FOUNDATIONS FOR MATHEMATICS

During the early years of life, young children begin to explore their world, a world that relies on mathematical concepts to build a foundation for further learning. They begin to compare quantities, find patterns in various objects, move through their environment, and engage in problem solving.

Mathematics helps children survey their environment and start to form a sense of order. This beginning sense of order is of primary importance in constructing a solid foundation for future success. Children’s math development is nourished by everyday play activities and exploration of the world around them. It is important for adults to support young children’s learning and play, answer their questions, take care of their physical needs, and encourage their natural curiosity in order to lay the foundations for later success.

Adults can support the development of mathematics by incorporating math into everyday activities. Mathematics is more than counting and recognizing numbers. It involves learning about heavy and light, big and small, and long and short. Math also involves learning about shapes (circle, square, rectangle), recognizing patterns (blue-yellow-blue-yellow) and comparing quantities (which is more and which is less). Using math words around young children helps them begin to understand math concepts. Math must be connected to children’s lives. There is no need to drill children with flashcards or do worksheets or programs of direct instruction to get them to learn math. When children learn math in contrived situations rather than in routine activities that are connected with their lives, the results will be rote learning without understanding. This does not promote the “spirit of mathematics.” There are many opportunities for “math talk” as you go through the day.

Adults that are involved in the lives of very young children need to be familiar with the social, emotional, and motor development of infants and toddlers. It is vitally important that families and caregivers are sensitive to the emotional development and level of tolerance and persistence in young children. Every child learns at his/her own pace, and families and caregivers must understand that concentrating on a prescriptive level of skill development instead of intimate awareness of a child’s level of learning does not equate with long-term success built on a solid foundation of knowledge. It is better to proceed slowly and keep the child’s interest than to push too hard.

Providing daily opportunities for problem solving, reasoning, communication, connections, and representations make it possible for young children to learn the content of math. These processes develop over time with the help of adults who connect math to everyday activities. Connecting mathematics to other areas of learning such as music, art, and science also enhances both the mathematical concepts and the additional subject. When adults communicate and work with young children to enhance their knowledge of mathematics, the most important attribute they can bring with their solid foundation of skills is a positive disposition. A positive attitude toward mathematics and mathematical learning begins in early childhood.

Preschool children are curious, independent, energetic, and eager to learn new things. This makes them excellent candidates for acquiring math concepts that will form a working foundation for more formal math learning in kindergarten and primary grades. Nowhere is it more true to say children learn by experience and discovery than in acquiring math concepts. Adults have many opportunities to use naturally occurring events to stimulate curiosity and problem solving in order for children to begin to make the critical connection between living and learning. Adults also influence children’s attitudes and self-concept with regard to math processes. Math concepts that are appropriate for preschoolers to begin working with include numbers, volume, capacity, length, area, shape, space,
Mathematics Foundations

time, and size. Much of the work involves discovering relationships through matching and comparing, filling and emptying, and measuring and manipulating. There are many opportunities (teachable moments) for adults to ask questions or make comments (e.g., “I wonder what would happen if…”). The most important learning in early years is the vocabulary that develops as a result of these adult-to-child and child-to-child interactions.

**KEY FINDINGS**

- **Infants and toddlers have a natural interest in mathematics and use it to make sense of their physical and social worlds. In play and daily activities, they explore and play by sorting, comparing, and noticing the different shapes in their world.** [Geist E., 2003]

- **Recognizing and building on a child’s experiences are most effective in enhancing mathematics in early childhood. Young children learn best when families and caregivers focus on the child’s strengths and learning styles.** [Bredekamp, S., & Copple, C., 2009]

- **Families and caregivers need to explore and learn what children already know and help them to understand their knowledge as it relates to mathematics. They can provide multiple opportunities for infants and toddlers to organize, quantify, generalize, and refine those concepts that they, in the beginning, grasp only at an experimental or intuitive level.** [Geist, E. 2001]

- **It is important that infants and toddlers have experiences with known relationships and sequences of mathematical ideas.** [Geist, E., 2003]

- **Effective learning experiences are intentionally organized and build on a child’s understanding over time. Focused exploration is a primary method by which children build on knowledge and learn new concepts. Young children should be provided with time, materials to manipulate, and an environment to explore to develop a keen interest and love of learning.** [Bredekamp, S., & Copple, C., 2009]

- **Mathematical concepts should be woven into the daily experiences of a young child’s natural routines. Intentional weaving of mathematical concepts into literature, language development, science, social studies, art, movement, and music enhances all areas of learning.** [Lally, J., Griffin, A., Fenichel, E., Segal, M., Szanton, E., Weissbourd, B., 1995]

- **Mathematics is a developmental process that follows a sequence of awareness, exploration, creating, and gaining meaning.** [Copley, J.V., 2000]

- **Children move through this sequence at different rates because of individual differences, exposure to tools, hands-on materials, and experiences.** [Bredekamp, S. & Copple C., (Eds.), 1992; Kamii, Constance, 2000; Copley, J.V., 2000]

- **Preschool children can solve simple problems and love to do so. Children learn best when they find answers for themselves and in their own way.** [Fromboluti, C. & Rinck, N., 1999]
GLOSSARY:

**Counting and Cardinality** - know number names and the count sequence; count to tell the number of objects; compare numbers.

**Geometry** - Identify and describe shapes; analyze, compare, create and compose shapes.

**Operations and Algebraic Thinking** - understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

**Number and Operations Base Ten** - work with numbers 11 – 19 to gain foundations for place value, e.g. ten ones in 10.

**Measurement and Data** - describe and compare measureable attributes, classify objects and count the number of objects in each category.

**Symbols:** something visible that by association represents something else, e.g. restaurant logo

RESEARCH AND REFERENCES:


Mathematics Foundations


MATHEMATICS STANDARD AREA

❖ COMMON CORE STATE STANDARD: Counting, Cardinality, and Operations Base Ten
❖ ISTAR-KR: Counting and Quantity

Learning the meaning of numbers is more than learning how to count. It involves the ability to think and work with numbers and understand their relationships and the different uses for numbers. Counting lays the foundation for children’s early work with numbers. Counting a wide variety of objects is helpful in order for children to appreciate the breadth of the application of counting skills. Children enjoy practicing counting games from the time they learn to talk, e.g. counting fingers and toes. Infants and toddlers learn the meaning of numbers in everyday experiences the adult provides, e.g., a cookie for each hand – one, two. Everyday experiences the adult provides in the home, classroom, and nature allows children opportunities to watch, play, and interact with others to learn number vocabulary and to discover number relationships.

The developmentally progressive skills to mastering counting and quantity are as follows: demonstrates the awareness of the presence of objects; identifies more; uses numbers to compare; names and orders quantities; describes relationships between numbers and quantity.

Young children are learning when they:

M.1.1 Repeat a movement like a clap.
M.1.2 Touch one object.
M.1.3 Give an object when asked.
M.1.4 Repeat number words.
M.1.5 Count 1.
M.1.6 Select the preferred item when given two choices.
M.1.7 Communicate when something is empty or “all gone.”
M.1.8 Indicate a desire for more.
M.1.9 Clap or moves to a beat.
M.1.10 Touch in sequence, one at a time
M.1.11 Use fingers to show how many or age of self.
M.1.12 Use whole numbers up to 3 to describe objects and experiences.
M.1.13 Rote count to 3.
M.1.14 Match like numerals.
M.1.15 Give 1 object when asked.
M.1.16 Line up objects.
M.1.17 Identify which is more (visually, tactiley, or audibly).

A child can be supported by an adult who:

➢ Plays peek-a-boo with child to help her understand that objects continue to exist even when out of her sight (teaches object permanence).
➢ Plays hiding games with objects.
➢ Offers objects of interest to count.
➢ Models counting by pointing to objects as you recite the number, uses fingers to count, and puts up a finger one at a time as you count.
➢ Encourages the child to sort by looking for similarities in color or shape.
➢ Provides toys such as simple puzzles and interlocking blocks. Lets the child play without interruption so she can build attention span.
➢ Asks questions that require thinking.
➢ Encourages the child to point to and count their fingers, legs, nose, ears, and eyes.
➢ Helps child look for differences in size (e.g., bigger, smaller, shorter, longer)
How it looks in everyday activities:

Jennifer is busy changing baby Susan’s diaper. During the diaper change she looks at Susan and smiles and talks. The quiet time continues a bit after the diaper change is over. Jennifer touches each of Susan’s toes, counting aloud, “One, two, three…” Susan is attentive and coos back at Jennifer, matching her smiling face.

Big brother Eric watches his mother and sister. He is 6 and in the first grade. “Mom,” he says with all of the knowledge that first grade imparts, “babies cannot count. They don’t even talk!”

“Well, not yet,” Jennifer agrees. “When you were a baby you liked this game too. When we count with Susan it helps her know about numbers so she will be ready when she gets to first grade, just like you!” Eric thinks about this and gently touches Susan’s toe. “One.” he begins, smiling at his sister and mother.

Development of a skill in one area is related to and influences other developmental areas:

Social/Emotional:
- Develops a close, trusting relationship with primary caregivers; Child and adult enjoy playing together.

Communication/Literacy:
- Listens and responds to others.

Cognitive:
- Makes connections about what’s next; learns sounds have a purpose.

Self Help:
- Learns from authentic experiences.
Young children are learning when they:

- M.1.18 Count backward from 3.
- M.1.19 Give “more” when asked.
- M.1.20 Sing and dance to a number song.
- M.1.21 Count a number of objects up to three.
- M.1.22 Count each object only once.
- M.1.23 Imitate counting behavior using the names of large numbers.
- M.1.24 Identify first and last.
- M.1.25 Use whole numbers up to five to describe objects and experiences.
- M.1.26 Identify when objects are the same number, even if arrangement is changed.
- M.1.27 Rote count to five.
- M.1.28 Draw pictures or symbols to represent a spoken number.
- M.1.29 Match number symbols with amounts 1-3.
- M.1.30 Give “all” objects when asked.
- M.1.31 Identify the concept of “less.”
- M.1.32 Count backward from five.
- M.1.33 Give “some” and give “the rest” when asked.
- M.1.34 Identify the concept of “none.”
- M.1.35 Rote count to ten.
- M.1.36 Match number symbols with amounts 0-5.
- M.1.37 Apply one-to-one correspondence with objects and people.
- M.1.38 Identify the next number in a series of numbers up to ten.
- M.1.39 Count backward from ten.
- M.1.40 Pass out objects or food to people or characters.
- M.1.41 Name groups of objects.
- M.1.42 Use a tally system.
- M.1.43 Identify “first” and “last.”
- M.1.44 Trade several smaller items for a larger item.
- M.1.45 Communicate that a snack is split in “half.”
- M.1.46 Make guesses related to quantity.
- M.1.47 Break apart a whole quantity of something into a set.

A child can be supported by an adult who:

- Sings songs or says rhymes that have numbers.
- Counts real things to help the child use personal experiences with objects to better understand numbers.
- Provides daily opportunities for the child to count and recount objects as opportunities naturally arise, points to the object, and recites each number name while counting.
- Provides objects with naturally occurring numbers and number words such as clocks, timers, calendars, thermometers, computers, calculators, measuring cups.
- Uses number words and numerals, including zero, in meaningful everyday activities.
- Points out that counting lets the child know how many things are in a group.
- Uses a variety of strategies (e.g., questions, comments, counting) to prompt children to think about quantity and number words.
- Talks to the child about a variety of uses of numbers (e.g., keeping score in a game, finding an apartment, street address, or phone number).
- Provides opportunities for the child to guess the amount or size of something. Very young children will not be able to estimate accurately, because they are learning the concepts. They first need to understand concepts like more, less, bigger and smaller, first and last.
- Helps the child understand concepts like more, less, bigger, smaller, first, and last.
- Provides opportunities for the child to count and share things.
- Provides opportunities for 4- and 5-year olds to play board games to learn math concepts (e.g., counting, planning ahead, thinking, finding patterns, and understanding how much).
How it looks in everyday activities:

Alice sits in her high chair watching her mother Teresa move around the kitchen as she prepares a snack for her and the other children she cares for. Teresa opens a bag of pretzels and gives each older child a few on a napkin. Cody and Caitlin, who are 5, count their pretzels to make sure they have the same number. Alice points to the pretzels, looking at her mother and making sounds.

“Alice are you ready for a snack, too?” Teresa asks. Alice holds out her hand and vocalizes again. “Here is one pretzel” Teresa says, emphasizing the word one. “Do you want more?” she asks. Alice looks at her and smiles. Teresa puts the second pretzel in Alice’s other hand saying, “Now you have two pretzels. You have one for each hand.” Alice looks at the pretzels and starts to eat.

Development of a skill in one area is related to and influences other developmental areas:

Social/Emotional:
- Takes turns
- Acts out a story.
- Rhymes.

Cognitive:
- Displays number sense through measuring, counting, and comparing bigger and smaller.

Physical:
- Uses large and small muscles.

Self-help:
- Gains knowledge of snack foods that are healthy, and healthy food helps them grow.

Communication/Literacy:
- Shares communication by sharing with others a representation of what was done.
Math skills begin when a baby begins to notice what is around him. A baby may notice when a favorite blanket or stuffed animal is missing or “subtracted” from the room or put in view or “added to” the room, this is the beginning of understanding computation. Math thinking is occurring when an adult asks, “which animal is bigger” or when a child asks for “one more.” Comparing quantities is not dependent on knowledge of counting skills. Because young children do not use math words spontaneously, an adult helps them understand math words such as more, less, smaller than, bigger than, different than. These words help children describe the size and shape of objects and the relationships of objects to one another. Understanding the meaning of these words will help children perform simple operations of adding to and taking away when the child gets older. In building the foundation for computation, children need opportunities to observe adults and peers applying mathematical concepts and using problem-solving techniques. Including these concepts in their play and in adult-supported activities, enhances children's understanding.

The developmentally progressive skills to mastering computation are: manipulates objects for a purpose; matches objects and sets; makes a set of objects smaller or larger; follows models of addition or subtraction situations; describes the application of addition and subtraction situations.

**Young children are learning when they:**

M.2.1 Select the preferred item when given two choices.
M.2.2 Communicate when something is empty or “all gone.”
M.2.3 Indicate a desire for more.
M.2.4 Gather small collections of 1-3 objects without counting.
M.2.5 Take away an object when asked.
M.2.6 Show something that was received.
M.2.7 Show displeasure at losing something.
M.2.8 Give 1 object when asked.
M.2.9 Line up objects.
M.2.10 Identify which is “more” visually, tactiley, or audibly.
M.2.11 Count backward from 3.
M.2.12 Give “more” when asked.
M.2.13 Share a set of 2 with a friend.
M.2.14 Move objects one at a time from one group or container to another.
M.2.15 Identify the object that had been added to a group.
M.2.16 Describe that something was taken.

**A child can be supported by an adult who:**

- Plays and talks to the child.
- Places objects near the child for exploration.
- Moves the child from room to room to explore environments.
- Offers safe toys for play.
- Provides small blocks that can be held in the child’s hands.
- Gives the child stacking toys and objects that fit inside each other.
- Shows examples of one-to-one correspondence (e.g., plays “one-for-you one-for-me” game).
- Uses “number” and “size” words when talking to the child.
- Provides sorting opportunities.
How it looks in everyday activities:
Mrs. Lee leads Anne, Rose, and Julia in playing a rhyming game, *Ants on a Log*, singing “Three little ants come out to play on a sunny day!” The three girls pretend to be ants on a log. They enjoy the whole song, singing two ants and one ant until there are none.

“That was fun!” says Anne. “Let’s do more,” adds Rose. “OK,” agrees Mrs. Lee, “let’s draw some pictures of the ant song.” She brings out paper and crayons for each girl.

“Hmm,” Anne says, “I can draw three ants, one for each of us!” Rose nods and carefully draws three ant shapes on her paper. Julia watches, but she doesn’t start to draw anything yet. Seeing her hesitation, Mrs. Lee asks Julia what her favorite part of the song was. After a few more questions, Julia has some ideas and starts to draw. When her picture is completed, Julia tells Mrs. Lee “I want to do more ant games.” Mrs. Lee smiles because she has already planned to serve *Ants on a Log* for snack. She asks, “Who wants to eat an ant snack?” She brings out the ingredients, then explains and shows how to make the snack. Each girl gets to choose one stalk of celery, two spoons of peanut butter, and five raisins to make the snack. While the girls enjoy their snack, they talk about what makes a healthy snack food.

Young children are learning when they:

M.2.17 Count on fingers.
M.2.18 Identify and use the concepts of “one more” and “one less.”
M.2.19 Make a collection of items smaller by taking away items when asked.
M.2.20 Make a collection of items larger by adding items when asked.
M.2.21 Describe addition situations for numbers less than three.
M.2.22 Make guesses related to quantity.
M.2.23 Describe subtraction situations for numbers less than three.
M.2.24 Describe addition situations for numbers less than five.
M.2.25 Describe subtraction situations for numbers less than five.

A child can be supported by an adult who:

- Provides a variety of objects that work together in a 1:1 relationship (e.g., markers with caps, cars with garages, containers with lids).
- Asks the child to pass out utensils, napkins, and cups for snack/meal time.
- Engages in conversations with the child about quantity and comparisons as the child interacts with materials throughout the day.
- Provides a variety of materials that may be used for adding and subtracting.
- Poses questions which ask the child to make guesses or predictions (e.g., “How many do you think you have?”).
- Provides planned opportunities for the child to predict in naturally occurring activities (e.g., guessing how many days before garden seeds sprout).
- Provides opportunities for child to practice forming numerals with many different mediums (e.g., trace numerals in shaving cream, sand, salt; create numerals with rolled clay, pipe cleaners, craft sticks).
COMMON CORE STATE STANDARD: Measurement and Data  
ISTAR-KR: Time

Measurement is a frequently used application of mathematical concepts. Early measurement concepts also include attributes such as length, volume, area, weight, and time. Children need many opportunities to explore and discover the increments of time. They learn by applying concepts of time to real life situations in order to construct the meaning of time. As children begin to be aware of time they will associate an activity to familiar routines or schedules, e.g. meal time, nap time, bath. The timing of schedules is quickly computed by a young child’s knowledge of the sequence of daily events. The concepts of morning, afternoon, night, day, today, tomorrow, and yesterday develop in preschool children as the associate experiences to the time of occurrence.

The developmentally progressive steps to mastering the concept of time are: anticipates a routine; uses vocabulary to identify events in a routine; sequences events; uses measuring vocabulary units for time; uses measuring units for time.

Young children are learning when they:
M.3.1 Cooperate with a routine.
M.3.2 Anticipate an event.
M.3.3 Follow a daily schedule.
M.3.4 Follow steps in a simple routine.
M.3.5 Relate time to events.
M.3.6 Associate events with time-related concepts.
M.3.7 Tell what comes before and after.
M.3.8 Tell what activity comes first and what follows in sequence.
M.3.9 Tells three events in chronological order.

A child can be supported by an adult who:

- Offers opportunities for waiting (e.g., your turn is next). Introduces general concepts of time (e.g., yesterday, today, tomorrow; morning afternoon-evening) before discussing specific concepts like hours and minutes.
- Talks about general concepts of time using clocks and calendars (e.g., mark off days on monthly calendars until child’s birthday).
- Talks about time and sequence during daily activities (e.g., wake-up, eat breakfast, brush teeth, get dressed).

How it looks in everyday activities:
It was a warm and sunny day outside. Mrs. Jones recognized a good opportunity to learn about shadows, so she took her class outside. The children stood in different positions, moving their bodies and watching how their shadows changed. “Who knows what makes a shadow?” Mrs. Jones asked. Jimmy answered, “It happens when something gets in the way of a light.” “Let’s look at the different sizes of shadows.” said Mrs. Jones. She showed the children a yardstick and explained how to use it for measuring. Carolina is learning to use English, so Mrs. Jones used strategies such as gestures and repetition to make sure she understood the lesson. Carolina smiled when it was her turn to measure a shadow. She laid the yardstick on the shadow of her friend Lilly’s leg. As she measured it, Lilly moved and the shadow got smaller. The girls laughed together and then Lilly moved to make the shadow get bigger again. Jimmy operated his wheelchair to come closer to the girls. He looked at Carolina and reached out his hand saying, “Hey that’s neat! Can I have a turn with the yardstick?” Mrs. Jones watched as Jimmy held the yardstick out to measure Carolina’s shadow. “Now move,” he said “so it changes.” Carolina made her shadow get shorter, then taller, and then wider. “This is so cool!” Jimmy shouted. Carolina smiled and said, “Cool!”
Common Core State Standard: Measurement and Data

ISTAR-KR: Location

Early geometry concepts involve shape, size, position, space, movement, and direction. Geometry helps a child describe and classify the physical world they experience. Children typically enjoy exploring objects by dropping, rolling, throwing, submerging, or waving them. They are curious to explore with their whole body by running, climbing, building, taking things apart and putting them together again. These examples of early exploration are a child’s way of becoming aware of themselves in relation to people and objects around them. To a child, this is understanding how the world works.

To build the foundation for recognizing shapes and using directional words, children need opportunities to explore the size, shape, position, and movement of objects within their physical environment. Spatial reasoning (describing the position, direction, and distance of objects in relation to the child) begins as children become aware of their bodies and personal space within their physical environment. Children learn to recognize, draw, and describe shapes by manipulating, playing with, tracing, and making common shapes using real objects in a variety of activities.

The developmentally progressive steps to mastering the concept of location are:
- Demonstrates an awareness of the location of objects;
- Identifies location;
- Follows directions involving location;
- Communicates with location words;
- Uses prepositions to describe location.

Young children are learning when they:
- M.4.1 Notice objects and purposely move and manipulate different objects.
- M.4.2 Use a shape toy to explore basic shapes.
- M.4.3 Look or feel for an object that has been hidden from view.
- M.4.4 Put things in and out of other things.
- M.4.5 Put things on and off of other things.
- M.4.6 Find hidden objects or sounds.
- M.4.7 Hide behind or between objects in play.
- M.4.8 Identify where he/she is currently located.
- M.4.9 Search for something out of sight.
- M.4.10 Complete a three piece inset puzzle.
- M.4.11 Move objects from one container to another.
- M.4.12 Show interest in something out of place, like finding a small object on the carpet.
- M.4.13 Search for something out of sight.
- M.4.14 Complete an inset puzzle of 3 or more pieces.

A child can be supported by an adult who:
- Provides safe things the child can touch and manipulate such as blocks, boxes, or containers, shape sorters, and puzzles.
- Cuts sandwiches into different shapes and lets child fit the pieces together or rearrange them.
- Uses words such as same, different, more than, less than, and one more as you compare groups of objects.
- Uses location words such as “in back of”, “beside”, “next to.”
- Talks about what the child is doing so that the child begins to learn the words that describe concepts (e.g., “you were in the box, and then you climbed out.” “You climbed under the table”).
- Allows children to explore and pace themselves when playing with toys and learning a new skill. Allows child to find own sequence and rate of learning.
Young children are learning when they:
M.4.15 Give clues for finding hidden objects.
M.4.16 Discriminate between object that is pulled apart and one that is put together.
M.4.17 Identify the missing parts (e.g., the door of a car, nose of the dog).
M.4.18 Use “in” and “out” to indicate where things are in space.
M.4.19 Use “on” and “off” to indicate where things are in space.
M.4.20 Use the words “here” or “there” to indicate where things are in space.
M.4.21 Follow instructions to place an object “here” or “there.”
M.4.22 Follow instructions to place an object “beside” or “next to” something.
M.4.23 Follow instructions to place an object “between” two things.
M.4.24 Identify ten body parts.
M.4.25 Complete interlocking puzzle of 8-12 pieces.
M.4.26 Identify the missing object.
M.4.27 Give clues for finding hidden objects.
M.4.28 Discriminate between object that is pulled apart and one that is put together.
M.4.29 Identify parts of an object.

A child can be supported by an adult who:
- Provides simple puzzles, stacking toys, shape sorters, and texture balls.
- Puts safe objects in path of crawler to present problem-solving opportunity for child to obtain or move around the object.
- Models correct language when talking with child about quantity (e.g., part, pieces, whole, half, quarter).
- Provides a variety of shapes and materials that may be broken into parts and brought back together again (e.g., pizza, crackers, unit blocks, puzzles).
- Encourages the child to explore materials and environment through movement and hands-on experiences.
- Enables the child to have a wide variety of gross motor movement in open spaces both indoors and outdoors (e.g., walking, crawling, skipping, hopping, jumping).
- Provides materials in a variety of shapes and sizes to create and represent shapes (e.g., paper, pipe cleaners, play dough, scissors, tape, wood).
- Provides a variety of geometric materials (e.g., unit blocks, parquetry blocks, stencils).
- Uses and encourages the child to use language and physical gestures to demonstrate directional words with people and things in the environment.
- Names and calls attention to shapes naturally apparent in the environment.
- Encourages child to create representations of shapes by constructing models through drawing, block building, or other mediums.
- Provides space and hands-on materials for creating landscapes (e.g., train tracks, houses, roadways).
How it looks in everyday activities:

At home one evening Sandy plays on the floor with many different kinds of toys from her toy box. She has some small horses with pink and purple hair, a family of little people from her playhouse, some kitchen supplies, some different sized rings, and a stacking pole. Sandy looks through the toys until she finds all of the rings. There are 5 and they are all different colors and sizes. She puts the rings on the pole one by one. It takes her several tries to get the rings on in the right order, from largest to smallest. Dan, Sandy’s dad, watches. He notices that Sandy is working hard but is not frustrated, so he does not interfere, waiting to see if help is needed. When Sandy has the rings stacked correctly, she stops and looks over at her dad. Dan says, “Good for you Sandy! You found all the rings and put them on the stacking pole.” Sandy seems pleased as she dumps the rings off the pole to start again.

How it looks in everyday activities:

Jamal and several other children at the ABC Preschool were rolling out play dough. Mrs. Jackson, the teacher, brought cookie cutters and encouraged the children to cut out some circles, squares, and triangles. Jamal held up his circle next to Grace’s circle and said, “Hey Grace made the same as me!”

Mrs. Jackson said, “Let’s put all the shapes that match together.” She got three boxes and labeled them with a picture of each shape. She added a glue outline to each shape picture so that Jim, a student with a visual impairment, would be able to match his shapes to the boxes independently. Each child matched his or her shapes to the right picture on the box.

“Now let’s do another game with the shapes.” Mrs. Jackson said. “First, we take all the shapes out of the box. Now listen and I will give you a direction. Jamal, you find a triangle shape and put it under the box.” Jamal easily finds a triangle and is able to follow the direction. Mrs. Jackson gives many other directions using words like in, on, under, beside, and behind. When Grace has a hard time with the words over and under, Mrs. Jackson demonstrates.

Since the children still seemed to be enjoying the shape games, Mrs. Jackson had them look for circles, squares, and triangles all around the room. They had fun finding the different ways the shapes could look and feel, tracing them with their fingers and drawing them on paper. Mrs. Jackson brought out some stencils for Jim to make his drawings; but they were so popular all the children wanted a turn. To finish the shape activity, Mrs. Jackson brought the cleaned cookie cutters back out and the children cut their peanut butter sandwiches into shapes. “I like how this square tastes!” laughed Grace.
COMMON CORE STATE STANDARD: Measurement and Data

ISTAR-KR: Length, Capacity, Weight, Temperature

Measurement is a frequently used application of mathematical concepts. Counting is a type of measurement because it measures how many items are in a collection. Early measurement concepts also include attributes such as length, volume, area, weight, and time. Young children may learn that the properties exist, but they do not know how to reason about these attributes or measure accurately until later on. Young children develop measurement ideas over an extended time because the concept is quite complex. As young children explore objects/things by looking at, touching, or directly comparing them, they begin to understand the difference in the attributes of objects, an application of measurement.

As preschool children begin to use actual measurement instruments and explore measurement relationships, they apply the results to real life situations in order to construct concepts of measurement.

The developmentally progressive steps to mastering the concept of size, length, capacity, weight, and temperature are: explores measurement attributes; distinguishes between big and little/small and hot and cold; differentiates gradients of size and weight; uses common measuring tools in correct context; makes direct measurement comparisons.

Young children are learning when they:
- M.5.1 Give one object when asked.
- M.5.2 Select the preferred item when given two choices.
- M.5.3 Communicate when something is empty or “all gone.”
- M.5.4 Indicate a desire for more.
- M.5.5 Identify big.
- M.5.6 Pour substances out of containers.
- M.5.7 Identify which is “more” visually, tactiley, or audibly.
- M.5.8 Give “more” when asked.
- M.5.9 Share a set of 2 with a friend.
- M.5.10 Distinguish big and little.
- M.5.11 Make choices based on size.
- M.5.12 Identify when objects are similar.
- M.5.13 Pour substances into containers.
- M.5.14 Anticipates a sequence during daily activities.

A child can be supported by an adult who:
- Sets simple time limits (e.g., three more swings and we are done. Verbally counts 1, 2, 3.
- Offers a variety of safe household objects to explore (e.g., cups, bowls, spoons).
- Talks about measurement in daily routines (e.g., all done, more, heavy, longer).
- Extends play activities with a measurement activity (e.g., look at one more page in the book, build a tower with one more block, play with one puzzle at a time).
- Offers opportunities for waiting (e.g., your turn is next).
- Provides a variety of measuring tools and time-related instruments (e.g., rulers, measuring tapes, measuring cups and spoons, clocks, scales).
- Includes charts and posters with measurement language.
Young children are learning when they:

M.5.15 Order three objects by size.
M.5.16 Use any descriptive word or gesture to express amount or size.
M.5.17 Use cups and tools in sand and water.
M.5.18 Use common measuring tools in correct context.
M.5.19 Communicate the size of things relative to self (e.g., compared to size of finger, arms length).
M.5.20 Identify when something is hot and cold.
M.5.21 Communicate feelings of hot and cold.
M.5.22 Sort objects into long and short.
M.5.23 Identify similarities and differences in objects.
M.5.24 Ask why something is the same or different.
M.5.25 Identify when something is too heavy to lift.
M.5.26 Categorize familiar items by function and class.
M.5.27 Choose an object based on function.
M.5.28 Choose between two activities.

A child can be supported by an adult who:

- Introduces general concepts of time (e.g., yesterday, today, tomorrow; morning, afternoon-evening) before discussing specific concepts like hours and minutes.
- Talks about measurement concepts during every day activities (e.g., “It’s hot in here today.” “Your cup is almost full.” “Will this container be big enough to hold the blocks?”).
- Encourages the child to practice measuring with non-standard or arbitrary units of measure (e.g., hands, paper clips, blocks, feet).
- Talks about general concepts of time using clocks and calendars (e.g., mark off days on monthly calendars until child’s birthday).
- Talks about time and sequence during daily activities (e.g., wake-up, eat...
How it looks in everyday activities:

Two and a half year old Jake and his Daddy are getting dressed to go outside in the back yard so they can work in the garden one Saturday morning. Daddy helps Jake find the warm clothes they need to wear outdoors on this fall morning. “Now let’s put our shoes on,” Daddy says to Jake.

Daddy and Jake walk together to the back door where they keep their dirty work shoes. Jake’s small shoe is sitting next to Daddy’s big work shoes. Jake points to Daddy’s shoe and says “Big shoe” with wide eyes. Daddy chuckles and says, “Right Jake. Daddy’s shoe is big and Jake’s shoe is little.” Daddy starts to pick up his shoes then pauses. He smiles at Jake and asks, “Which shoe is heavier?” Jake picks up each shoe one at a time. He carefully carries the heavy work shoe to Daddy. “Yes, Jake.” Daddy says, pleased that Jake could figure out the task. “Daddy’s work shoe is heavy and your work shoe is light.” The two head out the back door to dig in the garden.

Development of a skill in one area is related to and influences other developmental areas:

Social/Emotional:
- Interacts cooperatively with adult.
- Experiences self-esteem by doing grown-up things.

Cognitive:
- Reproduces simple pattern.
- Practices doing things in sequential order.

Physical:
- Uses large and small muscles.

Self-help:
- Practices good hygiene such as hand washing to remove dirt, cleans tools.

Communication/Literacy:
- Engages in conversation.
COMMON CORE STATE STANDARD: Geometry
ISTAR-KR: Sorting and Classifying Objects

Learning to model, explain, and use addition and subtraction concepts in problem solving situations begins with the opportunity for young children to count, sort, compare objects, and describe their thinking and observations in everyday situations. When young children are provided an engaging environment to explore a variety of shapes, sizes, colors, and texture in their environment, they learn to differentiate the attributes of those shapes, sizes, colors, and textures. This exploration helps children develop the foundation for identifying patterns and recognizing relationships between patterns. They learn to identify and describe patterns using mathematical language when there are opportunities to sort, classify, and label things in their environment.

Preschool children continue to need hands-on activities to explore and describe patterns and relationships involving numbers, shapes, data, and graphs in problem-solving situations. They learn to model, explain, and use addition and subtraction concepts in problem solving situations when given the opportunity to count, sort, compare objects, and describe their thinking and observations in everyday situations.

The developmentally progressive steps to mastering the concepts of sorting and classifying are: explores attributes (e.g. shape, size, color); matches same attributes; matches opposites; sorts and patterns by one attribute; sorts and patterns by more than one attribute.

Young children are learning when they:
M.6.1 Show interest in visual/auditory/tactile patterns.
M.6.2 Show interest in something out of place, like finding a small object on the carpet.
M.6.3 Complete a word or phrase that repeats in a familiar song or story.
M.6.4 Purposely move and manipulate different objects.
M.6.5 Clap or move to a beat.
M.6.6 Nest smaller objects into larger.
M.6.7 Put things in order.
M.6.8 Move objects from one container to another.
M.6.9 Identify which is “more” visually, tactiley, or audibly.
M.6.10 Put pairs together.
M.6.11 Identify when objects are the same.
M.6.12 Follow along and imitate patterns of sounds and movement.

A child can be supported by an adult who:
- Provides books and picture patterns.
- Talks about size of objects during play and meals.
- Identifies patterns in everyday life.
- Offers the child opportunities to manipulate objects into and out of patterns.
- Provides simple three-piece puzzles.
- Provides toys that teach cause and effect (e.g., blocks for stacking and allowing space for blocks to fall when stacked too high, simple switch toys that turn off and on).
- Provides child with small blocks saying “Here are two blocks.”
- Provides blocks of different sizes.
- Provides simple matching activities (e.g., matching three-dimensional objects to pictures).
- Offers opportunities to sort and classify foods by attributes, color, and shape.
Young children are learning when they:

M.6.13 Reproduce patterns of sounds and movement.
M.6.15 Predict what comes next when shown a simple AB pattern of concrete objects.
M.6.16 Identify attributes of objects.
M.6.17 Give reason of placement of objects.
M.6.18 Sort a group of objects by more than one way.
M.6.19 Name groups of objects.
M.6.20 Divide a set of four objects into equal parts.
M.6.21 Categorize familiar objects by function and class.

A child can be supported by an adult who:

- Provides a wide range of opportunities in physical and social environments to encourage sorting and classifying.
- Supplies a variety of materials for sorting and classifying: shells, keys, cereal, pebbles, bottle caps, nuts and bolts.
- Provides items such as plates or egg cartons for the child to use in grouping objects that are sorted by attributes.
- Encourages the child to create, identify, match, and describe patterns in objects, designs, pictures, movement activities, and recurring events.
- Helps the child create and recognize patterns in his/her environment (e.g., room, clothing).
- Provides opportunities for the child to create his/her own patterns for others to follow or extend using prompts and no prompts.
- Encourages the child to verbally describe why he/she sorted, classified, and ordered objects in a certain way.
- Uses words that describe attributes and criteria of items in the child’s environment.
- Builds on the child’s understanding of a series by making changes and additions in materials (e.g., varying the number of objects, types of characteristics, degree of variation).
- Helps the child recognize and describe sequences in nature, daily routines, and in stories.
- Assists the child in identifying shapes in the environment.
How it looks in everyday activities:

The children in Mary’s home-based early care and education program are learning about sorting and counting. Mary finds many different colored blocks and hides them around the room. She makes sure there are different numbers of each color for this activity.

Mary says, “When you hear the music, search for a block. Everyone should find just one block.” Mary holds up one finger to show how many blocks each person should find. Mary watches as each child finds a block and then stops the music, signaling the children to gather in a circle.

“Let’s see how many of each color you found.” Mary says. “Everyone who found a blue, stand here,” she says and continues until all the children are grouped. Billy has trouble finding his group and says, “I need help.”

“Let me see your block.” Sean says. “You have a green one like Dmitri has. See?” Sean points to the right, and Billy goes over to stand by Dmitri. The boys hold their blocks up and compare the colors.

“Which color had the most blocks?” asks Mary. Billy shouts “Green!” happy to know the color he has. “No,” Sean says “there is more red.” Mary says “Let’s line up and see which has more.” She helps the children line up side by side and one by one so they can see which color has more blocks. “Red has the most. Blue and yellow are the same. And green has the littlest number.” Sean says.

How it looks in everyday activities:

Emma wakes up to a sunny spring day. She is excited because her mommy Julie promised they would plant flowers today. Emma and Julie go to the garden store to get supplies. Julie says, “I want two colors of flowers. Which colors do you like?” Emma wants all pink, but Julie helps her choose pink and white petunias.

At home, Julie shows Emma how to dig a little hole and put some water in it for the petunia. Emma chooses a pink one and places it carefully in the hole, patting the earth back around it. Julie digs the next hole and asks Emma to bring another petunia for it. Emma picks another pink petunia. “Let’s use the white one next.” Julie suggests. Emma gets a white one to plant. “Doesn’t that look nice?” Julie says as they watch the pattern emerge.

After the white petunia is planted, Emma digs the next hole. “What next?” asks Julie. “This time, pink.” Emma says, eager to show she knows the pattern “and then white, and then pink again.”