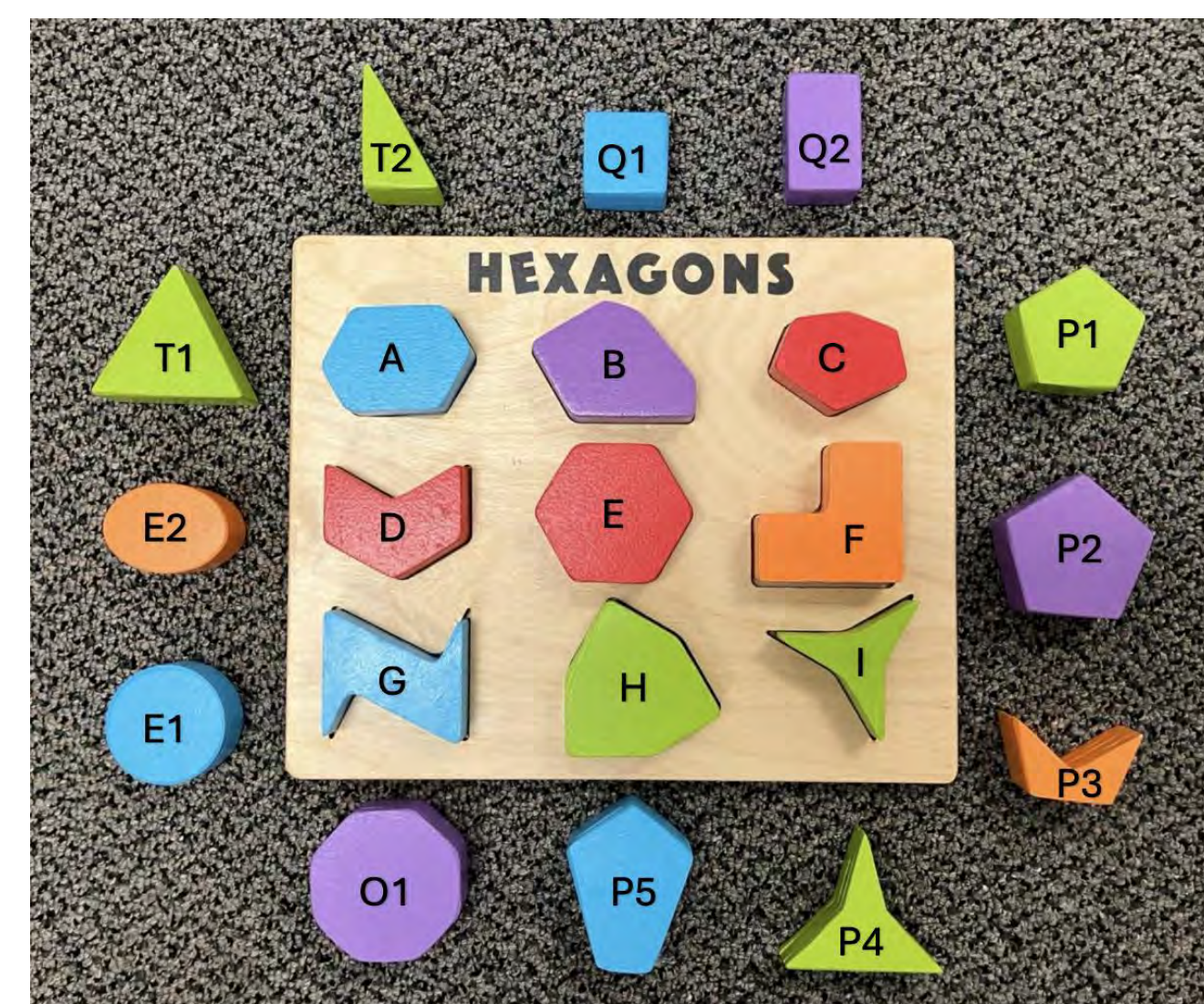
- **Instructional Activities:** math lesson routines designed to be driven by children's ideas in ways that showcase the range of knowledge and resources children bring with them into school.
 - Counting Collections (Franke et al., 2018)
 - Describe-Draw-Describe (Turrou et al., 2021)
 - Which One Doesn't Belong
 - Solving Story Problems (Carpenter et al., 2017)
- **Competent Participation:** local systems of participating in and communicating about mathematics that come to be interpreted as productive, successful, or desirable within particular classroom communities (Cobb et al., 2009; Gresalfi et al., 2009; Johnson, 2017; Kazemi & Stipek, 2001)
- **Young Children's Engagement in Mathematical Practices**
 - Making sense of and solving problems (Turner & Celedón-Pattichis, 2011)
 - Communicating reasoning (Celedón-Pattichis et al., 2012)
 - Using tools and representations (Johnson & Gaxiola, 2018)
 - Attending to structure (McMillan et al., 2023)
- **Coherence:** the degree to which children's experiences (in terms of content and pedagogical practices) connect and are scaffolded within classrooms and across grade levels (Coburn et al., 2018; Stipek et al., 2017)

Data Sources & Measures



Classroom observations

- Instructional activities
- Play



Assessment interviews

- Early number
- Spatial relations (Christopher Danielson)



Photo interviews

Research Questions

- How are opportunities to learn distributed within **Instructional Activities** designed to elicit and build from young children's mathematical ideas?
- What counts as **competent participation** in different early math classrooms, and how do individual children negotiate, take up, or resist these framings of their participation over time?
- In what ways do young children engage in **mathematical practices** (such as explanation, engagement with others' ideas, written representation, making use of structure), and how do their teachers interpret and respond to these contributions?

Early Findings



Children display greater knowledge of counting on challenging tasks

- More knowledge of the number-word sequence when counting objects vs. oral counting without objects
- Accurate use of one-to-one principle > accurate number-word sequence

Children are strategic in attending to shape features during puzzle activity

- Regularity
- Concave angles



Social construction of cognitive demand in preschool mathematics



Elevation of a "low-potential" task

Decline of a "high-potential" task

