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Early Childhood Building Blocks

Math Begins in Preschool: Talking the Language of Math

Sally Moomaw
Associate Director for Professional Development
Arlitt Child and Family Research and Education Center, University of Cincinnati

Introduction: Charlie's Train

Charlie was intently hooking Duplo cars together to make a train. He was fascinated with trains, and created them daily from whatever materials he could find. His preschool teacher knelt down beside him and asked, "What will this train carry—people or animals?"

Charlie replied, "People. It's a passenger train."
"What will your train look like if each car has one passenger?" asked his teacher.
Charlie carefully rummaged through a basket of plastic people and placed one person onto each car.
"Wow," said his teacher. "You have one, two, three people. I wonder what your train would look like if each car had two people?"
Once again Charlie reached into the basket. He carefully hooked one more person onto each car.
"Lots!" Charlie exclaimed when he had finished.

This snippet illustrates two important points:

1. Even very young children construct mathematical relationships.
2. Adults can help children form and express these relationships.

Essentially, adults help make mathematical relationships visible to children. As children form concepts, adults help them make sense of these concepts and express them.

What's Inside

Rationale: Playing with Math

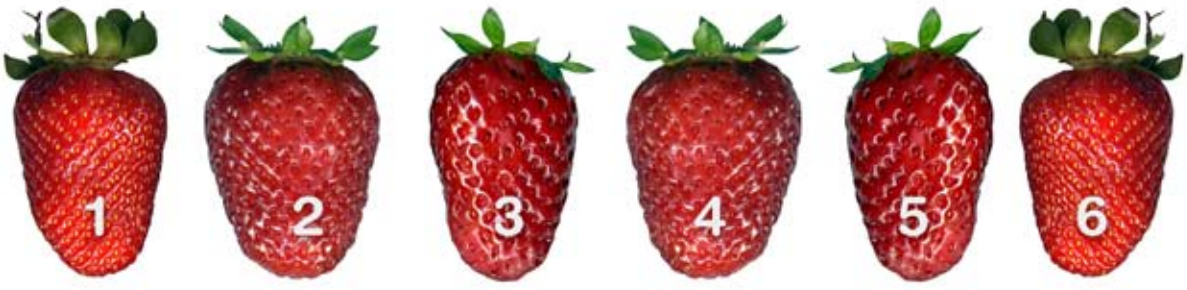
Children form mathematical relationships through their play, but adults often fail to notice this important development. As we observe young children doing what they do best—play—we often don't think about all the wonderful ways that play contributes to children's thinking. When we watch Maria carefully give one plate and one cup to each doll, we might not think about mathematics, but she does. When Andre puts all the pigs in one block pen and all the cows in another, we might not think about mathematics, but he does. When Emma makes a pile of goldfish crackers just like her brother's, we might not think about math, but she does. All these examples show children in the process of constructing important mathematical knowledge. Maria is working on one-to-one correspondence. Andre is sorting and classifying. Emma is beginning to quantify as she attempts to take an amount of crackers that is equivalent to her brother's. These concepts are the foundation for the mathematics that they will study later. Adults play a critical role supporting this early construction of math concepts.

Don't Confuse Counting with Quantification

Counting and quantification are not the same things. Of course, once children fully understand counting, they possess a great tool for quantifying, and a very important one as well. But first they must develop the understanding of what counting means, and they obtain this by having lots of play experiences involving one-to-one correspondence.

Children begin to quantify long before they use counting to do so. Did you know that even babies can quantify? Research indicates that infants can distinguish one object from two and may even quantify to three. Young children initially quantify perceptually. Therefore, if the amount of grapes on Mike's plate looks about the same as the amount of grapes on his friend's plate, he assumes that they have the same amount. As children gain additional experiences, they begin to apply more logic to their mathematical thinking. Specifically, they begin to use the concept of one-to-one correspondence to quantify. For example, Missy knows that if she is allowed to take as many strawberries for snack as there are strawberries on the picture card in front of her, she must take one real strawberry for each strawberry in the picture. She may even set her strawberries on top of the picture to make sure she's right. If Missy thinks Julie took too many, she may line up her strawberries next to Julie's and compare them. At this stage, Missy can take the correct amount of strawberries, but she still isn't counting them to find out how many she has or needs.

Eventually children learn that when they count, the last number they say is how many they have. At this point, they can count to find out how many they have or how many they need. Of course, prior to this, children often do a lot of counting. They may recite strings of number words, often in the correct order, but they don't know what this really means. They need time and experience to be able to combine this knowledge of counting words with the concepts of one-to-one correspondence and quantification.



Example: Talking the Language of Math

Adults can help children better understand the mathematical concepts they form during play by using "math talk." Math talk simply means talking about relationships:

- Does the brown teddy bear have as many cookies as the black teddy bear?
- How many people can fit in your boat?
- What would happen if one duck swam away?
- Do you have enough blocks to put one elephant on each block?

This type of "math talk" helps children focus on particular relationships that they construct through their play. Notice that the questions relate directly to the child's play. No one wants to be quizzed all the time out of context (e.g., Count the bears for me. How many do you have? How many is that?). What children want is for adults to join in and appreciate their play. Comments and questions that relate to their play stimulate children's thinking, help them visualize math problems, and teach them how to communicate mathematical ideas.

Math Standards Help Link Play to Concepts and Math Language

Mathematics standards arose out of the combined attempt by early childhood professionals and mathematics educators to help adults understand how young children think. Since we know that children construct key math concepts through their interactions with real materials and with other people, it should come as no surprise that math standards also align well with these events. The scenarios on page 4 show how events from daily life, enhanced by interactions with adults or other children, contribute to children's understanding of mathematics as found in some of the math content standards and age-related indicators.

Scenario #1

Katy and Jody loved playing with the zoo animals in the block area.
"Look," said Katy. "I made an island for each seal."
"Wait," replied Jody. "The zookeeper is bringing a fish for each seal." Jody pretended to give a toy fish to each seal.
"These 2 seals ate their fish and are swimming away," said Katy, moving them off their blocks. "These 3 are still hungry."

Math Standard Indicators

- Say number names when counting.
- Demonstrate 1:1 correspondence.
- Construct 2 sets, each with the same number of objects.
- Determine "how many" in sets of 5 or less.
- Compare sets of equal, more, or fewer.
- Group and regroup a given set.
- Use play to model a simple problem.

Scenario #2

Joey and Mark hooked a long row of linking blocks together.
"It's a python!" shouted Mark.
"It's big!" noted Joey. "How long is it?"
"Bring some chairs over," suggested Mark.
The boys were quiet as they lined up chairs under their python.
"How long is it?" asked the teacher.
"1, 2, 3, 4, 5, 6, 7, 8, 9, 10 chairs," counted the boys.
The teacher showed them how to write "10," and Joey copied it onto a sign.

Math Standard Indicators

- Count to 10 in the context of play.
- Say the number names when counting.
- Determine "how many."
- Represent quantity.
- Write numerical representations.
- Identify numerals.
- Attempt to solve problems.
- Measure using non-standard units.
- Use terms to compare attributes (e.g., big).

Scenario #3

Ken, Angi, and Sara pawed through a button collection.
"I'm taking all the big buttons," said Sara.
"Wait, you can't take that one," said Ken. "It's square, and I get all the square ones."
"What about these?" asked Angi, holding up a large button that looked like a ball and a small cube-shaped button with an "S" on it.
"I get the square," said Ken, pointing to the cube.
"It's really a box," said Angi.
Sara added, "I should get it because it has an S for Sara."
"OK," decided Angi. "Sara gets the box because it has an S. Ken can have this box (another cube-shaped button) because a box is like a square, and I get the ball because I'm collecting the circles."

Math Standard Indicators

- Match 2- and 3-dimensional objects.
- Sort similar 2- and 3-dimensional objects.
- Identify common 2-dimensional shapes.
- Describe 3-dimensional objects.
- Sort and classify objects by one attribute.
- Compare objects by similarities and differences.

Conclusion

Forget any math phobias you may have. For young children, math is fun and exciting. They enjoy putting objects into all kinds of relationships— e.g., biggest to smallest, aligned in rows, matched by color or shape, equally divided. Children like to talk about these concepts, too. Join in the excitement as you help children form these mathematical relationships.

Early Learning Content Standards

Pre-K Indicators	Kindergarten Indicators	Grade 1 Indicators	Grade 2 Indicators
Number, Number Sense and Operations Standard			
Pre-K–2 Benchmark **B. Recognize, classify, compare and order whole numbers**			
• Compare and order whole number up to 5. • Compare sets of equal, more and fewer and use the language of comparison.	• Compare and order whole numbers up to 10. • Compare the number of objects in two or more sets when one set has one or two more or one or two fewer objects. • Recognize the number or quantity of sets up to 5 without counting.	• Use ordinal numbers to order objects. • Recognize and generate equivalent forms for the same number using physical models, words and number expressions. • Count forward to 100, count backwards from 100, count forward or backward starting at any number between 1 and 100. • Demonstrate that equal means "the same as" using visual representations.	• Use place value concepts to represent, compare and order whole numbers using physical models, numerals and words, with ones, tens and hundreds. • Recognize and classify numbers as even or odd.
Pre-K–2 Benchmark **F. Count, using numerals and ordinal numbers.**			
• Touch objects and say the number names when counting in the context of daily activities of play. • Demonstrate one-to-one correspondence when counting objects. • Count to ten in the context of daily activities and play. • Determine "how many" in sets of five or fewer objects.	• Explain rules of counting, such as each object should be counted once and the order does not change the number. • Count to twenty. •Determine "how many" in sets (groups) of 10 or fewer objects.	• Count forward to 100, count backward from 100, and count forward or backward starting at any number between 1 and 100.	
Pre-K–2 Benchmark **G. Model, represent and explain as combining sets and counting on.**			
• Group and regroup a given set in the context of daily activities and play. • Construct sets with more or fewer objects than a given set. • Count on (forward) using objects such as cards, number cubes or dominoes that have familiar dot patterns.	• Represent and use whole numbers in flexible ways, including relating, composing and decomposing numbers. • Model and represent addition as combining sets and counting on and subtraction as take-away and comparison.	• Model, represent and explain addition as combining sets (part + part = whole) and counting on. • Use conventional symbols to represent the operations of addition and subtraction.	
Pre-K–2 Benchmark **I. Model, represent and explain multiplication as repeated addition, rectagular arrays and skip counting.**			
• Construct two sets of objects each containing the same number of objects. • Join two sets of objects to make one large set in the context of daily routines and play.	• Construct multiple sets of objects each containing the same number of objects. • Demonstrate joining multiple groups of objects each containing the same number of objects.	• Model and represent multiplication as repeated addition and rectangular arrays in contextual situations.	• Model, represent and explain multiplication as repeated addition and rectangular arrays and skip counting.
Measurement Standard			
Pre-K–2 Benchmark **B. Select appropriate unites for length, weight, volume (capacity) and time, using: 1) objects; i.e., non-standard unites; 2) U.S. customary units: inch, foot, yard, ounce, pound, cup, quart, gallon, minute, hour, day, week, and year; 3) metric units: centimeter, meter, gram and liter.**			
• Begin to identify and use the language of units of time. • Recognize that various devices measure time. • Begin to use terms to compare the attributes of objects. • Order a set of objects according to size weight or length.	• Identify units of time (day, week, month, year) and compare calendar elements. • Compare and order objects of different lengths, areas, weights, and capacities; and use terms such as longer, shorter, bigger, smaller, heavier, lighter, more and less.		• Identify and select appropriate units of measure for: a. length – centimeters, meters, inches, feet, or yards; b. volume (capacity) – liters, cups, pints, or quarts; c. weight – grams, ounces, or pounds; d. time – hours, half-hours, quarter-hours, or minutes and time designations a.m. or p.m..

Early Learning Content Standards

Pre-K Indicators	Kindergarten Indicators	Grade 1 Indicators	Grade 2 Indicators
Measurement Standard			
Pre-K–2 Benchmark **D. Apply measurement techniques to measure length, weight, and volume (capacity).**			
• Measure length and volume (capacity) using non-standard units of measure.	• Measure length and volume (capacity) using uniform objects in the environment.	• Estimate and measure weight using non-standards units. • Estimate and measure lengths using non-standard and standard units.	• Estimate and measure the length and weight of common objects, using metric and U.S. customary units, accurate to the nearest unit. • Select and use appropriate measurement tools.
Geometry and Spatial Sense Standard			
Pre-K–2 Benchmark **C. Sort and compare two-dimensional figures and three-dimensional objects according to their characteristics and properties**			
• Match identical two- and three-dimensional objects. • Sort and classify similar two- and three-dimensional shapes. • Identify, name, create and describe common two-dimensional shapes. • Identify, name and describe three-dimensional objects using the child's own vocabulary.	• Identify and sort two- dimensional shapes and three- dimensional objects.	• Identify, compare, and sort two-dimensional shapes.	• Identify, describe, compare, and sort three-dimensional objects (i.e., cubes, spheres, prisms, cones, cylinders and pyramids) according to the shape of the faces or the number of faces, edges or vertices.
Patterns, Functions and Algebra Standard			
Pre-K–2 Benchmark **A. Sort, classify and order objects by size, number, and other properties and describe the attributes used.**			
• Sort, order and classify objects by one attribute.	• Sort, classify and order objects by size, number and other properties.	• Sort, classify and order objects by two or more attributes such as color and shape, and explain how objects were sorted.	
Pre-K–2 Benchmark **A. Model problem situations using objects, pictures, tables, numbers, letters, and other symbols.**			
• Use play, physical materials or drawings to model a simple problem	• Model a problem situation using physical materials	• Describe orally and model a problem situation using words, objects or number phrase or sentence.	• Use objects, pictures, numbers and other symbols to represent a problem situation.
Data Analysis & Probability Standard			
Pre-K–2 Benchmark **A. Pose questions and gather data about everyday situations and familiar objects.**			
• Gather, sort and compare objects by similarities and differences in the context of daily activities and play.	• Gather and sort data in response to questions posed by teacher and students.	• Construct a question that can be answered by using information from a graph.	• Pose questions, use observations, interviews and surveys to collect data and organize data in charts, pictures graphs and bar graphs. • Recognize that data may vary form

About the Author

Sally Moomaw is the Associate Director for Professional Development at the Arlitt Child and Family Research and Education Center and a clinical faculty member at the University of Cincinnati. Sally earned a Bachelor of Music Degree and a Master's Degree in Child Development, both from the University of Cincinnati, and is currently working on a doctorate in special education. She taught preschool and kindergarten children in inclusive classrooms at the Arlitt Center for 22 years. Sally is the author or coauthor of nine books, including *Lessons from Turtle Island: Native Curriculum in Early Childhood Programs*, which won the Gustavus Meyers Outstanding Book Award for the study of bigotry and human rights. She created the Ohio Department of Education Mathematics Tool Kit to help preschool teachers implement state content standards and has served as a faculty member for nationally televised broadcasts, including *Heads-Up Reading*. Her research interests include early mathematics development and social justice.

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For more information

Contact Nancy Brannon at nbrannon@ohiorc. org or Nicole Luthy at nluthy@ohiorc.org. Visit http://rec.ohiorc.org to see the REC website. Also see other Early Childhood Building Blocks.

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