

PROJECT MATHPACK: EXAMINING FAMILY MATHEMATICAL PLAY PATTERNS AND THE INFLUENCE ON PARENT BELIEFS AND CHILDREN'S MATHEMATICAL UNDERSTANDINGS

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WHAT IS EARLY MATH?

- We asked this question to parents of 3-4 year old children
- How do we define mathematics for young children?

ten
Shapes
Counting
Adding
Subtracting
Measuring
Numbers

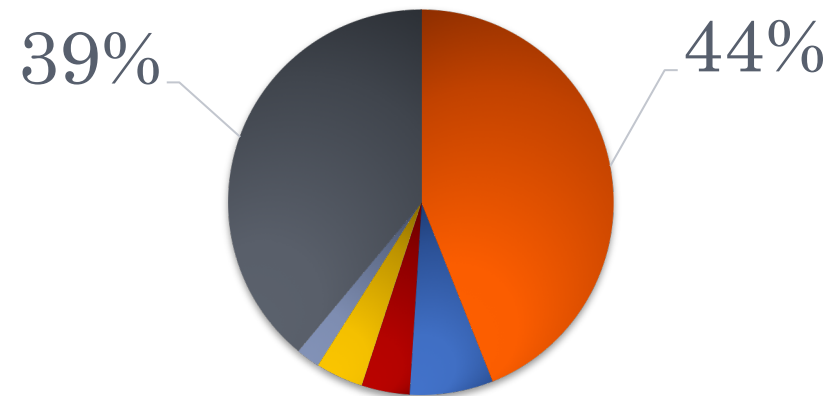
- Is my child a mathematician?



MATH IS MORE THAN COUNTING

- Perceptions from parents are not uncommon
- Representation of mathematics in media and in children's literature is often counting oriented
- Review of EC Mathematics Literature from 2000-2015 (Linder & Simpson, 2017) show a heavy emphasis on research related to Numbers and Operations. Out of 1141 articles- 44% were focused on Number and Operations content while other content areas were barely represented.

Types of Early Math Content Researched



■ Numbers and Operations ■ Geometry ■ Algebra ■ Measurement ■ Data Analysis ■ Other



HOW DO WE CHANGE PARENT THINKING ABOUT MATH?

Where we are now

ten
Shapes
Counting
Adding
Subtracting
Measuring
Numbers

WordItOut

Where we need to be

Discuss
Reason
Communicate
Problem Solving
Geometry
Thinking Mathematically
Play
Problem Solving
Measure
Reflect
Data Analysis
Representation
Patterns
Count
Collaborate
Question



ADDRESSING THE CONCERN- WHAT WE KNOW

- Parents are perceiving mathematics as a static set of content or skills
- Mathematics is often seen as a “school age” subject and not integrated into home play with young children
- This work explores:
 - How do parents perceive children’s capabilities related to mathematics?
 - How can we encourage parents to support young children’s mathematics capabilities through mathematical play?



BRIDGING CLASSROOM AND HOME ENVIRONMENTS

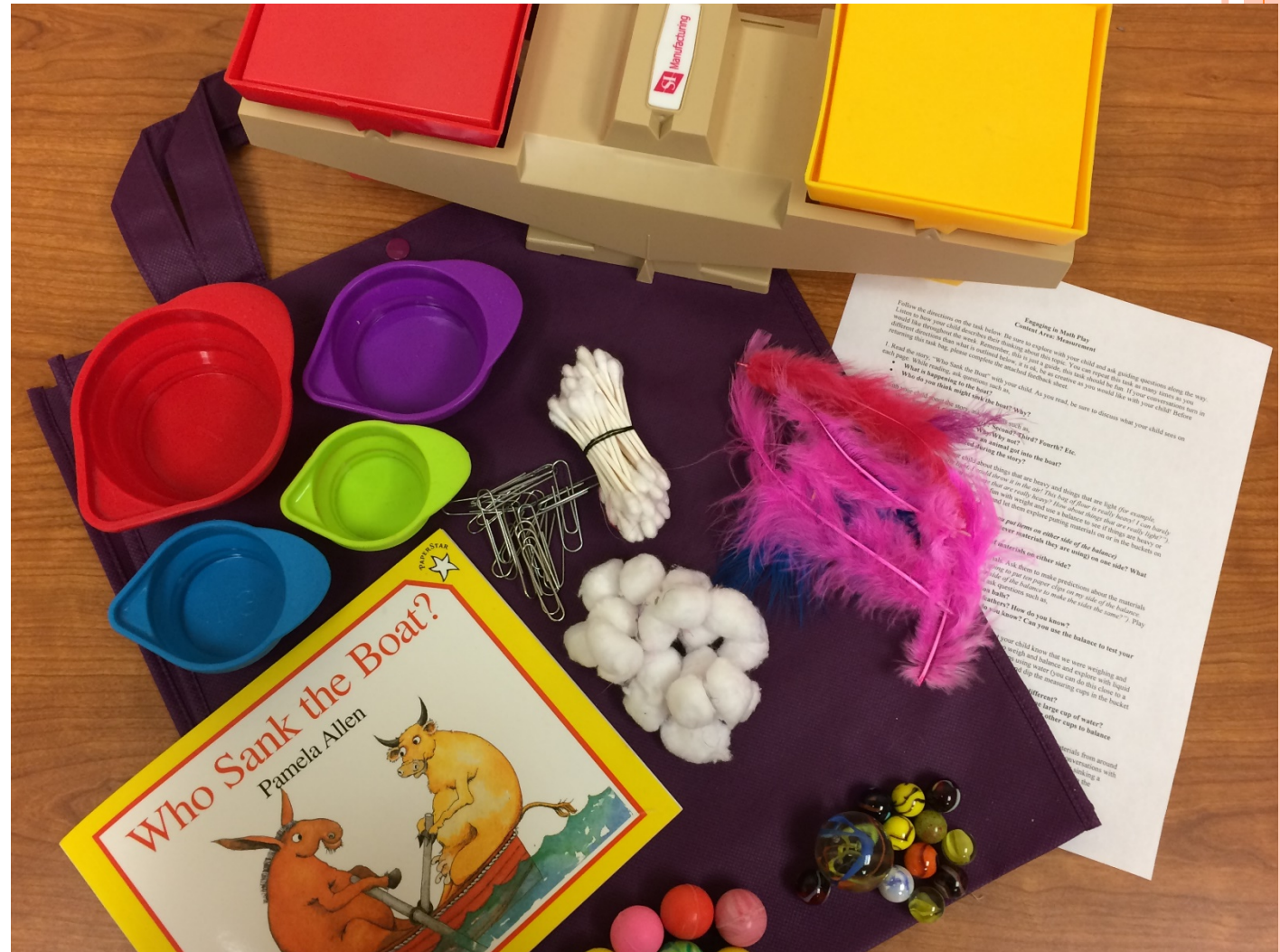
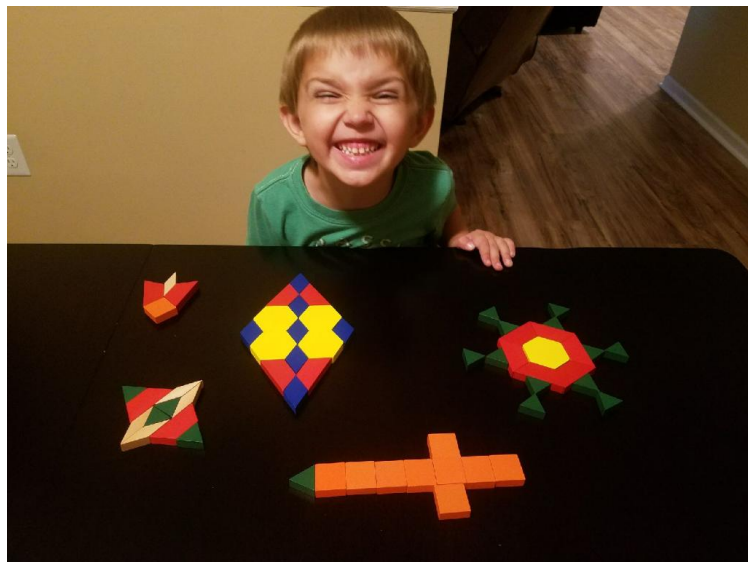
- For young children especially, parents might not know what it means to explore mathematics
 - Find ways to help parents understand what their children should be able to do.
 - Find ways to help parents see the value in mathematical play!
- Some options already identified
 - Newsletters- give math games/explorations instead of worksheets
 - Remind me app (or similar)- send pictures of children exploring and playing mathematically- ask families to make connections at home (e.g. if they are sorting in class, ask families to sort laundry or toys in their play room together).
 - Back to School night- discuss what your philosophy is related to early mathematics



Project



MathPack



PROJECT MATHPACK GOALS

- To introduce mathematical concepts to parents and children in a non-intrusive manner
- To increase mathematical interactions during play between parents and children
- To support high-quality questioning strategies, discourse, and making connections during mathematical play



LITERATURE REVIEW

○ Play

- Preschoolers thrive on interactive conversations and games (Sroufe, 2000)
- Play supports parent and child in multiple ways
 - Play → parent-child relationships (Ginsburg, 2007)
 - Play → approaches to learning and mathematics (Coolahan et al., 2000, Miedel & Reynolds, 2000, Huntsinger, et al., 2016)

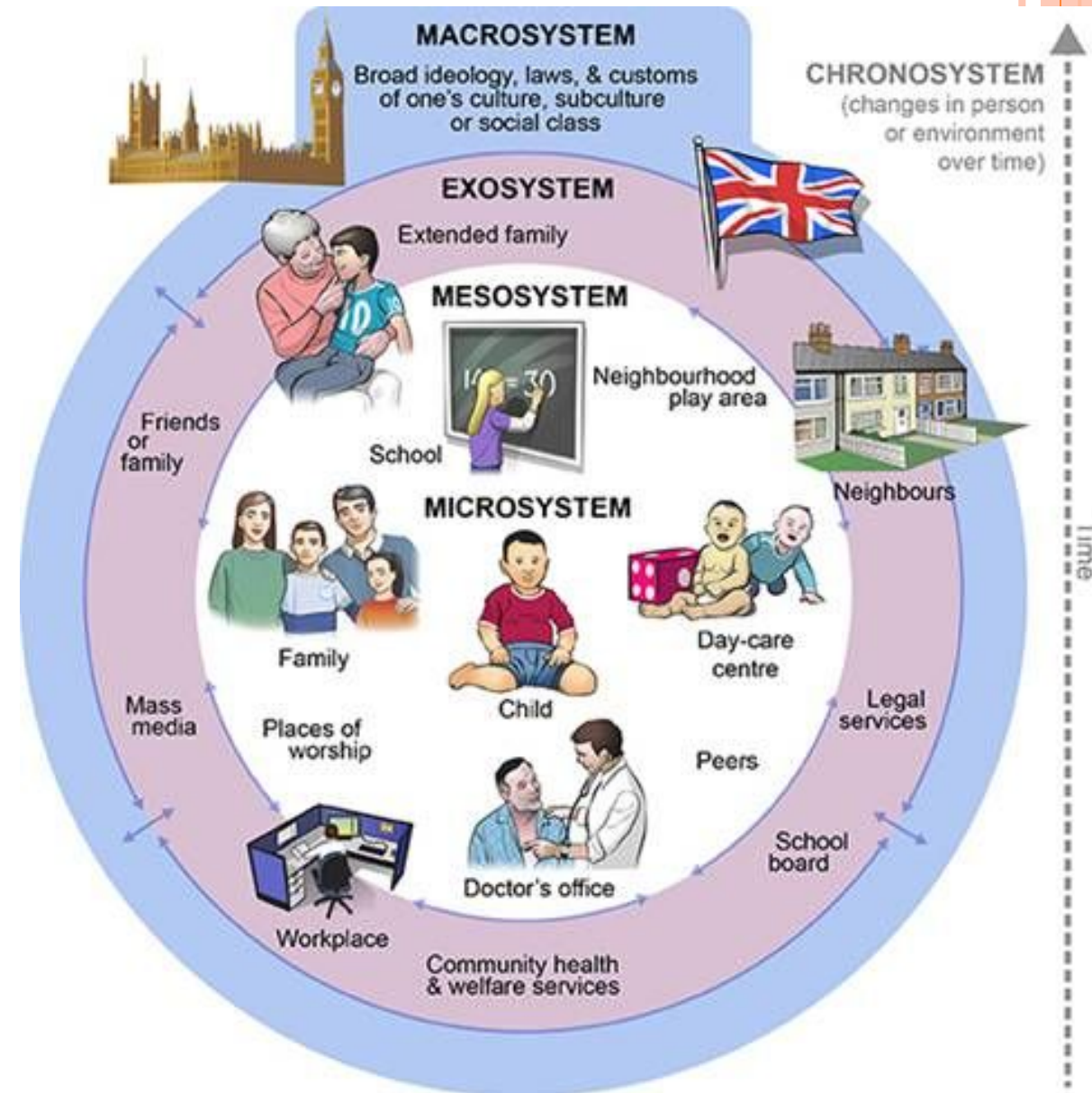
○ Take-Home Bags

- Content focused (Literacy, Science, some Math)
(Dever & Burts, 2002; Kokoski & Patton, 1997, Zeece & Wallace, 2009)

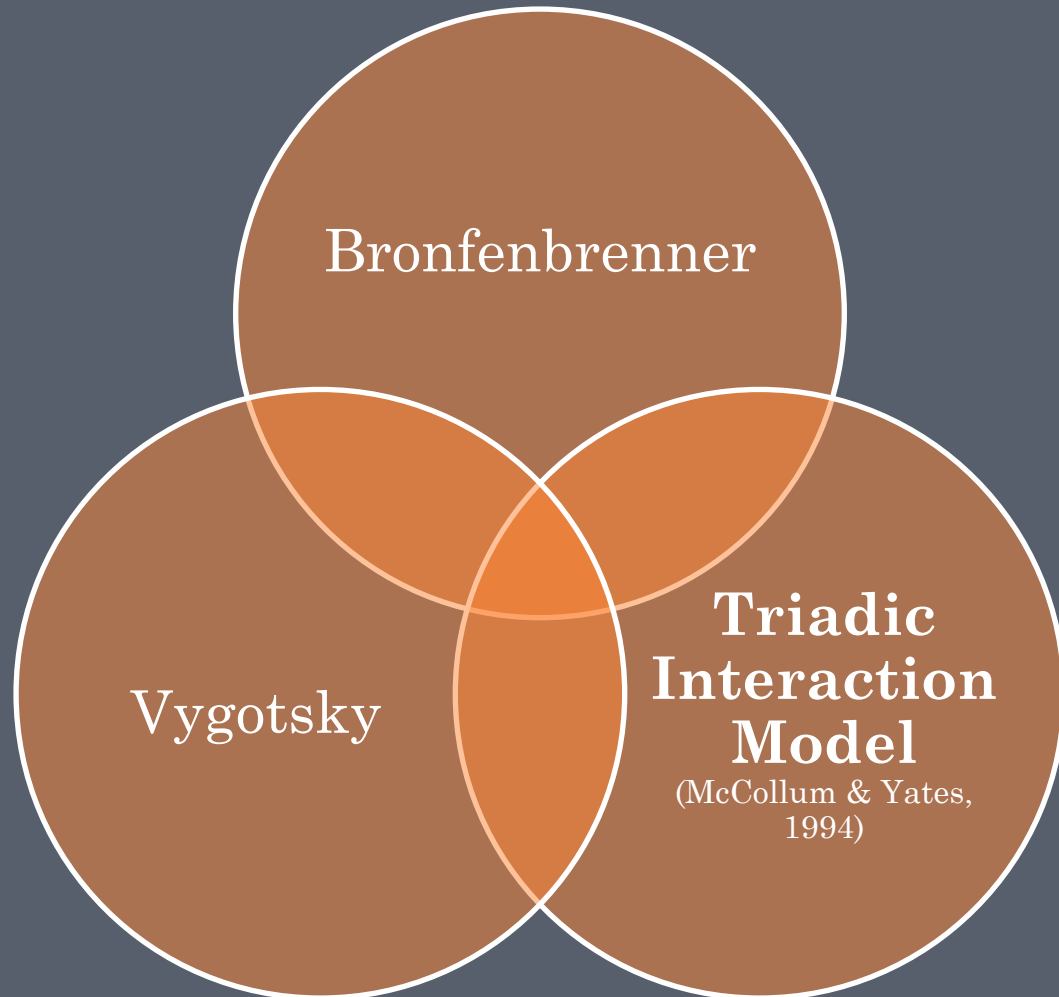


THEORETICAL BACKGROUND

- Bronfenbrenner's Ecological Systems Theory



THEORETICAL FRAMEWORK



Learning is a social process, rooted within interactions with other people.

Varied systems of the environment and the interrelationships among those systems shape children's development.

Triad: Parent, Child, & Researcher

PROJECT MATHPACK INTERVENTION PILOT

- Five MathPacks (Geometry, Measurement, Data Analysis, Early Number, and Algebra)
 - Built around 5E learning cycle
 - Begin with a read aloud
 - Engage in a math task connected to the story
 - Make ongoing mathematical connections to home environment
- MathPacks sent home weekly, parents asked to play at least one time during the week
- Data Collection
 - Pre/Post snapshots of play
 - Pre/Post belief surveys and interviews
 - Feasibility surveys within each bag

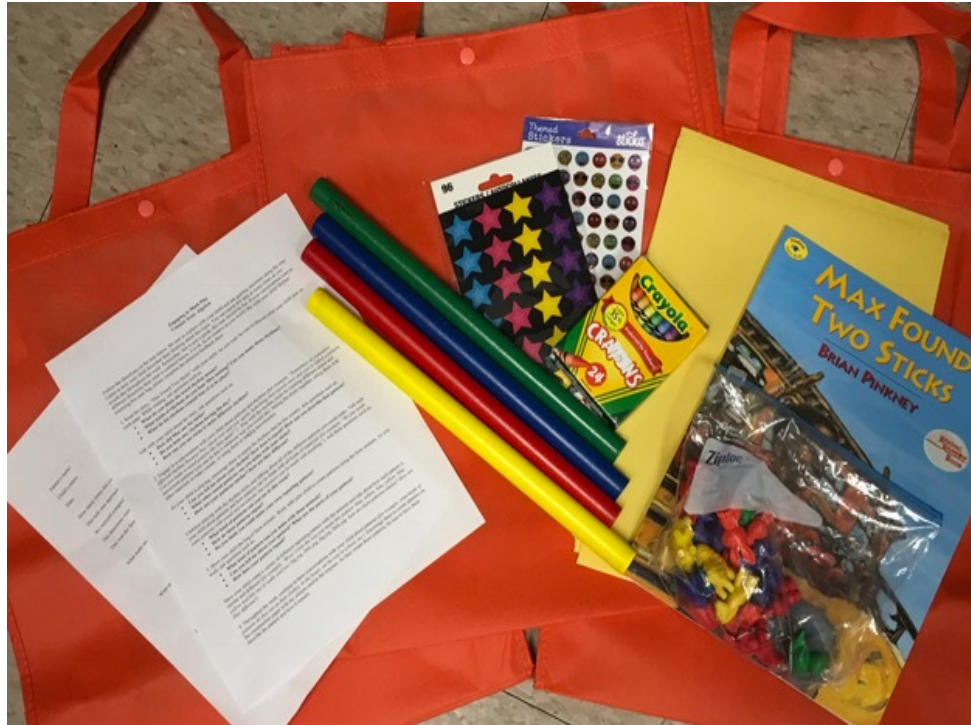


RESEARCH DESIGN

- Concurrent Mixed Method Design
 - Pretest-Posttest design, no control group
 - Phenomenology
- Research Question: How and to what extent does the MathPack intervention influence mathematics play interactions between parents and children?



PART OF A SAMPLE TASK SHEET



Engaging in Math Play Content Area: Algebra

Follow the directions on the task below. Be sure to explore with your child and ask guiding questions along the way. Listen to how your child describes their thinking about this topic. You can repeat this task as many times as you would like throughout the week. Remember, this is just a guide, this task should be fun. If your conversations turn in different directions than what is outlined below, it is ok, be as creative as you would like with your child!

1. Read the story, “Max Found Two Sticks” with your child. As you read, be sure to discuss what your child sees on each page. While reading, ask questions such as,

What do you think the word rhythm means?

What kinds of rhythms do you hear Max making? Can you make those rhythms?

What do his rhythms remind him of as he plays?

Talk with your child about the story, ask questions such as,

How did Max use his sticks?

Do you hear any rhythms during the day?

How can you use sticks to make different rhythms?

2. Engage in a conversation with your child about patterns and rhythms (*for example, “Sometimes we remember different rhythms because they repeat over and over again. Something that repeats over and over is called a pattern. Can you make a sound pattern like Max made?”*). Play with the rhythm sticks by creating different sound and movement patterns (you can do this in whatever way you would like- hitting the sticks together, using them with other materials to make sounds, or using them in making movements). As your child is playing, encourage them to repeat the rhythms that he/she creates. Ask questions such as,

Can you tell me about your rhythm? How does it repeat? How can you describe that pattern?

What other sound patterns can you make with your sticks?

How are your patterns similar? How are they different?

Continue playing with the rhythm sticks and talking about all of the different patterns you could make. Talk with your child about patterns and how patterns can be made with all kinds of materials (*for example, “We just made some patterns with sound and movement, but a pattern can be made with anything”*). Ask them questions such as,

What kind of patterns can you see in this room?

How do these patterns repeat?

Do you think you could make your own repeating pattern?

PARTICIPANTS N = 9

Parent's name*	Child's name and age*	Years in Head Start/ Early Head Start	Parent's level of education	Number of Siblings
Monika	Jack (4)	3	High School	1
Susan	Treyvonne (4)	3	High School	2
Shelley	Franklin (3)	1	Associates	1
Cynthia	John (4)	2	High School	0
Lucy	Lucas (3)	2	Associates	0
Jackie	Nakita (4)	2	Some College	3
Jacqueline	Jessica (4)	3	Bachelors	2
Natalie	Tony (4)	3	Some College	3
Maggie	Molly (4)	3	Some College	1

*All names are pseudonyms



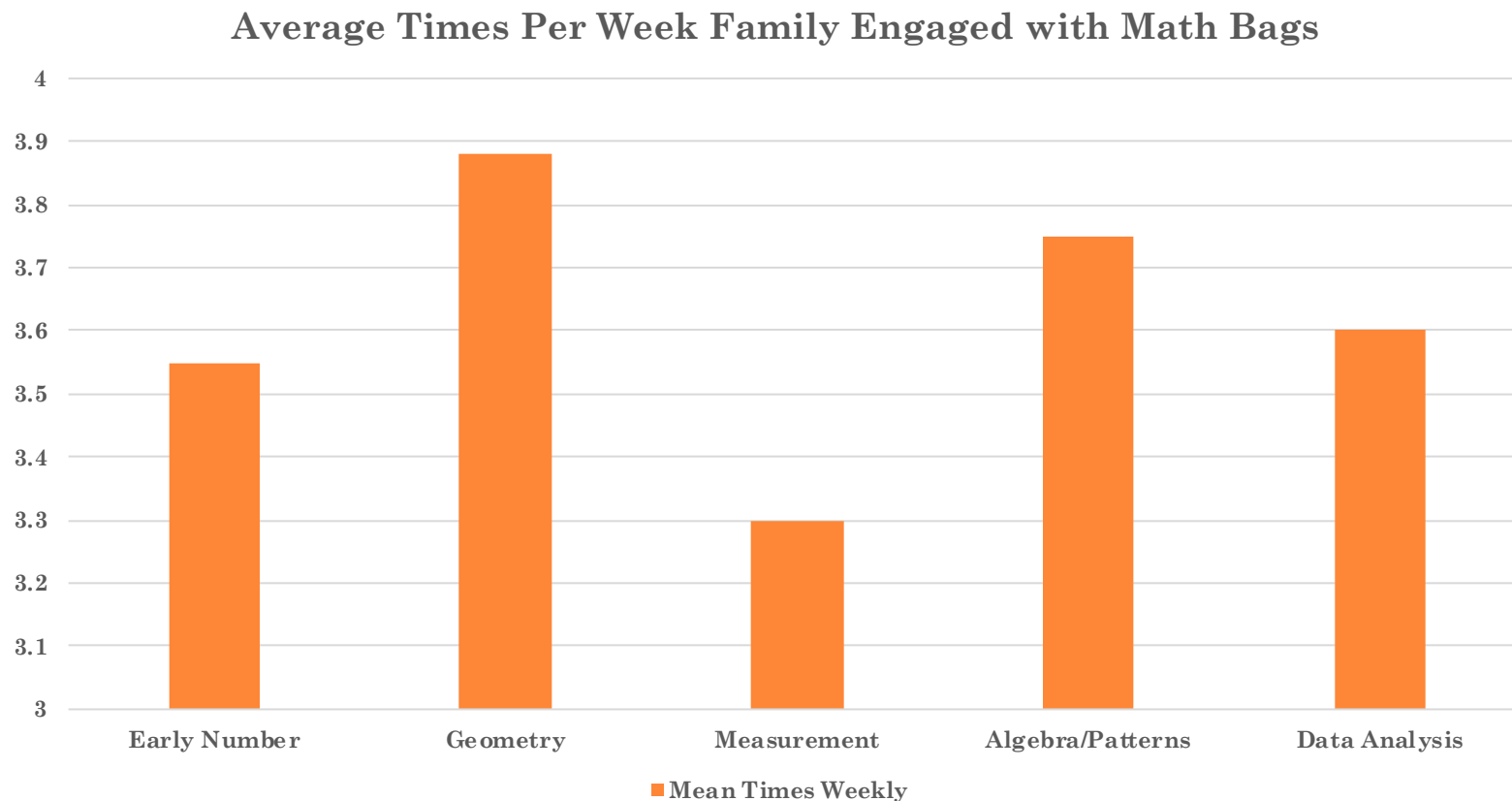
EXAMPLES OF MATHEMATICAL PLAY

- When viewing these videos- think about:
 - How much mathematical talk to you hear?
 - What is the parent's role during play?
 - What is the child's role during play?



RESULTS: FEASIBILITY

- 100% families completed the five-week intervention
- Participants went above the requirement for amount of times to complete each bag



RESULTS: SNAPSHOTS OF PLAY

- Pre and Post Observations: 15 minutes of play
- Pre: 149 mathematical interactions
- Post: 485 mathematical interactions
- Majority of mathematical content (60%) identified in post-observation interactions were related to number concepts such as counting or composing sets.
- Questioning occurrences between parents and children doubled following MathPack intervention (69 versus 138 instances)
 - Repetitions of what their child said (“I ate too much!”, “You ate too much?”) low-level questions geared toward reviewing knowledge they expect their children to know (e.g. letters or colors).



RESULTS: SNAPSHOTS OF PLAY

○ Where to play?

- Pre Observations: Eight parent/child dyads chose to stay in the dramatic play area (kitchen with a pretend stove and refrigerator, a crib with an assortment of baby dolls, and an ironing board)
- Post Observations: Three parent/child dyads stayed in the dramatic play area. Six pairs chose to play in the block area, the puzzle area, or at a table with play dough.

○ What are the roles?

- Pre Observations: Parent standing over the child, often directing their children as they play by telling them what to do next.
- Post Observations: Parent either sitting next to child or laying down on the floor with them while playing. Instead of directing the child, parents began to ask children what they wanted to do,



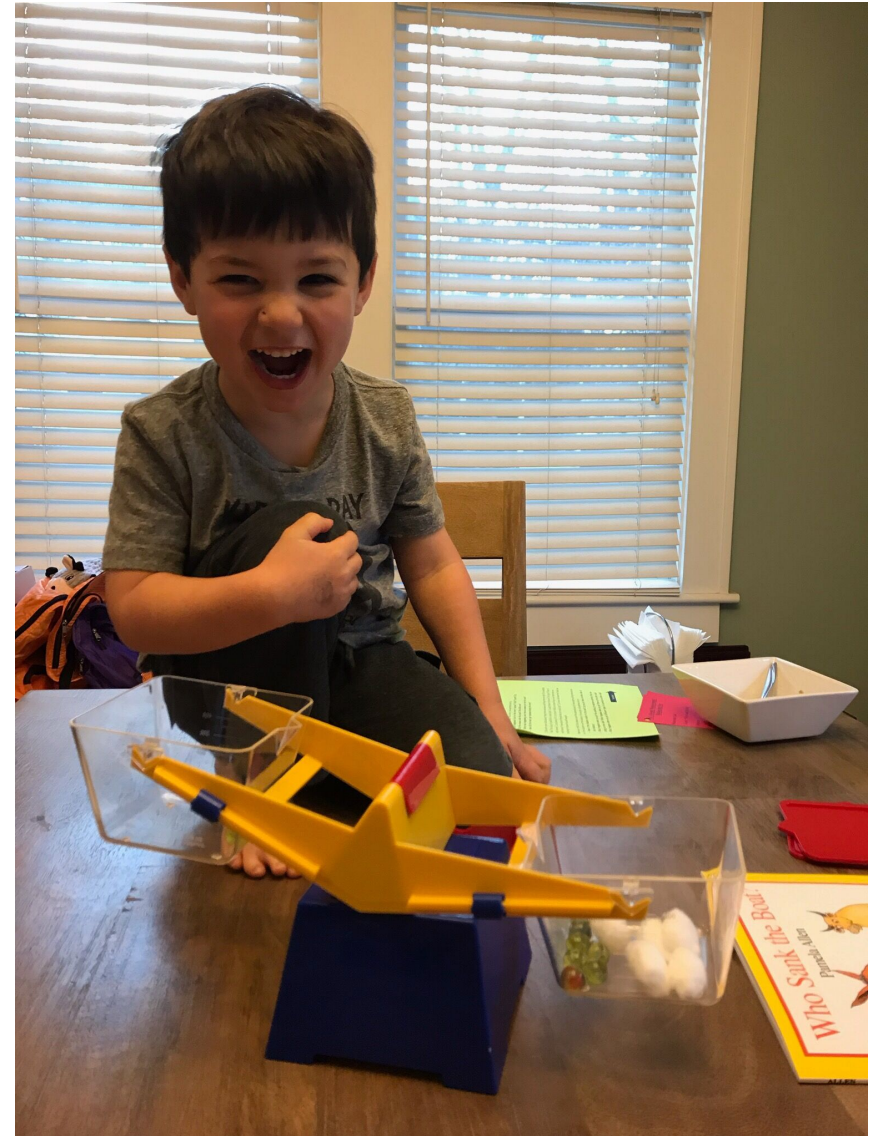
RESULTS: PRE/POST INTERVIEWS

- ***Value of mathematics.*** Future-oriented perspective- useful or valuable for children to understand because they will need it in the future. This view of mathematics did not change in post interviews.
- ***Math is counting.*** Participants described mathematics only in terms of numbers and operations ('counting' or 'adding' or 'subtracting'). While many parents held this definition of mathematics in the post interviews as well, a few parents shifted their definitions to be more encompassing of content and processes related to early mathematics.
- ***Purpose of math play.*** High level of value for engaging in play with their child. They cited various reasons for wanting to play with their child however, post interviews included mathematics centric reasons and examples. Roles also showed a shift in post from director to facilitator
- ***Maintaining balance.*** Lack of time to engage with children in play. Parents cited the flexibility built into the bags and having the tasks readily available as supports in the post interviews. These features seemed to support their efforts to increase math play with their children. Families with older siblings prioritized their time to support the older child discussed how the bags made them realize the importance of prioritizing time for their younger child and cited having the older sibling join them and make connections to what they were doing in school as a way to mediate time issues.



SECONDARY PILOT

- N=85
 - Control group, 5-week treatment group, 10-week treatment group
 - Pre/post snapshots of play
 - Pre/post parent surveys
 - Ongoing feedback surveys
 - Pre/post child interview/assessment (REMA)



PRELIMINARY RESULTS

- Parents across five- and ten-week groups reported playing with MathPacks an average of two to three times per week.
- Ten-week MathPack intervention group showed increased and more substantive (open-ended and process-centered) questioning strategies during snapshots of play when compared to families in the five-week treatment group and the control group.
- REMA indicates children in five- and ten-week groups showed increased understanding of subitizing with numbers under six. Children in ten-week groups also showed increased understanding of simple problems (e.g. You have 7 boxes in your cart. You need 12 boxes. Use these to make sure there are 12) and increased ability to replicate and create simple repeating patterns



PRELIMINARY RESULTS: FEASIBILITY

- Both 5 and 10-week groups felt MathPacks were appropriate for their children and stated that they would like to continue the intervention past the ten-week model (however parents did indicate that receiving packs every week became cumbersome and would rather receive the same amount of content with a smaller amount of packs).
- “It helps because it makes that bridge from home to school and it kind of shows you know what we’re already teaching the children and makes it look like, I guess for a lot of child care, we’re just daycare teachers, but really we’re like teaching children early math skills,” (Teacher participant, 10-week group).
- Teachers mentioned making connection with reading and increase in number awareness, counting skills, and patterns when asked to elaborate on the changes they have seen in their students



SIGNIFICANCE

- Children engage with mathematical thinking throughout their play.
- MathPacks seemed to allow parents to develop strategies to recognize entry points for mathematics interactions within children's everyday play.
- However, increased support may be required to move parents towards translating their understanding of mathematics play to everyday play contexts.



QUESTIONS?

