THE NATIONAL CENTER ON
Quality Teaching
and Learning

MATHEMATICS AND THE PRESCHOOL CHILD

HIGH FIVE MATHEMATIZE

Created using materials from *High Five Mathematize*
Developed by the National Head Start Family Literacy Center

NCQTL

It's More than Counting Bears – Culture Counts

NORTH WEST INDIAN HEAD START COALITION TRAINING CONFERENCE August 2017

Math Bingo

- Math Bingo is a great resource to be used with teachers and parents to see how math is used in every day life.

Objectives

- Define Math
- Examine the different math concepts and skills
- Discuss why math matters
- Strengthen teaching staff's skills in recognizing and building on/"mathematizing" everyday culturally appropriate mathematical learning opportunities
- Identify opportunities for mathematics learning experiences in early childhood classrooms and daily routines,

What are your Math memories?

- Close your eyes. Think back to your childhood days or “school days” and recall your experiences with math. What do you remember? What feelings do you associate with math?
- Turn to a neighbor and share your experiences.
- Do you think your personal experiences with math influence your teaching practices? In what ways?

Sharing Activity

- Ways you create math culturally appropriate activities?
- How do you use culture and math throughout the day?
- How do you engage children in problem solving?

THE IMPORTANCE OF EARLY CHILDHOOD MATHEMATICS

- There is a significant math gap at kindergarten entry for low income children (Denton & West, 2002).

- Early math skills in kindergarten predicted 5th grade achievement in math and AND reading (Claessens, Duncan & Engle, 2006).

- Mathematical ideas are in children's play and everyday experiences in the culture.
- Young children develop some math concepts through self-guided discoveries.
- Adult support is essential to maximize learning – to move mathematical development along.

Math is a developmental sequence

- ***When children are allowed to explore many objects*** they begin to recognize similarities and differences of objects.
- ***As children begin to recognize similarities and differences***, they can classify objects.
- ***When children are able to classify objects*, they can see similarities and differences well enough to recognize patterns**

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- ***When children can recognize patterns*, copy and create patterns, they can arrange sets in a one to one relationship.**
- ***When children can match objects one to one*, they can compare sets to determine which have more and which have less.**

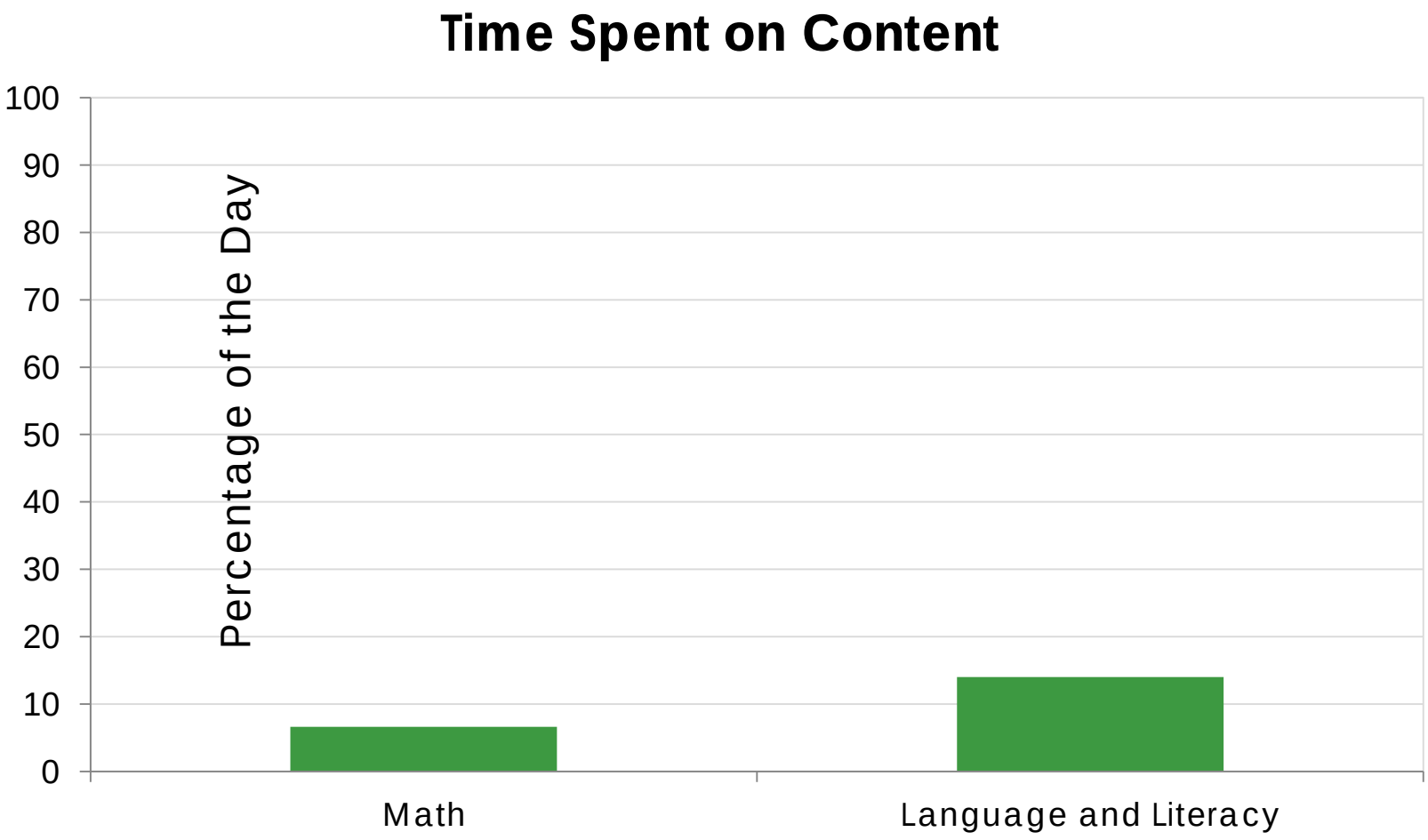
SO, WHY DOES EARLY MATH MATTER?

When children master math skills early on, they have a strong foundation for ongoing and more complex math learning.

Children's early math skills predict **BOTH** their later math and reading skills in grade 3!


BUT
THERE ARE CHALLENGES TO EARLY MATH LEARNING

WHAT DOES THE CHALLENGE LOOK LIKE IN CLASSROOMS?




A more focused approach


SUPPORTING
EARLY MATH

SUPPORTING YOUNG MATHEMATICIANS: PROVIDE MATERIALS!

Provide children with materials that support mathematical exploration and play with children when they use these materials.

Take note of children's math learning and think of new activities and materials that will challenge them.

MATHEMATIZE

Definition: to bring out the math in what children are doing (commenting, questi

- Example:

Whee! Look how fast the ball rolls down the slide.

You stayed up and the ball went down!

Which slides down faster – a ball or a boy? Why does the ball go so fast?

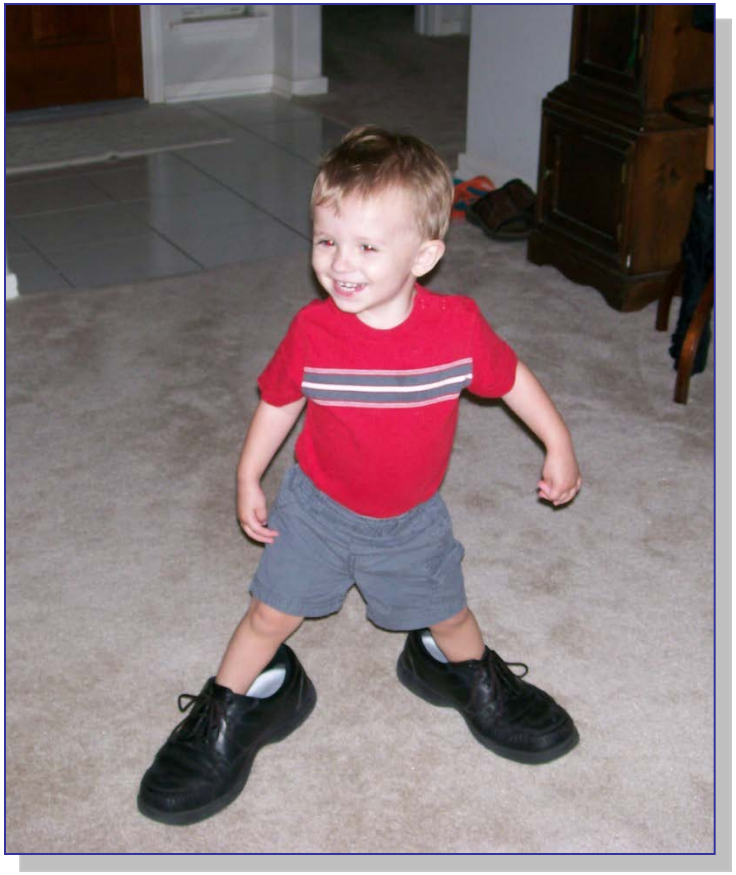
Math Connections

- Shape (geometry)
- Spatial concepts: up, down
- Speed, comparing (measurement)

Adults mathematize children's experiences when they:

- emphasize math concepts and relations
- use mathematical language
- make comments, ask and answer questions, and pose math-related problems
- provide a variety of materials and tools for exploration of math ideas

Mathematize Example: In Daddy's Shoes



Those shoes are so BIG and so LONG!

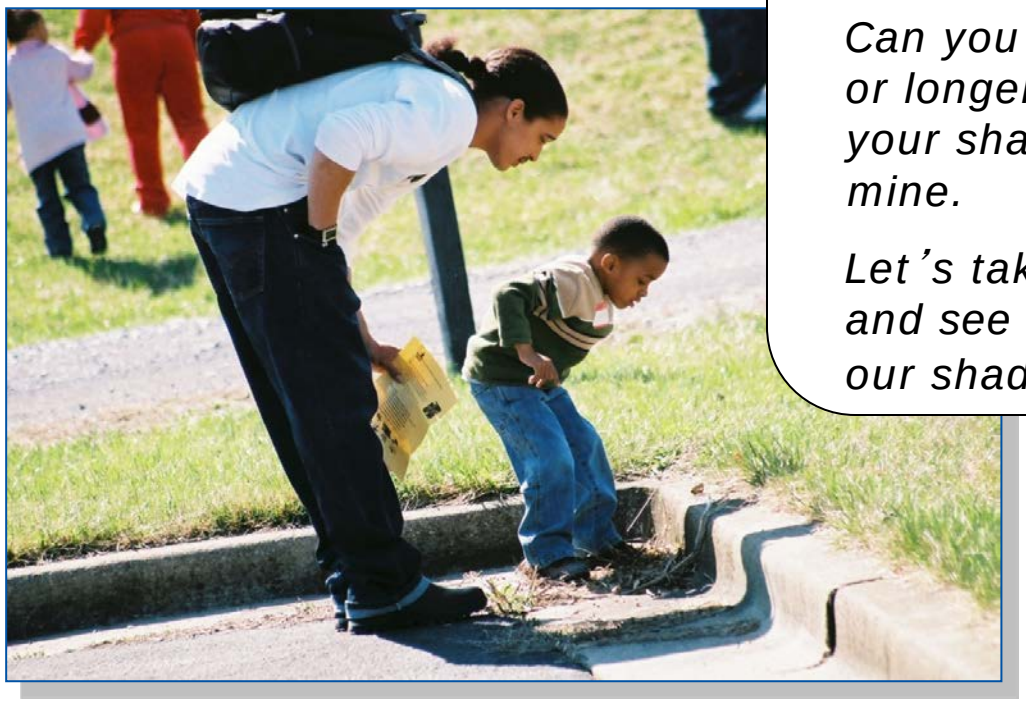
They are much bigger than your little feet!

How far can you walk in Daddy's shoes?

Math Connections

- Size: big, little, long (measurement)
- Comparing two objects: feet and shoes
- Distance

MATHEMATIZE EXAMPLE: DISCOVERING SHADOWS



How long is your shadow?

Can you make it shorter or longer? Try to make your shadow as long as mine.

Let's take five steps back and see what happens to our shadows.

Math Connections

- Size, comparing: longer, shorter (measurement)
- Number
- Problem solving

MATHEMATIZE EXAMPLE: BUILDING WITH BLOCKS

Tell me how you chose the blocks for your structure.

I noticed that you used a long, flat block on the bottom.

How did you make the two sides look the same?

Math Connections

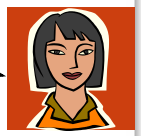
- Sorting, matching
- Shape, spatial relations (geometry)
- Symmetry (patterns)

MATHEMATIZE EXAMPLE: SINGING WITH FRIENDS

Listen to the pattern as I clap. Clap-clap, clap-clap.

"Five little monkeys jumpin' on the bed!" What comes next?

Oh, no! Another monkey fell off. How many are left?



Math Connections

- Repeating lyrics and movements, rhythms (patterns)
- Number words
- Counting backwards

MATH AREAS

- Numbers and Operations
- Geometry & Spatial Sense
- Patterns
- Measurement

NUMBERS AND OPERATIONS

COUNTING OBJECTS

In preschool children's counting skills improve when they…

- Count small groups and label them with numbers
- Compare groups of objects to determine which has more
- Share evenly with friends

WHAT ARE CHILDREN LEARNING?

- Subitizing
  - To look at a small group of objects and automatically know how many there are without counting

- Cardinality
  - Knowing that the last number counted gives the total number of objects in the group. Answers the question of “how many?”

WHAT ARE CHILDREN LEARNING?

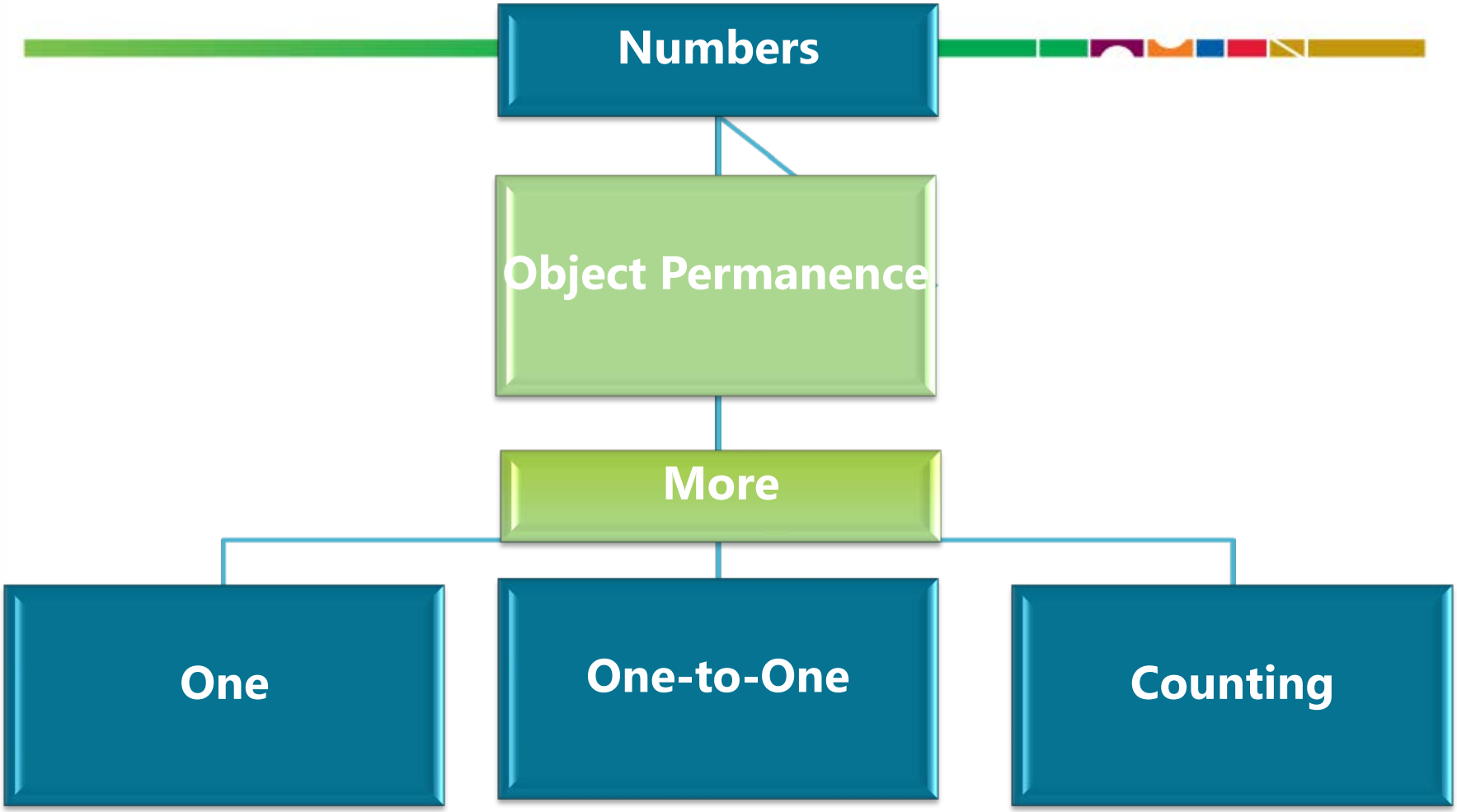
- One-to-One Correspondence
  - Matching one and only one number word to each object

- Combining and Separating
  - Refers to adding, subtracting, multiplying or dividing objects

Examples:

- "How many would you have if I gave you one more?"
- "I have three graham crackers but if I eat one, how many will I have left?"

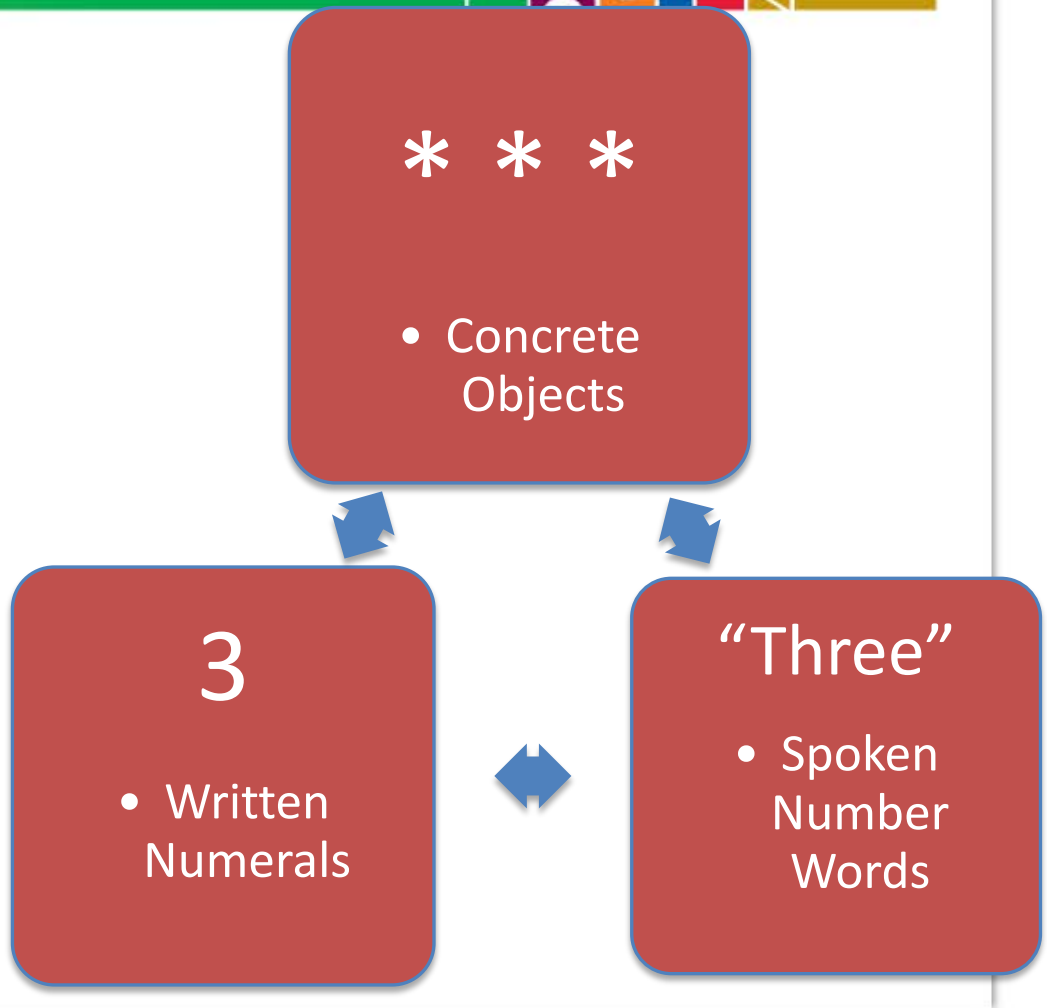
Fundamental Concepts - Numbers



REPRESENTING NUMBER

Help children learn to connect:

- Concrete Objects
- Spoken Words
- Symbols, like dots or tally marks
- Written numerals



Video

DEVELOPING NUMBER AND OPERATION CONCEPTS

- Provide engaging materials for children to count and compare
- Engage children in finger plays that involve counting
- Model counting and take advantage of times to count throughout the day
- Use the question “how many” to encourage children to count, compare, and talk about quantity
- Model and teach counting strategies, such as touching objects, lining up objects, pulling each object to the side after it is counted
- Pose problems involving number, for example, “How many counting bears are in your cup?” and “If you give me one, how many will you have?”
- Encourage children to write numbers that are meaningful, such as their age, how many siblings they have, how many days until grandma visits
- Provide materials to play games, such as cards, dominos, dice, and books

Numeracy activity

- At your table use your materials to practice number and operation concepts.

GEOMETRY AND SPATIAL SENSE

During the preschool years, children learn to…

- Name common 2-D and 3-D shapes
- Identify shapes by their attributes
- Develop spatial sense
  - Building with blocks
  - Working puzzles
  - Climbing
  - Playing ball with a friend

GEOMETRY IS ABOUT . . .

points

lines

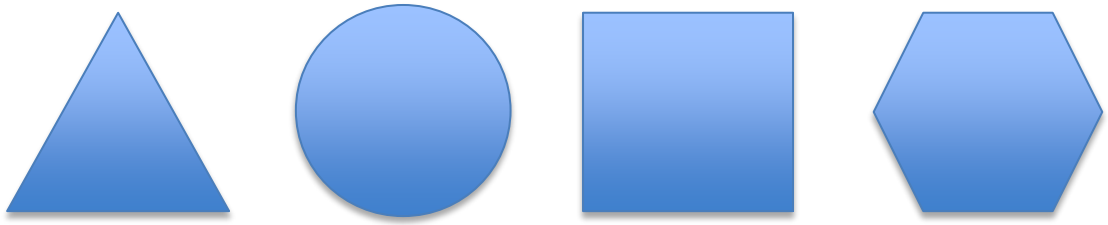
angles

surfaces

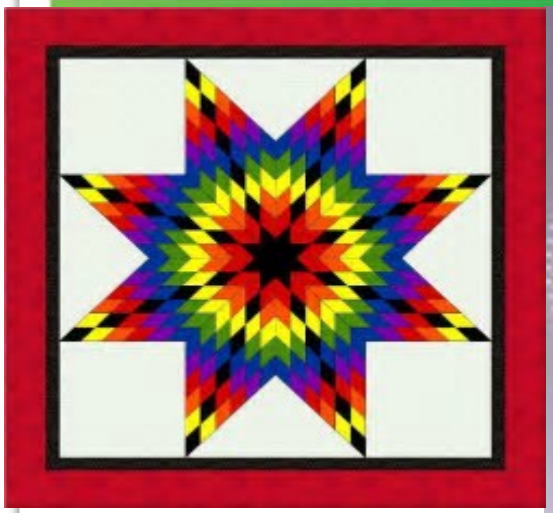
solids

WHAT ARE CHILDREN LEARNING?

- Recognizing and Naming Shapes
- Two-Dimensional Shapes
  - Have height and width, but no depth



- Three-Dimensional Shapes
  - Have height, width, and depth
  - Have faces, edges, and corners (or vertices)

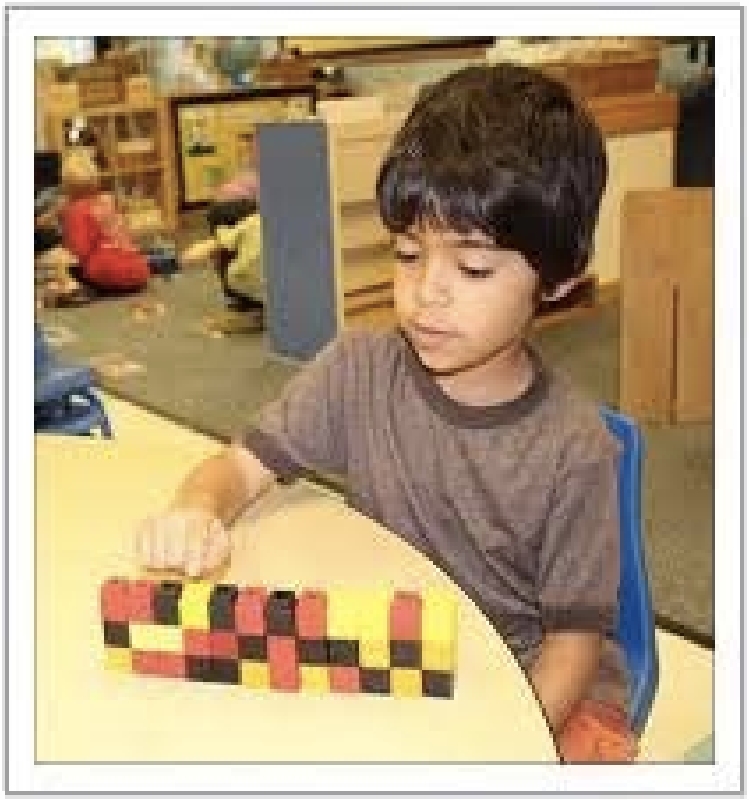


Spatial Relationship

- Up
- Down
- Beside
- Near
- Far
- Next
- After
- In front of

What are some of the math processing skills?

- Problem Solving
- Reasoning
- Communicating
- Representing
- Connecting

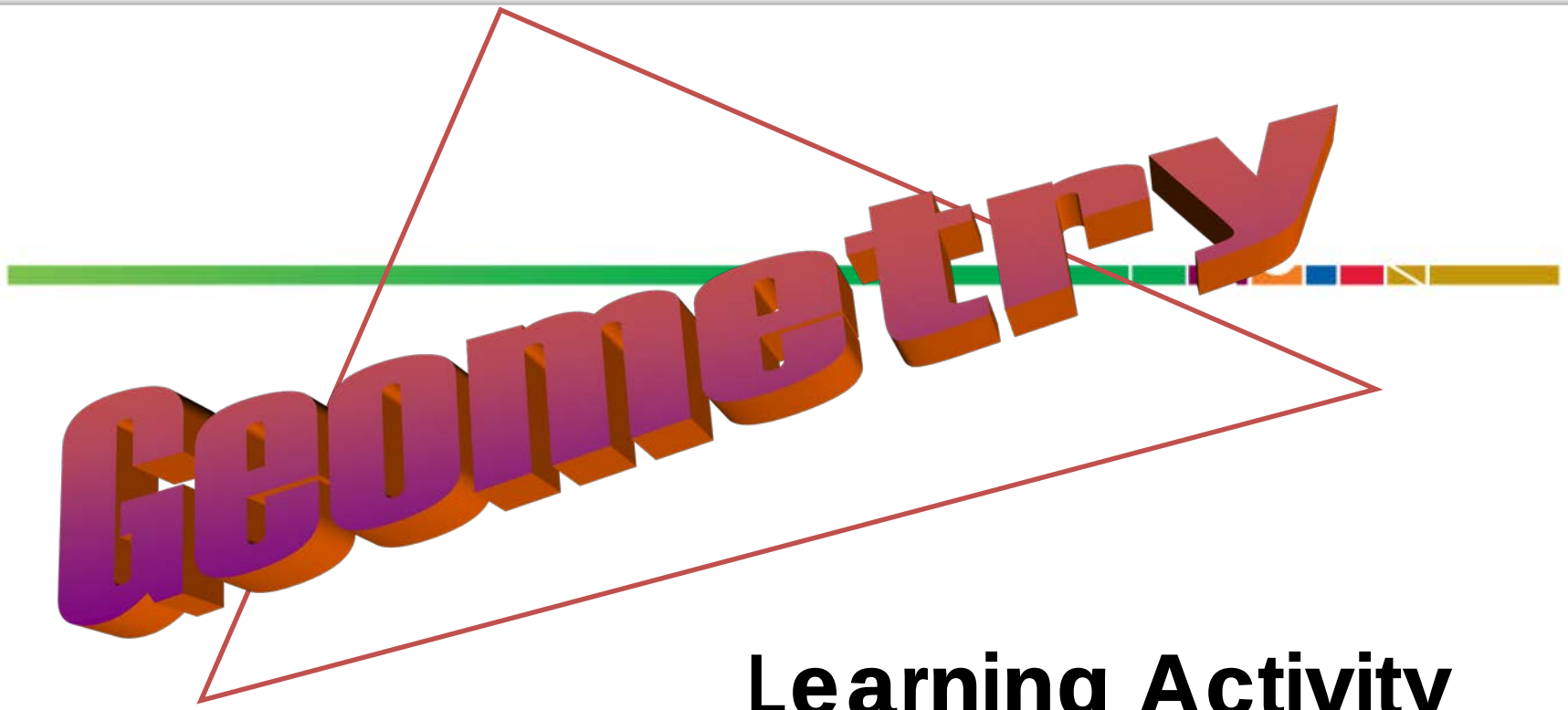


Problem solving

- Problem solving is key to helping children develop mathematical understandings.
- There are numerous ways to solve a problem. Some problems can have more than one answer.
- Expand on children's natural ability to solve problems.
  - Use routines and daily activities to teach problem solving
  - Use open-ended questions and comments

WHAT ARE CHILDREN LEARNING?

- Geometric and Shape Attributes
  - Length of sides
  - Number of sides
  - Size of angles
  - Number of angles
  - Two versus three dimensions
  - Curved or straight lines
  - Diameter, radius and circumference for curvilinear shapes, like circles or spheres

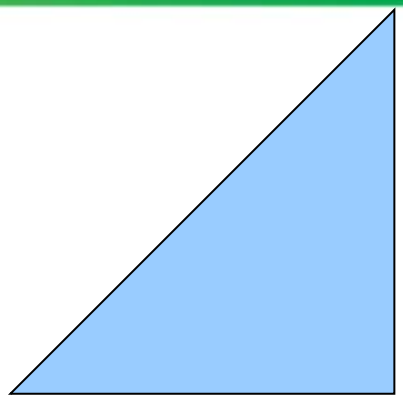


Learning Activity

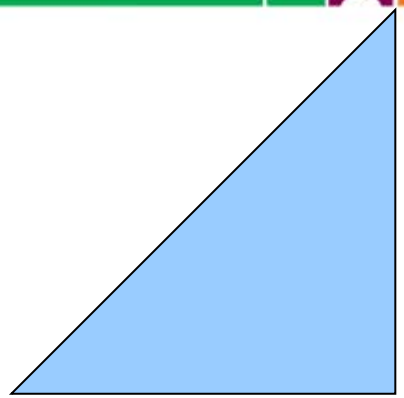
Get ready for a hands-on experience making shapes with Wooden Pattern Blocks!

MAKE SHAPES BY PUTTING TWO OR MORE PIECES TOGETHER.

- Use your wooden pattern blocks to compose new shapes.
  - Put the shapes together in different combinations by sliding, rotating (turning), or flipping them. Take them apart and start again.
- Challenge yourself!
  - See how many different shapes you can make using just one shape.
  - Try to make at least **5 different** rectangles using a combination of similar and different shapes.

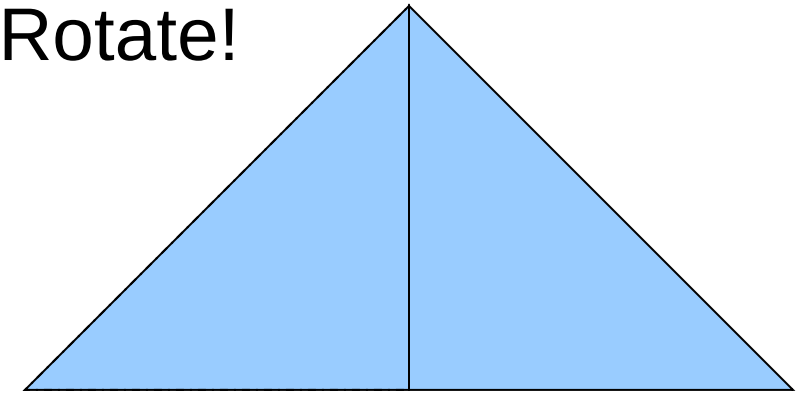


Slide!



Rotate!

Young children learn to manipulate shapes using these transformations, too! You can observe this when you watch them match shapes in a shape sorter, work puzzles, and create designs, patterns, and constructions with blocks or 2-D shapes.



Flip!

Fundamental Concepts – Geometry and Shapes

Matching

Stacking

Photos courtesy of EHS NRC

DEVELOPING GEOMETRY AND SPATIAL SENSE CONCEPTS

- Help children notice attributes of shapes such as number of sides and corners, curved versus straight lines, etc.
- Provide examples of 2-D shapes that are irregular or in different orientations so children can expand their thinking about shapes
- Provide opportunities to put together and take apart different shapes
- Plan experiences that encourage children to move their bodies through space in a variety of ways (obstacle courses, acting like different animals, “Going on A Bear Hunt, etc.)
- Talk with children about:
  - Similarities and differences between 2-D and 3-D shapes
  - How to figure out where a puzzle piece fits
  - What they are doing and where things are using descriptive language

PATTERNS

- Preschoolers need opportunities to engage in a variety of experiences with pattern (music, movement, art, stories, blocks).
- Through these experiences, they learn to recognize and reproduce patterns that they hear or see and even create their own patterns.

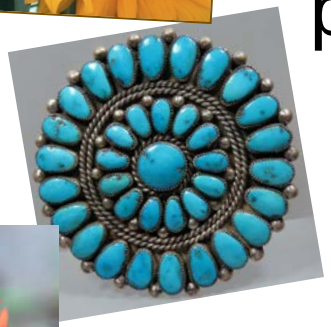
WHAT IS A PATTERN?

A pattern is a regular and predictable arrangement of things.

- **Regular** means that the arrangement occurs in a consistent way—in a repeating or growing manner.
- **Predictable** means that after the pattern is established, you can figure out what comes next.

WHAT CAN MAKE A PATTERN?



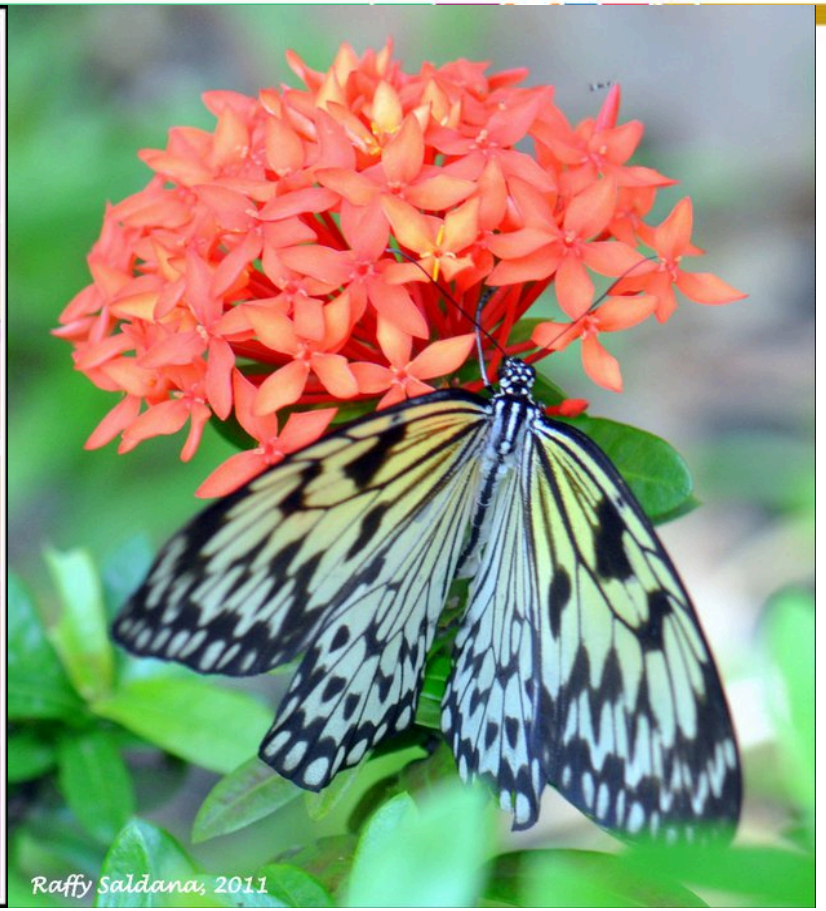



Many things can make a pattern:

- Objects
- Actions
- Sounds
- Images
- Numbers
- Events

Patterns are everywhere!

Patterns can be seen in Nature



Fundamental Concepts – Pattern, Reasoning, Algebra

Sorting

Classification

Patterns

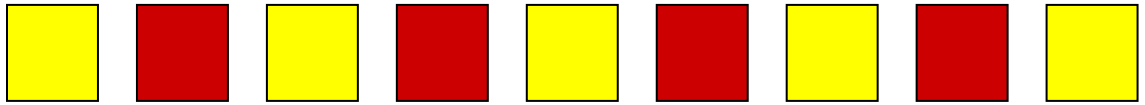
Sequence

Seriation

Photo courtesy of EHS NRC

REPEATING PATTERNS

Repeating patterns replicate a certain sequence (core unit) again and again.

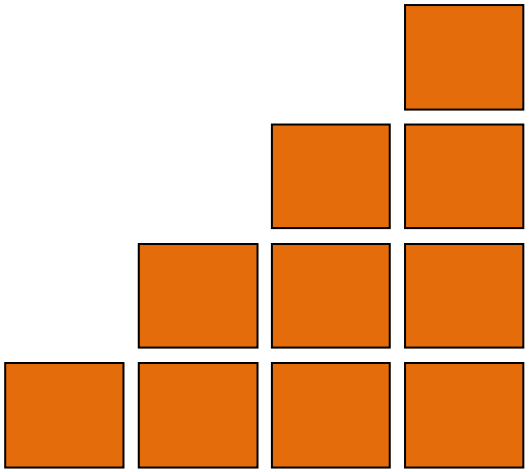


This girl made an ABBABB pattern. The repeating sequence is “blue ring, red ring, red ring.”

GROWING PATTERNS

Growing patterns change from one value to another in a predictable way. This often involves a change in number, as in the patterns pictured below.

This boy made a type of growing pattern by arranging sand dollars in order of size.

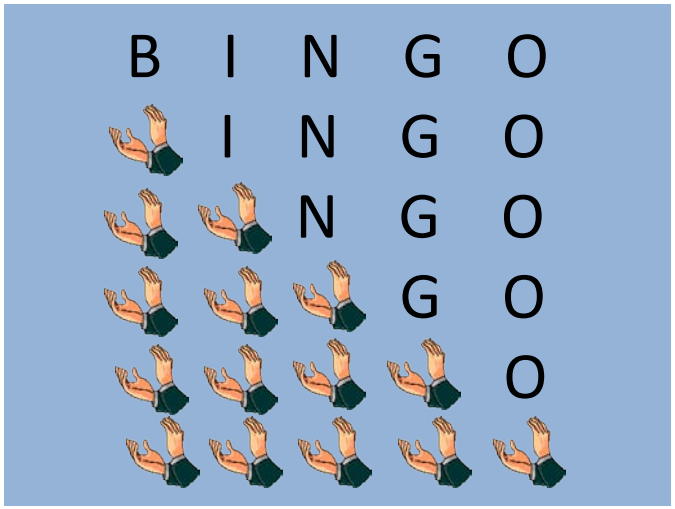


Seriation
a type of classifying and patterning, requires objects to be arranged in an increasing or decreasing order

PATTERNING SKILLS

Children learn about patterns by working with them. **Through a multitude of experiences** they learn to do the following with patterns:

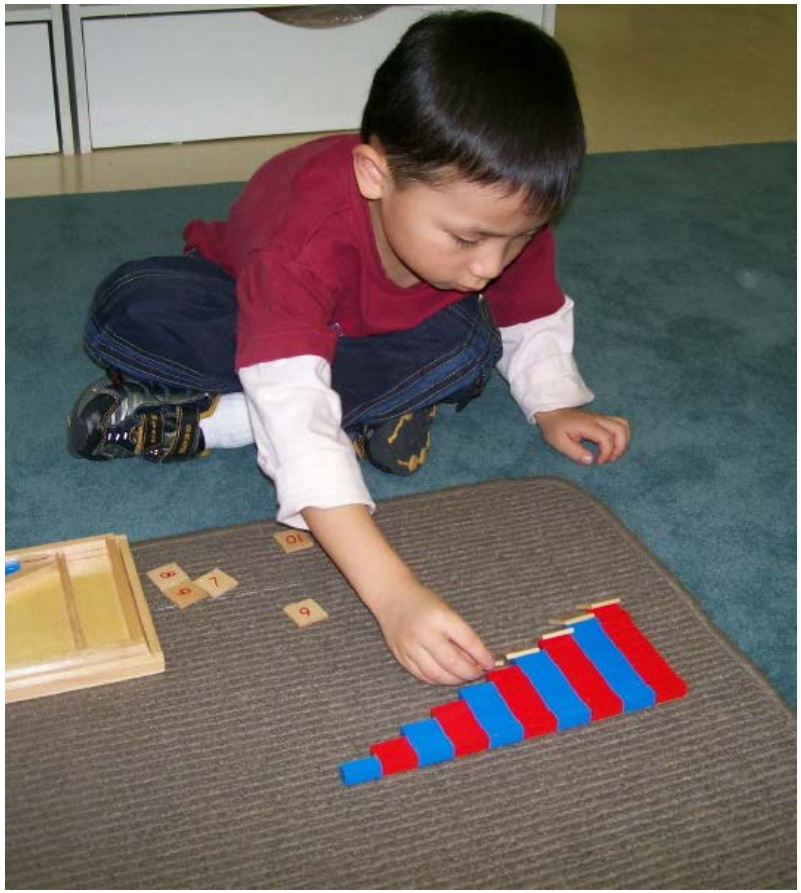
- Recognize
- Copy
- Describe
- Create
- Extend



DEVELOPING PATTERN CONCEPTS

- Provide opportunities for children to sort or arrange items like lids, buttons, or toy animals by an attribute, such as color of lids, number of holes in buttons, where animals live
- Create patterns with children and encourage them to make and describe their own patterns
- Plan for patterning not only with physical objects, but choose songs, stories, and games that involve patterns
- Talk about the regular, predictable parts of the school day and ask what comes next
- Represent movement, object, or sound patterns with pictures or symbols

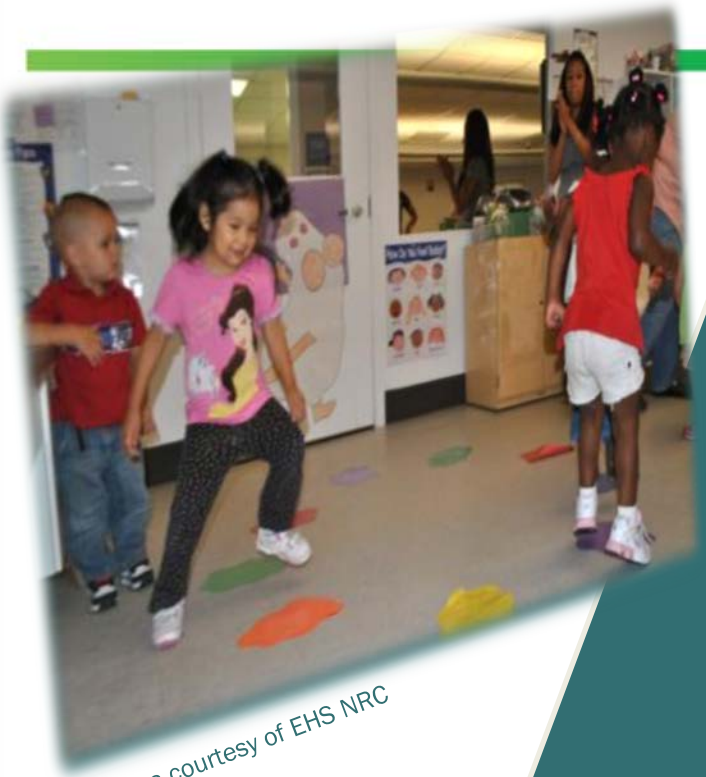
PATTERNING: ACTIVITY TIME



- Create a pattern using the materials at your table
- Once complete explain your pattern another person at your table, include what type of pattern it is and how you created it
- Write down and share ways you are going to incorporate more patterns into your classroom

MEASUREMENT

Fundamental Concepts - Measurement



Photos courtesy of EHS NRC

- Distance
- Measurement
- Size Comparison

Young children's understanding of measurement is grounded in their real-life experiences.

- A child plays with rocks in the science center and says, "This rock is so heavy!"
- Children in the dramatic play area discuss family roles based on size, "You are the baby because you're smaller. I'm the mommy because I'm bigger."
- During lunch time, children talk about differences in amounts of food on their plates and how much milk they have.

WHAT CHILDREN ARE LEARNING

- **Length, Height, Width, and Area**
  - **Enjoy measuring distances and area using non-standard measurement tools, such as lengths of string, links, own hands.**
  - **Benefit from opportunities to explore standard measurement tools, such as measuring tapes, rulers, and scales.**
  - **Lots of practice and experimentation!!**

WHAT CHILDREN ARE LEARNING

- **Weight**
  - **Intrigued by the differences in weights of objects that are similar in size.**
  - **Plan experiences that allow children to make comparisons.**
  - **Provide opportunities for exploration**
    - **Example: A balance scale and many objects of different weights**

WHAT CHILDREN ARE LEARNING

- **Volume and Capacity**
  - **Children often experience volume and capacity in their play.**
  - **Capacity- how much a container can hold**
  - **Volume- the space that a solid object or liquid takes up**

WHAT CHILDREN ARE LEARNING

- **Time**
  - **Children think of time in terms of their own experiences**
  - **Time is an abstract idea for preschool children**
  - **Explain time in a meaningful manner**
    - **Example:**
      - **Child-friendly daily schedule**
      - **Consistent transitions (2 min warnings)**
      - **Discuss past and future events, “when I was a baby”, “when I grow up”**
      - **Talk about yesterday, tomorrow, and next week**

DEVELOPING MEASUREMENT CONCEPTS

- Provide materials that encourage children to explore measurement, like standardized and non-standardized tools
- Use language that compares quantities (more than, less than, same as, etc.)
- Use measurement terminology to identify differences in attributes (longer, shortest, heavier, lightest, etc.)
- Suggest measurement strategies when children compare size, capacity, weight, and other dimensions

LEARNING ACTIVITY: MEASUREMENT

- Find a partner
- Select two materials from your table
- Using one material at a time measure the length of each of your shoes, then repeat with another material
- Record your data
- Discuss the your learning process as you completed this activity

HOW DO CHILDREN LEARN MATH?

- Children learn math skills naturally through everyday experiences and through planned activities.
- Teachers must MATHEMATIZE to help children connect these everyday math experiences.

A FINAL NOTE . . .

- Young children need a multitude of experiences to develop an understanding of math concepts.
- Provide a variety of experiences to support different learning styles.
- Start with simple skills and slowly work toward more complex ones.
- Be patient; children will make many errors when learning these concepts, but with experience they will learn and benefit from this knowledge.
- Recognize that math is integrated in your culture and used throughout the day!

MATH MATRIX

- Use this form to plan math activities around the daily schedule.

- Write down specific materials, activities, and conversations that will help you intentionally teach across these four math areas.

Questions and Reflect

Creative Adventure

- We will watch a short clip from a video that can be found on eclkc.
- Note the number of ways you see math happening.

Thank You!

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