# Early Emergence of Socioeconomic Disparities in Mathematical Understanding

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## Introduction

- The goal of this DRK-12 funded project is to examine the pathways through which socioeconomic status shapes toddlers' emerging math skills.
- Data collection in participants' homes began in February of 2020 but was abruptly stopped in response to the COVID-19 pandemic.
- To ensure the safety of our staff and participating families, the study was redesigned to be fully online; data collection resumed in July of 2020.
- Here, we present preliminary data from online numeracy and spatial assessments.

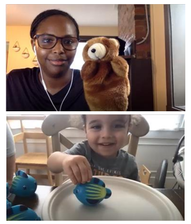
## Research Questions

1. Do measures of numeracy and spatial skills capture meaningful variability in toddlers when administered online?
2. How do parent reports of numeracy and spatial activities predict performance on these online measures?

## Participants and Procedures

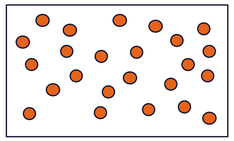
- 105 children (55 girls) and a parent (96% moms)
- Children ranged from 30 to 38 months of age
- 69% had at least 1 parent with at least Bachelors' degree
- Families provided informed consent during a phone call with project staff
- Staff members delivered bins with materials to participants' homes prior to the first research call.
- Families completed two Zoom calls, each lasting 30-45 minutes, including observational tasks and child assessments
- After the second call, staff members picked up and sanitized research materials and participants completed an online survey

## Online Measures



**Give a Number (Wynn, 1990, 1992)**
Children produced sets of items based on researcher's prompt (e.g., "Can you feed the bear two fish?")
Titrated trials to narrow in on cardinal value knower-level
Plastic fish and plate provided to families in materials bins

**Counting**
Children asked to verbally count as high as they could
Counting sheet with dots provided as a prompt, if needed



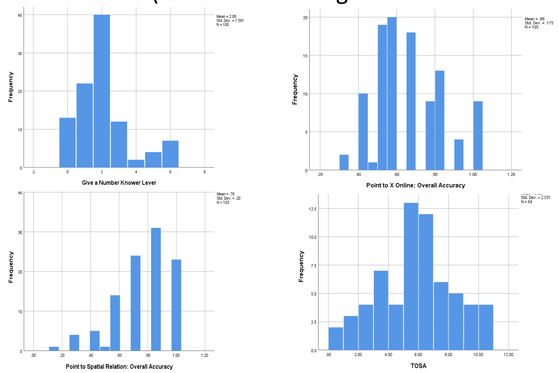
**Point to X (Wynn, 1992)**
Children pointed to one of two sets of items based on researcher's prompt (e.g., "Which has four ducks?")
2 practice trials to ensure understanding followed by 12 test trials
Stimuli shown in binder provided to families in materials bins

**Point to Spatial Relation**
Children pointed to one of two images of stuffed tiger based on researcher's prompt (e.g., "Where is the tiger between the cups?")
Seven test trials assessing distinct spatial relations
Stimuli shown in binder provided to families in materials bins

**Modified Test of Spatial Ability (TOSA; Verdine et al., 2013)**
Children recreated a design using magnetic wooden shapes
Children's creation scored based on location, rotation, horizontal/vertical positioning, and proximity of pieces
Magnetic surface, wooden shapes, and printed design card provided to families in materials bins

## Results and Implications

- Measures of numeracy and spatial skills were normally distributed and intercorrelated (All correlations significant at the .01 level)




| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Give a Number | 1.00 | | | |
| 2. Counting | .500 | 1.00 | | |
| 3. Point to X | .647 | .545 | 1.00 | |
| 4. Point to Spatial Relation | .487 | .318 | .407 | 1.00 |
| 5. TOSA | .339 | .377 | .338 | .335 |

- Numeracy measures were moderately associated with numeracy activities in the home but not spatial activities
- Some specificity in associations with home activities was seen (e.g., spatial activities were related to spatial relations and not numeracy)

| | Numeracy | Spatial |
|---|---|---|
| Give a Number | .345*** | .099 |
| Counting | .337** | .148 |
| Point to X | .308** | .068 |
| Point to Spatial Relation | .263** | .241* |
| TOSA | .029 | .091 |

- We conclude that online data collection offers a safe, affordable alternative to in-person research with young children

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