Arkansas Children's Week
April 10 - 16, 2021

Make Amazing Things Happen

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Diana Courson, editor

Arkansas State University Childhood Services
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Sponsored by
Arkansas Department of Human Services
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Thank you to our ACW Ambassadors and to everyone who shared ideas, inspiration, and expertise!

Make Amazing Things Happen (MATH)

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Make

Amazing

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Happen

Welcome! This year's Arkansas Children's Week is all about **math**! We'll delve into the components and concepts of math, and we'll consider the importance of math in all of our lives. How can we help children see themselves as confident, capable mathematicians?

Math is already an integral part of our day.
It's woven into familiar routines and favorite stories, and it is ever-present in children's play. We can mathematize each day by spotlighting and expanding on "math moments."

Children thrive in a math-rich environment.
We can spark mathematical curiosity and invite children to construct knowledge through active exploration: gathering, scooping, sorting, building, and more. Our learning environments can be child-powered and full of fascinating possibilities!

Early math is essential for children of all ages.
Skills children build in infancy and beyond provide a strong foundation for learning in years to come. Math isn't just about academics. We have the power to help children develop positive math mindsets. Math is a powerful way of proving and confirming things and a problem is an exciting invitation to figure something out.

What we say and do matters very much.
We can model and teach math in engaging ways, guided by what we know about child development. We can help children recognize their own thinking and reflect on what they know so far. Our math stance can help children grow.

Join us to celebrate Arkansas Children's Week 2021.

We'll Make Amazing Things Happen… with MATH!

Making Sense of Mathematics in Early Childhood

- Baby Benjamin places a rubber toy rabbit to his mouth and begins to chew. He pauses and frowns, then drops the toy and reaches for another. His caregiver smiles at him as she notices, "You found your favorite freezy ring, didn't you, Ben?"

- Nine-month-old Aliyah laughs as her grandmother bounces her up and down on her lap. Each time the pretend pony ride stops, Aliyah signs: "More, more, more!" Grandmother bounces her again.

- Amir and Ruby play with a set of large, soft blocks in their toddler room. Amir arranges his blocks in a row while Ruby stacks hers to make a tower. Amir glances over at Ruby's work and says, admiringly – "Whoa – that's tall!"

- Jayla, age four, runs her fingers through a basket of shiny buckeye nuts. She selects an ice cube tray from a nearby shelf and drops one nut into each compartment of the tray. She calls to friends, "I made cupcakes! Who wants a cupcake?"

- A trio of seven-year-olds work together to create a paper parachute for a superhero toy. They toss the toy into the air, but it plummets down to crash on the ground. Soon they're caught up in an animated debate about how to build a better parachute.

At first glance, an observer might not notice that these everyday play experiences also provide rich evidence of children's interest in mathematics. Math for young children can sometimes be viewed through a narrow lens: "How high can she count?" and "Which numerals can he recognize?" While numbers and counting are important, they're just one part of math.

The Arkansas Child Development and Early Learning Standards (CDELS) focus on four components of mathematical thinking.

MT1. Number Concepts and Operations

MT2. Algebraic Thinking

MT3. Measurement and Comparison

MT4. Geometry and Spatial Sense

Together, these components enable children to make mathematical sense of their world. When we look at the play scenarios again - with a broad mathematical lens – we notice that Ben explores attributes of teething toys. Jayla incorporates one-to-one correspondence into pretend play. On the pages that follow, you'll find more information about each component of mathematics and ways to support mathematical thinking and learning in real life.

Number Concepts and Counting

Arkansas Child Development and Early Learning Standards (CDELS)

MT1.1 Demonstrates number sense and an understanding of quantity

MT1.2 Explores combining and separating groups (numerical operations)

Many children catch on to the idea of counting by rote at a young age. That means that they listen to adults or older children counting, and they learn to repeat a series of sounds that they remember: "One, two, three, four, five…" In time, children begin to recognize that there is a pattern to counting. After 21, 22, and 23, we eventually arrive at 31, 32, 33 – and that pattern continues in the 40s, 50s and beyond. Now the child can count high numbers by rote, too!

But there's more to counting than knowing how to recite numbers. In addition to remembering the number sequence, children learn that numbers correspond to things that are being counted. They begin to count the things in their world, often touching each thing as they count. They learn that the last number counted tells how many. How many toy cars on the block road? How many chairs at the table? Counting offers a way to know for sure.

Many children begin counting sets of objects by lining them out in a row. That's easier to see and keep track of than a jumbled pile of objects. In time, children notice that the quantity of a set of things stays the same, even if the things are rearranged. For example, 10 children walking down the hallway looks different than 10 children running around the playground, but it's still 10.

As children interact with play objects and other everyday materials, they begin to group them together. It can be interesting to figure out how many, and then to compare sets of objects using words like *more* and *less*. As children gain experience, they experiment with different strategies for counting, combining, and dividing materials.

Numbers gain even more importance as children use them to describe changes. "There was one bird on our feeder, and then two more came. Now there are three!" With time and playful practice, children understand that written numbers (numerals) can represent the quantity of things. For example, they connect the numeral 4 with four candles on a birthday cake or announce, "Our classroom has a number 6 on the door because there are one, two, three, four, five other doors in this hall before ours."

Subitizing is another way of thinking about quantity. That's the ability to look at a small collection of things and "just know" how many there are – without counting each one. A preschooler might look at snack plates and announce, "I have three strawberries, and you have two!" They're showing you that they've worked with groups of objects enough to hone a special math sense - a stable mental concept of what two and three items looks like.

Number Concepts and Counting in Action

Gathering more of something

Matching up (one-to-one correspondence)

Lining things out

Grouping things together

Counting objects

Counting on fingers

Comparing more, less, all, none

Subitizing, seeing quantity at a glance

Figuring out which number comes next

Identifying first, second, last (ordinality)

Dividing something to make fair shares

Taking a group apart, subtracting

Combining groups, adding things together

Writing/using numerals purposefully in play

How can adults support number concepts and counting?

Here are some examples of adult interactions that model, teach, and encourage purposeful, playful interactions with number concepts and counting.

- Share counting songs, chants, and rhymes.
- Invite children to help you gather something. "Let's find plastic eggs! We can collect them in our buckets."
- Use words like lots, few, none, more, less, and equal during play and routines.
- Use fingers to represent numbers and encourage children to do the same.
- Point out written numbers in the environment that are meaningful to the child. "Your football jersey has a 1 and a 2 – you're number 12!"
- Model arranging objects in lines to count them, touching each one as you count, and encourage children to do the same.
- Pretend to lose track while counting so that children can supply the answer.
- Experiment with grouping objects. "Can you think of another way to make five?"
- Invite children to think and problem-solve while you play together. At a pretend restaurant: "Soup costs three dollars? I have one… two [play money] dollar bills. Is that enough?"
- Use self-talk to explain numbers and counting in daily routines. "We have 14 children in our group today and two teachers. I'll write down that we need 16 lunches from the kitchen."
- Talk about ordinality when thinking with children about daily plans. "First, we'll go outside and gather some leaves. Next, we'll investigate the leaves with our science and math tools. Last, we'll put them in the art area so that you can make collages."
- Use a calendar for purposeful planning and problem-solving. "Let's count to figure out how many more days until our family picnic!"

If viewing online, see number concepts and counting in action in these videos from the Erikson Institute Early Math Collaborative.

Why One-to-One Correspondence Matters

Many Ways to See How Many

Mouse Count Story Time in Kindergarten

View this book online: http://asuchildhoodservices.org/#!chs_publications

Reflecting on Daily Practices

The Arkansas Workforce Knowledge and Competencies (WKC) suggest knowledge, skills, and abilities that educators put into practice at each stage of their professional journey. These leveled competencies are a valuable tool for self-assessment and reflection, enabling educators to identify strengths and set goals for professional growth. The competencies below are directly correlated with AR CDELS MT1. Number Concepts and Operation. Take a moment now to envision each one coming to life in a vibrant early childhood environment. What are some specific adult-child interactions you might observe to support each competency?

Arkansas Workforce Knowledge and Competencies (WKC)		
foundation	**intermediate**	**advanced**
2.9.F.a Finds opportunities to count with children throughout the day 2.9.F.b Uses words related to quantity throughout the day such as more, fewer, equal	1 2.9.I.a Provides opportunities for children to manipulate and count objects, compare quantities and use numerals	2.9.A.a Asks questions and makes comments that help children construct an understanding of numbers, quantity, and operations

Have you explored counting and numbers with children today? What are you curious about? How might you stretch and grow your math interactions with children tomorrow?

Sing a Song of Counting

These traditional children's songs and rhymes offer playful opportunities to practice counting, addition, and subtraction. Use fingers or props to represent numbers and encourage children to join in and make predictions as you sing.

Alice the Camel
Five Green and Speckled Frogs
Five Little Ducks (Went Out One Day)
Five Little Monkeys (Jumping on the Bed)
Ten in the Bed
The Ants Go Marching
Two Little Blackbirds (Sitting on a Hill)

If you are unfamiliar with these tunes, YouTube can help. Remember, though: real life interactions with you are much more valuable for children than videos! Learn the words and tune, then unplug to share them with children.

Materials to Encourage Numbers and Counting in Play

Here are some examples of play objects and other materials that might be included in an experience-rich play environment to support children's interest in numbers and counting.

Infant and Toddler

- Collections of objects to gather
- Muffin tins with balls or other objects to place
- Posting toys to fill and empty, such as a canister with jar lids
- Toy telephones with numbered buttons
- Number and object books such as *Ten Red Dots*
- Simple matching games
- Toys that can be taken apart and put together again

Preschool and Kindergarten

- Collections of objects to count and group
- Ice cube trays or other sorting trays
- Dominoes with dots
- Numbered peg boards
- Counting books, such as *Anno's Counting Book*
- Number and object puzzles and matching mats
- Simple math games such as path games and Tiny Polka Dot
- Flannel or magnet board props for acting out counting songs and rhymes
- Dramatic play props with numbers, such as menus, cash registers, money

Schoolage

- Interlocking Base Ten set
- Sudoku puzzles
- Playing cards and math card games such as Math Fluxx
- Seek-and-find books with complex illustrations, such as *Mr. Tweed's Good Deeds* and *Hidden in Nature*
- Age-appropriate, challenging board games such as Mancala, Shut the Box, Trouble, Monopoly, Ticket to Ride
- Abacus, with demonstration and support for using
- Fraction puzzles

Experiences at each age and stage build the foundation for math development in later years.

Algebraic Thinking

Arkansas Child Development and Early Learning Standards (CDELS)

MT2.1 Uses classification and patterning skills

Algebra in early childhood?! This facet of mathematics may surprise parents and educators. While we're not talking about the same sort of algebra that high school students do, very young children can indeed learn logical thinking skills that support mathematical learning for a lifetime. Algebraic thinking is all about seeing and understanding patterns and changes. It is another powerful tool for children as they make sense of their world.

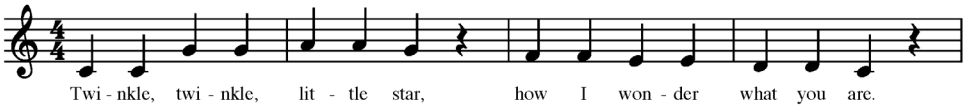
A pattern is something that repeats or grows in a predictable way. When we think of patterns, we often think of things in our environment, such as striped socks on little feet or checkerboard tiles on a hallway floor. It's true that those are patterns, but we experience other patterns in our daily lives, too.

- Patterns of events as part of our familiar daily schedule -
  First, we put on jackets. Then we walk to the playground, and then we get the trikes and balls out of the shed – same way, every day!

- Patterns of words in familiar songs and stories -
  "Did Pete cry? Goodness, no!" (*Pete the Cat, I Love My White Shoes)*

- Patterns of motion in familiar activities -
  When we wash our hands, we get them wet, then we get them soapy. Lather, lather, lather – then rinse and dry.

- Patterns of sound in music -



Algebraic thinking also focuses on how things change over time. In springtime, tadpoles in a puddle gradually grow legs and turn into frogs. Seeds sprout and grow into plants. What are some other things that change in the spring? What changes can be observed in summer, fall, and winter? Algebraic thinking isn't an isolated math skill. It intertwines with literacy, music, movement, science, and more.

Algebraic Thinking in Action

Exploring textures and other characteristics of objects

Taking part in predictable daily routines; figuring out "what next?"

Noticing what is the same and what is different about objects

Grouping things that have something in common

Patterning with beads, blocks, or other objects

Recalling the familiar refrain of a song

Patterning with movement – e.g., clap, clap, stomp!

Figuring out what is missing in a pattern or sequence card series

Sorting things by one attribute, then by another

Retelling a story with a sequence of events or "plus one" structure

Generalizing truths about math – e.g., sometimes a set of objects can't be divided into equal groups

Exploring different ways to group numbers – e.g., 3 and 2 is five, but so is 1 and 4!

Figuring out unknown numbers – e.g., "If there are six coins in the sandbox, and I've found four… I should look for two more."

If viewing online, click the link below to see algebraic thinking in action as an infant and teacher investigate attributes in story illustrations (video from the Erikson Institute Early Math Collaborative).

Ideas About Attributes: Story-Sharing with an Infant

View this book online: http://asuchildhoodservices.org/#!chs_publications

How can adults support algebraic thinking?

Here are some examples of adult interactions that model, teach, and encourage purposeful, playful interactions with algebraic thinking.

- Encourage children to notice, explore, and describe attributes of objects that interest them.
- Use movement patterns in playful ways, such as singing *Head, Shoulders, Knees, and Toes* or moving down the hall using a step-step-stomp pattern.
- Talk and think with children about sequences as part of familiar daily routines. "What will we do when we wake up from rest time?"
- Invite young children to help you find more of something. "Let's pick up all of the green blocks." Invite older children to help sort by more than one attribute. "Can you help me find a small, shiny button?"
- Invite children to notice and describe patterns in their environment, such as stripes on a toy tiger or repeating rows of red and blue race cars on a t-shirt.
- Call attention to patterns in stories, such as the "plus one" pattern in *The Napping House*. Encourage children to talk about what they notice and predict.
- Work alongside children with sorting and patterning sets, using self-talk to highlight your thinking. "This pattern card says I need a round, red bead. Will this one work? No. It's red, but it's square."
- Encourage children to explain their thinking as they sort and pattern.
- Provide labels on shelves and on containers of materials. Show children how to use labels as they sort and return items.
- Challenge children to think of ways that two or more objects are alike and how they differ. "Our cow and horse toys both have four legs, and they are both creatures that live on a farm. The cow has spots, but the horse does not."
- Share analogy riddles with older preschoolers and school-agers and invite them to think of their own.
    - Cub is to bear as kitten is to _____.
    - Sock is to foot as glove is to _____.
    - Soup is to bowl as juice is to _____.

Some of the examples above are easily identified as math-focused interactions. Others are not primarily about math but still encourage algebraic thinking and logical reasoning in the context of other daily events. All are valuable for children!

Reflecting on Daily Practices

The competencies below are directly correlated with AR CDELS MT2. Algebraic Thinking. Take a moment now to envision each one coming to life in a vibrant early childhood environment. What specific adult-child interactions might you observe to support each competency?

Arkansas Workforce Knowledge and Competencies (WKC)		
foundation	**intermediate**	**advanced**
2.9.F.c Participates with children as they sort objects and explore patterns	2.9.I.b Provides opportunities for children to sort objects and explore patterns	2.9.A.b Engages children in conversation about their thinking as they sort objects and work with patterns

As you think about the time you share with children, consider ways that you support and encourage algebraic thinking. What are you curious about? Do you have any new ideas that you would like to try?

Shoe Sort

Children's shoes offer many different attributes to explore. With infants and toddlers, encourage children to notice and eventually name attributes of their own shoes and others'. You might point out that several children have shoes that light up when they stomp or sandals with open toes.

With older children, invite children to take off their shoes. Place one shoe from each child in a pile. How many different ways can children think of to sort shoes? They might sort by type, making a row of sneakers and a row of boots. Fasteners are interesting, too. Some shoes have laces, while others have buckles or Velcro; some slip on and don't have fasteners at all. You could also sort by color or size. Or how about shoes with characters on them and those with none?

Sort and resort the shoes together as long as children seem interested and engaged. Enlist their help in figuring out where to place shoes and in counting and comparing piles. Repeat the shoe sorting game again another day to review and build on what you've tried so far.

Materials to Encourage Algebraic Thinking in Play

Here are some examples of play objects and other materials that might be included in an experience-rich play environment to support children's interest in patterns and change.

Infant and Toddler

- Quilts, mats, and materials with simple visual patterns
- Collections of similar objects with varying attributes, such as a basket of balls of different textures and sizes
- Toys that rattle or chime when shaken
- Busy boxes with clear cause and effect actions
- Pictorial schedule with large, clear photos of daily events
- Simple books that follow a pattern such as *Brown Bear, Brown Bear*

Preschool and Kindergarten

- Pattern cards with Unifix cubes, counting toys, or beads and laces
- Sequence cards or puzzles showing familiar events
- Percussion instruments such as maracas and rhythm sticks
- Sorting sets with bowls or mats
- Flannel or magnet board pieces for retelling events in a patterned story
- Collections of loose parts for sorting, patterning, and mandala making
- Picture and word guides for special play activities, such as easel painting

Schoolage

- Brainteasers, such as "Wacky Words" rebus puzzles and triangle peg puzzles
- Weaving loom, tools for knitting and crochet
- Small beads and colorful thread for making friendship bracelets
- Collections of loose parts for sorting, patterning, and mandala making
- Recipes for baking or making slime
- Materials for making and breaking secret codes
- Boomwhackers or other percussion instruments with sheet music
- Snap Circuits, coding (programming) games

At all ages, materials should be engaging and enjoyably challenging. They may take some work to figure out and master, but they should not be overly frustrating for the child.

Measurement and Comparison

Arkansas Child Development and Early Learning Standards (CDELS)

MT3.1 Participates in exploratory measurement activities and compares objects

Like other areas of mathematics, measurement and comparison begin with noticing. As soon as they can grasp and mouth play objects, infants gain knowledge about size and shape. They continue their investigation by dropping, banging, and tossing objects. All of these actions represent a very young child's interest in experimenting and figuring things out.

As children grow, they discover that there are many different ways to describe and compare things. They begin to notice and talk about questions such as those below.

- How long or tall things are (length)
- How heavy something is (weight)
- How much something can hold (capacity)
- How much space something takes up (area)
- How long something takes (time)

With opportunity and experience, children begin to call on measuring and comparing as powerful ways of proving things. Which toy car rolls the fastest? How deep is that puddle? There are ways to find out! The idea of putting things in order also appeals to many children. You might see them arrange dolls, pinecones, or toy dinosaurs from smallest to largest.

Children may discover that attributes can be surprising. A small golf ball actually weighs more than a large beach ball. A tall, narrow cup holds the same amount of water as a short, wide one. Children experiment again and again to make sense of unexpected results.

Measuring and comparing are often informal in the early years, but children are also intrigued by all sorts of measuring tools. They are eager to investigate the Bannock Device that measures feet at the shoe store, the big scales at the supermarket, and the thermometer outside their classroom window. These devices all support the child's budding interest in gathering information and solving problems.

Measurement and Comparison in Action

Shaking, mouthing, banging, dropping different objects

Investigating size, temperature, weight, or other attributes

Filling and emptying containers

Lining things out, stacking things up

Comparing with a friend – Who is taller? Whose hand is bigger?

Counting to compare groups of objects – e.g., figuring out whether there are more Goldfish or Danios in the fish tank.

Measuring in informal ways, using everyday items

Arranging items from smallest to largest or longest to shortest

Using words like tall, wider, or heaviest to describe and compare

Using measuring tools such as balance scale, tape measure, measuring cups

Talking about time by using terms like "yesterday," "in a minute," "for a long time."

Talking about and investigating scale and distance

If viewing online, see measurement in action in these videos from the Erikson Institute Early Math Collaborative.

Comparing Capacity at the Sand Table

Peg Towers

Measuring a Block Tower in Kindergarten

View this book online:
http://asuchildhoodservices.org/#!chs_publications

How can adults support measurement and comparison?

Here are some examples of adult interactions that model, teach, and encourage purposeful, playful ways to measure and compare.

- Compare objects with very young children. The silky blue blanket feels smooth and slick, but the pink fleece blanket feels soft and nubby.
- Talk about length, size, and weight in engaging ways. "I wonder if we could make a playdough snake that is as long as the table?"
- Create age-appropriate opportunities for children to safely interact with heavy objects such as buckets of sand or a wagon full of friends.
- Use clocks and timers in positive, purposeful ways. "Several of you want a turn to use the new keyboard in our music area. Let's use a sign-up sheet and a timer to make sure that everyone gets a turn."
- Talk with children about outdoor thermometers and temperatures. "There's just a little bit of red showing in our thermometer today. Let's take a closer look…It says 34 degrees, much cooler than yesterday. We'll need to wear jackets."
- Encourage interested children to help measure things in informal ways. "Can you wrap your arms all the way around the tree trunk? How about if two children join hands and work together?"
- Incorporate measurement and comparison as you play alongside children. "Last time I stopped by the block area, your structure was as high as your waist. How high is it now?"
- Incorporate measurement and comparison in planned learning experiences. "Let's use yarn to measure the height of the sunflower in our garden. Do you think it has grown since last time?"
- Invite children to think about proportions. "You made pale pink by mixing a little red paint into a cup of white paint. What do you think would happen if you mixed a little white paint into the red?"
- Model making tally marks as a way to record data and invite interested children to do the same. "Let's go for a walk to see how many windows we can find."
- Involve children in enjoyable graphing and charting activities.
- Provide age-appropriate opportunities for woodworking, baking, map-making, and other activities that involve measurement.

Reflecting on Daily Practices

The competencies below are directly correlated with AR CDELS MT3. Measurement and Comparison. Take a moment now to envision each one coming to life in a vibrant early childhood environment. What specific adult-child interactions might you observe to support each competency?

Arkansas Workforce Knowledge and Competencies (WKC)		
foundation	**intermediate**	**advanced**
2.9.F.d Uses measurement words with children (e.g., length, smaller, heavy) 2.9.F.e Describes standard and non-standard units of measure	2.9.I.c Provides materials and tools that invite children to measure and compare objects using non-standard units of measure 2.9.I.d Provides tools such as rulers and measuring cups for children to explore	2.9.A.c Scaffolds exploration of attributes of objects by describing what children are doing and/or by inviting children to express their thinking

As you look back on your recent experiences with children, consider ways that you've encouraged their interests in measuring and comparing. What do you wonder? What new interactions might you try with children?

Jump into Measurement

Make a tape line on the floor. Invite an interested child to stand on the tape line and jump forward as far as they can. Add a sticker or small piece of tape to mark where their feet touched down.

Would they like to try again? Add another mark to represent this second jump. Repeat a third time. Which jump was the longest? Older children may enjoy using a yardstick or measuring tape to measure from the starting line to their landing spot. A small group of children can take turns jumping, observing, marking, measuring, and sharing their technique tips.
("Try swinging your arms!")

Play Materials to Encourage Measurement and Comparison

Here are some examples of play objects and other materials that might be included in an experience-rich play environment to support children's interest in measuring and comparing.

Infant and Toddler

- Stacking rings
- Nesting cups
- Containers to fill and empty
- Objects with identifiable attributes such as medium and large-sized soft blocks
- Simple graduated puzzles
- Simple books about concepts like large and small or fast and slow, such as *Big Bear, Small Mouse*

Preschool and Kindergarten

- Interlocking links or other non-standard measuring tools
- Measuring cups with sand or water, along with containers to fill
- Thick and thin-line paintbrushes, markers, and crayons.
- Dolls of different sizes, with clothing of different sizes
- Sand timers – 30 second, 1 minute, 3 minutes
- Loose parts or commercial materials to arrange by size
- Loose parts or commercial weights with balance scale or analog kitchen scale
- Measuring tape, yardstick, ruler with interesting things to measure

Schoolage

- Stopwatches
- Graphing mats with collections of loose parts
- Graduated cylinders with sand or water
- Variety of familiar and less familiar measuring tools such as ruler, level, anemometer, protractor, spring scale, sundial
- Age-appropriate woodworking materials
- Analog clock with minute marks and second hand

Loose parts here, there, everywhere. Have you noticed that some materials and activities seem to overlap among the different components of mathematics? Math concepts are often connected to one another, and some materials can be used in several different ways.

Geometry and Spatial Sense

Arkansas Child Development and Early Learning Standards (CDELS)

MT4.1 Explores and describes shapes and spatial relationships

In the first year of life, children begin to notice the shape of things in their world. A baby bottle or sippy cup has a round feel in hand, while a wooden storage shelf has straight, parallel lines that meet in predictable, 90-degree angles. Children begin to understand these geometrical truths long before they have the words to explain them.

In the toddler and preschool years, children learn to name shapes – circle, square, triangle, and more. In time, and with encouragement to analyze shapes in their environment, they learn that rules define shapes. For example, some pebbles are round, and some pebbles are not. And, the sides of a square are all the same length. If some sides are longer than others, that must be another kind of rectangle. In this way, geometry connects with measurement and comparison.

Children come to recognize relationships between flat (two-dimensional) shapes and three-dimensional shapes. How is a circle like a ball? How is it like a cylindrical soup can? Irregular shapes – such as very long, thin rectangles or wide, "squished" triangles - may become increasingly fascinating. Children actively explore combinations of shapes in their constructive play and artwork.

The second part of this component – spatial sense – has to do with the position of objects in the environment and in relationship with one another. *Under*, *over*, *next to*, and *on top of* are all examples of spatial relationships. Spatial sense can relate to the position of people in their environment, too!

Children explore orientation as they learn about spatial relationships. How does the playground look different when viewed from the platform of the tallest climber? Why does a puzzle piece fit only when you turn it a certain way?

Children discover that they can rotate, flip, stack, and rearrange shapes in other ways to change their place in space, and they become increasingly aware of symmetrical and asymmetrical arrangements.

Geometry and Spatial Sense in Action

Exploring the size and shape of objects

Making objects move by scooting, dropping, tossing, or rolling

Rotating or moving objects to make them usable, such as turning a sippy cup to make the mouthpiece accessible or pushing a step stool up to the sink.

Following simple spatial requests – e.g., "Put your blanket in your cubby, please."

Using spatial vocabulary – e.g., "I put the dinosaur on top (of the sand pile.)"

Sorting and matching shapes; working puzzles

Naming and talking about simple, familiar shapes: circle, square, rectangle, triangle

Noticing what is the same and what is different about shapes

Focusing on shapes while sorting and patterning

Naming and talking about increasingly complex shapes and 3-dimensional shapes

Constructing with geometric blocks and creating with paper shapes

Drawing increasingly accurate shapes to represent real objects and imaginative ideas

Using spatial sense while investigating and making maps

How can adults support geometry and spatial sense?

Here are some examples of adult interactions that model, teach, and encourage children to think about and investigate shapes and spatial relationships.

- Name and describe shapes and positions as part of everyday interactions.
- Pair gestures with words, such as drawing a circle with a fingertip while describing something as "round."
- Use and encourage position words while sharing storybooks. "Look – where is the hat now?"
- On walks or buggy rides, invite children to notice curved and straight paths, turns, and corners.
- Join as play partner in block play, following the child's lead. "What could we do with these cylinder blocks?"
- Call attention to shape concepts in ways that interest children. "That big truck has a rectangular trailer for hauling things."
- Play active games that involve spatial relations, such as using hoops in different ways—jump in, jump out, walk around, and so on.
- Use self-talk to describe your actions as you make shapes with play materials. "I'm combining these triangle magnet tiles to make my shape stand up." Invite children to describe their work, too.
- Encourage children to think and talk about what they understand so far. "What do we know about cubes?"
- Ask questions that invite children to think and describe. "How is this plastic egg like a ball? How is it different?" Or, "Why do you think our rest cots are shaped like long rectangles? What if they were square instead?"
- Encourage children to notice and investigate shapes in their environment. "What do you think the triangle-shaped road sign means?"
- Invite children to take part in playful obstacle courses.

If viewing online, click the link below to see geometry and spatial sense in action as a preschooler and adult play a shape matching game (video from the Erikson Institute Early math Collaborative).

Can You Make Yours Like Mine?

View this book online:
http://asuchildhoodservices.org/#!chs_publications

Reflecting on Daily Practices

The competencies below are directly correlated with AR CDELS MT4. Geometry and Spatial Sense. Take a moment now to envision each one coming to life in a vibrant early childhood environment. What are some specific adult-child interactions that could be observed to support each competency?

Arkansas Workforce Knowledge and Competencies (WKC)		
foundation	**intermediate**	**advanced**
2.9.F.f Uses shape names and spatial words throughout the day in conversations with children	2.9.I.e Provides materials that engage children in manipulating shapes 2.9.I.f Implements activities in which children move through space in different ways	2.9.A.d Talks with children about how they are using materials and/or moving through space; invites children to explain their thinking and use problem-solving strategies

As you think about your recent experiences with children, consider ways to support and encourage children's interests in geometry and spatial relationships. What are you curious about? Are there any new ideas that you would like to try?

Hide and Seek Friends

With infants, hide a stuffed toy under a blanket and invite them to uncover it. Clap and cheer together when your hidden friend is found!

Add complexity for toddlers and younger preschoolers by having them turn their backs or cover their eyes while you hide the toy somewhere nearby. Use – and invite children to use – spatial relationship vocabulary to describe where they find the toy. "Silly bunny was hiding behind the drum!" Children will enjoy hiding toys for you and their classmates to find.

Older, more experienced preschoolers and kindergarteners may be interested in making a map of their play space to mark the location of hidden objects. Schoolagers enjoy even more complex seek-and-find activities and can become engrossed in creating treasure maps and scavenger hunts.

Play Materials to Encourage Geometry and Spatial Sense

Here are some examples of play objects and other materials that might be included in an experience-rich play environment to invite children to explore shapes and positions.

Infant and Toddler

- Grasping toys for young infants
- Stacking and nesting toys
- Shape sorters
- Simple shape puzzles
- Objects that can be moved, such as balls with tubes and ramps
- Age-appropriate blocks – such as large vinyl cubes – with room to build
- Shape books such as *Color Zoo* and seek-and-find books like *Where's Spot?*
- Safe things to climb, crawl through, and get inside

Preschool and Kindergarten

- Wooden unit blocks with variety of shapes and sizes
- Geometric pattern blocks
- Framed jigsaw puzzles and, later, boxed puzzles
- Magna-tiles, train tracks, ball/marble run toys
- Geoboards with rubber bands
- Clipboards, paper, and writing tools to make representations of work
- Shape books such as *Mouse Shapes*
- Shape stickers or die-cut paper shapes for open-ended collages

Schoolage

- Lego, Kapla, and other constructive play sets
- Tangram puzzles
- Spatial relationship games such as Izzi, Mastermind, and Connect Four
- Jigsaw puzzles
- Maps, compass, atlas, globe
- Origami sets
- Clay and other sculptural materials

What about workbooks? Many materials marketed to parents and educators claim to teach children about shapes by having them color or trace. However, research is clear: Children learn mathematical concepts best by interacting with real objects that they can handle, move, and arrange.

It's All About the Attributes, Baby!

Human beings enter the world with a natural inclination to investigate and learn! They look intently at the people and things around them, kick their feet, and experiment with moving their bodies in other ways. They discover their own hands and feet, followed by objects they can reach for, grasp, and explore with their mouths.

Mathematics learning begins as infants and toddlers interact with their world. They find out about things around them by gazing at them, mouthing, touching, and moving them. In doing so, they discover that not all things are the same. In fact, the things in our world can differ from one another in a staggering number of ways! The very young child is making sense of attributes: a crucial foundation for all math learning.

Attributes are the characteristics, features, and qualities of a thing. Examples include, but are not limited to, color, size, weight, texture, temperature, and transparency. Infants and toddlers learn about these concepts through real-world research that happens as they play, experiment, and explore. It takes time and repeated opportunities for an understanding of attributes to emerge and solidify. That's probably one reason infants and toddlers seem hard-wired to repeat actions – like shaking, dropping, and banging objects – over and over again.

This is vital work for the very young child; their cognitive development and mathematical thinking depend on it! A child who has a comprehensive understanding of attributes is well-equipped for math learning and development in the years that follow.

- Moving oneself and making things move builds spatial sense.
- Investigating ways that things are alike sets the stage for classifying skills.
- Investigating ways that things are different prepares the child for sorting.
- Exploring corners and flat and round sides of things is a baseline for geometry.
- Developing a sense of large and small, warm and cool, heavy and light, fast and slow must happen before measurement is possible.
- Gathering and combining things sets the stage for later counting and addition.
- Discarding and taking things apart are valuable experiences that connect to subtraction and fractions.
- Filling up and emptying boxes, baskets, and other containers prepares the child to understand quantity and capacity.

Infant and toddler mathematical discovery happens naturally through play and daily experiences. It does not rely on direct instruction or coaching from adults. Still, adult choices can help or hinder investigation and discovery. Here are some ways to support and encourage the youngest learners.

Provide room to move.
There's not much to investigate in a crib or baby seat. The youngest infants will enjoy studying the world from your lap or a safe floor-play space when they know that you are near. Older infants and toddlers need opportunities to crawl, scoot, and move around the room in other ways as they follow their interests.

Cut the clutter.
Well-meaning designers often create bright and showy baby things. Rugs, quilts, wallpaper, and toys can be a riot of colors and decorations. While it is true that young children are curious about colors and patterns, they can feel overwhelmed by too much to process.

We can reduce visual clutter by using natural, neutral-colored walls and floors as a backdrop for more vibrant playthings. Choose play objects with simple color-schemes and arrange them in uncrowded baskets and shelves where children can easily reach them. Sort and replace materials as children lose interest in them, ensuring open floor space where the eye can rest.

Both of these soft elephant toys offer colors and textures to explore, but one might be trying to do too much. Which toy do you think would be more supportive of a toddler's focused play?

Cultivate contrast.
Offer collections of objects that are alike in some ways but different in others. Grasping toys for infants can be made of rubbery silicone, hard plastic, or sealed wood. A mobile infant might discover that you can see through translucent play balls, but not solid ones. A basket of bells in a toddler space could include a large cowbell, a wand with full-sized jingle bells, and a handful of much smaller jingle bells in a sealed jar.

The indoor space itself can provide contrast, too. Open curtains create a warm, sunny spot on the floor that feels different than cool tiles elsewhere in the room. Mats and rugs add different textures to explore, too. If lights are adjustable, you might even make one corner of the play space dim (not dark) – another contrast. Variances like these create a sensory-rich environment with many different attributes to investigate.

Choose play objects that encourage children's ideas and efforts.
Children investigate by gathering, moving, and changing things. Older infants and toddlers, especially, benefit from play objects that can be carried around and used in many different ways.

Imagine how a curious infant or toddler might interact with each of these things. These play objects are all round, but how are they different? What surprising attributes might be discovered by handling and moving them?

The best play objects are child-powered, not battery-powered. Children's play is rarely enhanced—and often disrupted—by toys that light up, talk, play music, or have other electronic features. With child-powered toys, children think and experiment in their own ways rather than relying on the toy for instructions and feedback.

Respond to children's actions and experiences.
Be present and attentive as children investigate the people and things in their environment. Don't disrupt the child when she is concentrating, but make yourself accessible if she wants to show you what she is doing. When children seek a connection with you, use gestures, comments, or questions to show that you notice them. "Dani, you've placed a ball inside each bowl!" Commentary like this helps children connect words and concepts with their actions. Pause between responses to give children time to process new information.

What happens when children encounter difficulties in their play? Perhaps the stacking rings won't fit together the way a child thinks they should, or maybe a too-large ball has stuck in a tube instead of rolling through. Frustrating moments like these are a natural part of experimentation, but children benefit from the opportunity to work through them and figure them out.

Infant-toddler specialist Janet Lansbury suggests that a child's request might be, "Hear me, don't fix me." In other words, it is helpful for a child to know that we empathize with their frustration, but we shouldn't step in to solve a problem that they can work out on their own. It's immensely satisfying for learners of all ages to persist and finally figure out a challenge. Even infants gain confidence in the realization that they can do hard things. We're there to share in those victorious moments, too.

Balance familiar and novel invitations to explore.
Very young children need opportunities to repeat the same play activities numerous times. Over hours, days, and weeks, they interact with familiar materials again and again. With each repetition, they strengthen and deepen their understanding. They may play precisely the same way they did before or pick up where they left off and explore a little more. Because we honor and trust children's repetitive play, we ensure that favorite play objects are accessible every day—ready and waiting in their familiar places.

At the same time, we know that children *also* benefit from a sprinkling of novelty in their place space – something new to discover and try! We ask ourselves, "What will children experience today that they didn't experience yesterday?" It's especially powerful when we can connect new play invitations (provocations) with children's current, strong play urges and interests. For example, if several mobile infants have seemed especially curious about sparkly, reflective objects lately, their educator might add one of these sets of materials.

- Unbreakable mirrors that can be moved around
- Sealed sensory bottles with glitter on a sunny windowsill
- Swatches of shimmery, metallic fabric
- Silver metal mixing bowls and trays

The environment hasn't changed in any major way, but there's something new to investigate. Observing children's interactions with these new materials will provide clues about their interests and ideas. Thus, begins an observation-response cycle that is at the heart of rich, meaningful daily experiences.

Keep an open mind about children's investigation.
Sometimes, children may use materials in very different ways than we imagined. Nesting cups might be used for rolling rather than stacking. Stacking rings may become bracelets for one child, while another repurposes a bowl as a hat or seat. There's more than one way to play!

We can trust children to use materials in ways that interest and satisfy them; as long as they are engaged, meaningful learning IS happening! Rather than asking *why*, we ask *why not*. Unsafe or destructive behavior can be redirected, but all other explorations are welcome!

Explore outdoors, too.
When we think of attributes to discover, no indoor environment can rival the richness of the great outdoors! Out there, clouds move through the sky and tree branches sway in the breeze. Sunshine and shade invite investigation and so, too, do changes of weather and season.

Here are three things that a young child might notice and investigate outdoors.

What attributes are waiting to be discovered?

It can be challenging to go outdoors with infants and toddlers. There are individual schedules to consider, and there's a lot of work involved in putting on jackets or sunscreen and preparing to travel. Is it worth all the trouble? When we consider all of the physical and cognitive benefits, the answer must be yes!

We can apply a mathematical lens to our outdoor play space, too. Can children find room to move? Are there pathways to follow and changing elevations to explore? What can children find to gather, carry, push, and pull? What small additions or changes can we make from time to time to enhance and extend children's investigations?

Partner with families to make learning visible.
Parents and other family members can sometimes feel anxious about math. They wonder when their child will learn to count to ten or point to a square. They worry about whether they have bought the right kinds of books and toys and whether there is something more they should do.

We can put minds at ease as we highlight "mathematic moments" that are a natural part of infant and toddler play. By thinking with families about ways to support authentic learning at home and child care, we acknowledge that meaningful math experiences in these first years of life matter very much!

Find Out More

Nurturing Mathematical Thinkers from Birth, Zero to Three Journal

View this book online: http://asuchildhoodservices.org/#!chs_publications

Balls and Boxes: Observation Provides New Clues about Early Math Abilities

Once upon a time, it was assumed that mathematical thinking was a complex skill that did not develop until the preschool years or later. We now know that even very young infants have an interest in—and an ever-growing understanding of—mathematics. But how do we know? What has happened to shift our understanding of when and how mathematical thinking begins?

Modern researchers have tremendous tools at their fingertips. For starters, it is easier now than ever before to film a child's actions and interactions unobtrusively in a natural setting, providing video evidence that can be viewed again and again. Scientists have also developed precise ways to view electrical activity in the brain. These offer insights about what and how a child thinks long before they can talk with researchers. As exciting new evidence of early mathematical skills comes to light, scientists and educators have grown increasingly curious and eager to find out more.

In 2003, researchers conducted a simple experiment with 14-month-old children (Feigenson and Carey 2003). Each child worked one-on-one with an adult. They watched as the adult placed one or more toy balls in a solid box with a hole cut in the top. The child was then invited to reach through the hole to retrieve the balls. What do you think happened?

When children observed the adult put just one ball into the box, they tended to stop after they retrieved one ball; they didn't reach back into the box again. They seemed to know that there were no more balls in the box. However, if children saw an adult place two or three balls in the box, they tended to reach in, again and again, searching until all of the balls were retrieved. That's evidence that they were able to track, remember, and understand something about quantity!

Next, a similar experiment was conducted with 21-month-old children (Langer et al. 2003). This time, the child watched as an experimenter put two balls in the box. After a pause, the experimenter pulled one of the balls back out. They wondered, how might this change a child's perceptions about balls in the box?

Each child was directed to "take all the balls out of the box." Most children reached in just once to retrieve the one remaining ball. Were these 21-month-old toddlers demonstrating that they understand subtraction? Or was something else going on?

If you wanted to find out more about how young children think about numbers and quantity, what playful investigations might you try? Many different experiments have occurred since the one described above, each providing additional insight into what children know and how they learn. If you are viewing this article online, you can read examples **here** and **here**. [View this book online: http://asuchildhoodservices.org/#!chs_publications]

While most early childhood educators aren't researchers in the formal sense, experiments such as these inspire us to be curious about children's thinking. The spaces we share with children are their learning labs, filled with opportunities to actively investigate and test new ideas. What are children showing us as they play and as they engage in conversations with us and one another?

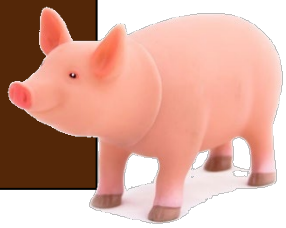
The next time you play alongside young children, notice how their actions with play objects provide insight into their thoughts and ideas. What new resources could you offer to support their play and deepen your understanding of what they know so far? You might want to keep a journal or sit down with a friend or colleague to talk about your observations and questions. Being an attentive and thoughtful observer of children can be fascinating. Even more importantly, it provides the clues you need to support and extend children's mathematical exploration in meaningful ways!

Try This

Offer a collection of simple toys—such as plastic farm animals—paired with a collection of small boxes and tins. Some of the animals should be able to fit in some of the containers. Notice how children experiment with placing toys in boxes and taking them out again.

What do children seem to be thinking about and figuring out?

What might you add or change in response to their ideas?



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7 Big Benefits for Young Block Builders

1. Block play strengthens a child's mathematical thinking skills, social skills, abstract thinking skills, creativity, and literacy-readiness (Hanline, Milton, & Phelps, 2009). What other material can do all of that at once?!

2. Although there are many books, computer programs, and apps designed to teach math to young children, the real secret to math success is logico-mathematical knowledge (Kamii et al., 2004). Learning to think in this unique way builds the foundation children need to truly understand counting, sorting, and classifying, and they can only develop it when they have a chance to interact with real objects, like blocks!

3. Math benefits from block play extend beyond kindergarten and first grade. Preschoolers who were given the time, space, materials, and encouragement for complex play with blocks during the preschool years had higher mathematics test scores in seventh grade. These advantages continued in high school, where they had better math grades and were more likely to be enrolled in honors math courses (Wolfgang et al., 2001).

4. Not only that, but for girls, equal access to blocks and other building materials during the early childhood years was proven to eliminate the boy-girl gender gap in high school mathematics performance (Wolfgang et al., 2001).

5. Children who were given ample opportunities to play with divergent (open-ended) materials – like blocks – were compared with children who used mostly convergent materials – like puzzles, matching activities, and lacing cards. The block builders performed better on problem-solving tasks (Pepler & Ross, 1981). They demonstrated lower levels of frustration and higher levels of creativity when solving problems.

6. "Block play provides a structure and foundation for children to learn to persevere, develop self-control and delay gratification, expand curiosity, gain self-confidence, and learn to overcome failure." (Tough, 2012) Perhaps most amazingly, children are naturally motivated to build these perseverance skills when they work with blocks; no nagging required!

7. Even adolescents benefit from block play! A study shows that young teens who have opportunities to engage in cooperative construction projects with peers form higher-quality friendships (Roseth et al., 2009).

It's a fact – every child needs blocks!

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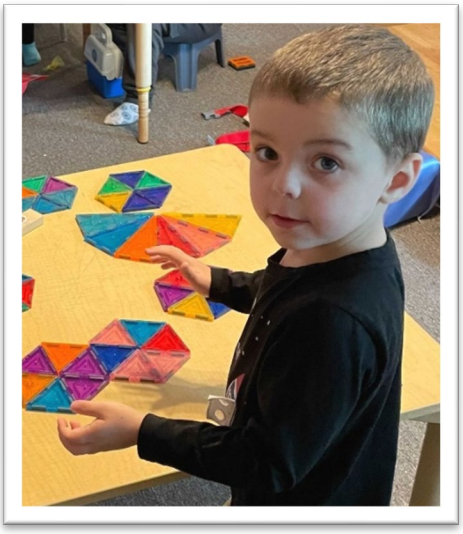
"7 Big Benefits for Young Block Builders" has been reprinted from Arkansas Children's Week 2015, Zoning in on Construction. To view the entire resource, click here or go to http://asuchildhoodservices.org/#!chs_publications



Circles from triangles: a 3-year-old's constructive play.
Photo shared by Mother's Touch Preschool FCCH, Booneville

What's Your Math Attitude?

"Attitudes are contagious. Is yours worth catching?" –unkown

Imagine a teacher tripling a recipe from home so that she can share it with children at school. She realizes that she made a mistake in her calculations.

> She might make an exasperated face and exclaim, *"Oh, no—I messed up! This is too hard! I'm no good at math!"*
>
> Or, she might laugh and say, *"Oops—that was a close one! I'm glad I caught my mistake. This is tricky. I'm going to write it down to help me figure it out."*

Children are attuned to our words, tone, and body language—even when we're not talking directly to them. Both of these examples send clear messages about math. The first one suggests that either you're good at math… or you aren't. Children sense how hard their teacher is being on herself for making a mistake. How might this affect their feelings about their own math challenges?

The second example acknowledges the mistake in a much different way. This time, the teacher sends the message that mistakes are part of the learning process and can be corrected. She demonstrates that a challenging math problem is something to work through and shows confidence in her ability to do so. Small shifts in our stance can make a big difference for children!

A complicated recipe offers the opportunity to show that we can take our time and figure things out.

Here are five key math ideas that children can learn from adults in their lives.

1. Math is helpful. It's how we figure things out and succeed with things we want to do.
2. Problems are for solving. We can work together to figure them out.
3. Persistence pays off. It feels rewarding to work through something challenging.
4. Math can be beautiful, surprising, and fascinating.
5. Math is for everyone.

When it comes to teaching math, one of our most important and long-lasting roles as educators is to help children see math as a valuable way of making sense of their world. We can bolster their confidence in their abilities to work and think mathematically. We accomplish this through our curricular interactions, but also through our own mathematical mindset and modeling.

Partnering with Families

A pair of teaching partners look back over last year's monthly family nights. Most had moderate attendance, and a couple had a full house. One notable exception stands out. In October, their focus was "Math Counts." Even though the invitations promised an evening of fun and games, only two families attended.

Wondering if October was a busy month for families, the teachers move this year's math night to a different month. But yet again, almost no one shows. When they talk with a student's mother about it, she trusts them with a candid response.

She tells them that she isn't good at math, and she would be embarrassed for everyone to know. The idea of having to do math in front of other parents fills her with anxiety. She wonders if she might mess things up for her son by somehow teaching him the wrong things. "I just want him to be better at math than I was."

The teachers appreciate her honesty, and they're concerned that she feels so worried. Research tells us that parents' math abilities don't have much bearing on children's math abilities, but parent math *attitudes* absolutely do affect their children! (Mohr-Schroeder et al., 2017). This is also true for other important big people in a child's life: grandparents, teenage siblings, and so on.

Many adults carry baggage from unpleasant childhood experiences with mathematics. Math classes may have been uninteresting, or grades may have been a source of tension within families. Even people who excelled at math may have come away with confusing feelings; children who show early aptitude are often expected to "just know" the answers. Families and teachers care about today's children and share a desire to help them have a better experience.

To partner with families, we might begin with a sincere conversation about math attitudes. Let families know that your teaching team focuses on being mindful of your stance about math, and invite them to join you on this mission. Together, you can think through scenarios like the one at the beginning of this article as you consider ways to support and encourage children.

You may also want to focus on all the mathematical expertise that families can share from their jobs and hobbies. Mechanics, photographers, musicians, and truck drivers all use math. So do plumbers, gardeners, architects, and nurses. Their tools and experiences are fascinating to children. Comics and sitcoms often joke about never using math in real life… but we do!

Lastly, consider ways to highlight children's joyful math experiences. Our children don't feel anxious about math; they feel excited! Assure families that each child builds skills at their own pace. It isn't a race. Rather than focusing exclusively on what children can do (skills), also emphasize how they do it. In other words, encourage families to view their child as eager, determined, creative, and capable.

It may take more than a game night to help families think differently about math and their young mathematicians, but it's worth the effort!

> “
>
> It is important to nurture interest in mathematics and to build identities as capable mathematicians during early childhood because this is the time when children begin to define their self-concept by making choices and developing preferences.
>
> ERIKSON INSTITUTE
> EARLY MATH COLLABORATIVE

Partnering with families is an essential component of high-quality early childhood education. Do you have a family engagement success story that you would like to share? If so, please email Marcy White, mwhite@astate.edu.

Mohr-Schroeder, Margaret J.; Jackson, Christa; Cavalcanti, Maureen; Jong, Cindy; Schroeder, D. Craig; Speler, Lydia G. *School Science and Mathematics*, v117 n5 p214-222 May 2017.

The Case Against the Countdown

That is enough, Jonah! I'm counting to three! One… Two…Two-and-a-half….

This sort of exasperated counting can be heard in supermarkets, city parks, and maybe even some child care centers. It's a strategy that adults sometimes use to try to gain a child's attention and urge them to comply. Usually, "three" is followed by an unpleasant consequence of some kind.

If we want children to have positive feelings about numbers and counting, why would we turn counting into a power struggle or a punitive event?

If counting is a go-to guidance strategy for you, consider alternatives. A calm, expectant pause can work wonders. If viewing online, you can read more about consequences here.

[View this book online: http://asuchildhoodservices.org/#!chs_publications]

Here are some other ways to flip guidance interactions to use math more positively.

Instead of –

"You're going in time-out for 4 minutes because you are 4 years old. That's the rule."

You might try –

"I can see by your actions that you need to regroup."

(Child is helped to calm and can express that she feels ready to try again.)

Instead of –

"Look at the timer. You only have two more minutes left to use the computer. If you don't leave the computer center when the timer dings, you won't be allowed to play there for the rest of the day."

You might try –

"The timer says that your turn is almost done. Two more minutes. Our timer helps us make healthy screen time choices, and it helps everyone have a fair turn." (And then, at turn's end, "Would you like to walk around with me to look for another place to play? How about magnet tiles or easel?")

Notice when and how math comes up in your interactions with children. You have the power to help children associate counting, telling time, and other math concepts with positive experiences.

Moving Through Each Day with Math

Make math meaningful by incorporating it into predictable daily routines. Below, you'll find examples of mathematical interactions during each part of the day.

Notice how skills range from simple to more complex. Examples at the top of each list are usually suitable for younger children, while those near the bottom may be ideal for older children. Early experiences build a strong foundation for later learning.

> "…The development of children's mathematical thinking skills depends on their exposure to and engagement in mathematical learning opportunities both at home and in early learning settings."
>
> *Arkansas Child Development and Early Learning Standards* (CDELS)

Math at Mealtime

- Investigate the characteristics of dishes and foods by banging, sliding, grasping, mouthing.
- Use sign language to ask for more or to signal all done.
- Take one bib, one cup, one bowl, or one spoon.
- Notice that bottles, cups, or bowls are empty or full.
- Notice shapes, such as round balls of cereal or triangle-shaped crackers.
- Place a plate, napkin, or cup at each place at the table.
- Talk about more and less. Ask for "just a little" or "lots, please."
- Count or sort when serving selves. "Take three crackers, please."
- Compare quantities: Are there more goldfish crackers or tiny pretzels in your scoop of snack mix?
- Count how many children are present to figure out how many napkins or cups are needed.
- Use food for comparing quantities and simple addition and subtraction. "If you eat one of your strawberries, how many will you have left?"
- Divide food into fair-share portions or solve a sharing challenge. "We have two pieces of toast left, but four children would like another serving. What can we do?"
- Use a recipe to prepare foods to share.

Math During Hygiene Routines

- While washing hands, notice water temperature and lather hands fast and slow, tops and bottoms.
- Notice patterns on clothing. "Look—you have stripes on your socks. Red, blue, red, blue. That's a pattern!"
- Count buttons or other fasteners while helping a young child dress. "One snap, two snaps, three snaps – all set!"
- Learn to take an appropriate amount of soap, toilet tissue, and paper towels.
- Count to 20 while lathering hands.
- Use a two-minute timer while brushing teeth.
- Notice when it is time to refill toilet tissue, soap, or paper towels and help with these tasks.

Math During Transition Times

- Explore changes in temperature and brightness while moving from place to place.
- Explore near and far while moving from place to place.
- Tidy up by pushing chairs in to tables.
- Help count the number of children in the group before leaving the room and at each change of place.
- Subitize (recognize number without counting) as part of a small group. "Three of us are going to the water fountain."
- Use math talk during clean up times. "The small triangle blocks go together," or, "You worked hard to lift that heavy basket!"
- Use the clock to help guide transitions. "Our guest speaker will be here at 3:15."

Rest Time Math

- Experience rhythmic rocking or patting.
- Notice the pattern of slow-blinking twinkle lights.
- Listen to music with a slow, repetitive tempo.
- Sequence steps in a ready-for-rest-time routine. "First, we get our blankets from our cubbies. Then what?"
- Engage in quiet math activities if not sleepy or when waking early. "Would you like to use the magnetic tangrams or the pattern beads?"

More Math in Daily Routines

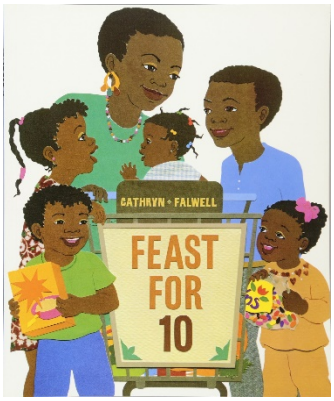
- Talk about the sequence of events in the day. "We change diapers and go potty before we go outside."
- Fold washcloths from a clean laundry basket.
- Help care for pets. Offer a small pinch of food for the fish or two scoops of food for the hamster. Or, turn on the lamp to make the lizard's home nice and warm.
- Count and compare daily attendance. "How many children are here today? Is that more or less than the number of children who were here yesterday?" "How many children are absent? How do you know?"
- Check a thermometer before outdoor play. "It's 33 degrees outside right now. Pretty chilly! Let's put on jackets."

Next Steps

What are some ways that you can share math ideas with families? How might you invite them to share their favorite, everyday "math moments" with you?

Connecting Literature and Math (CLAM)

A Component of STEM CURRICULUM



"1 cart into the grocery store.
2 pumpkins for pie,
3 chickens to fry…"

So begins the rhyming story *Feast for 10*, by Cathryn Fallwell. By the story's end, a happy family has shopped for, prepared, and enjoyed a holiday meal together.

Stories like this one offer a wonderful opportunity to introduce and strengthen math concepts. They're at the heart of a comprehensive resource that is available to all Arkansas early childhood educators. Connecting Literature and Math (CLAM) provides a set of 14 curriculum guides designed for children ages 3-5. CLAM developer Dot Brown shares the following information about the resource.

CLAM Background

In 2016, the Arkansas Child Development and Early Learning Standards (CDELS) were approved. The standards are organized into nine domains of development and learning, with **Mathematical Thinking** as one of the domains of learning. The following two statements from the introduction in the standards to Mathematical Thinking were important as the CLAM curriculum was developed:

"Young children love to think mathematically."

"All early childhood professionals, whether or not they feel skilled in math, can be great teachers of early mathematical concepts."

CLAM Information

- Available as a supplement to any Arkansas-approved curriculum, CLAM is a collection of fourteen curriculum guides. The guides focus on daily opportunities for children to experience mathematics through child-centered, hands-on materials and activities and teacher-guided experiences. Activities within each guide support one or more of the Mathematical Thinking learning goals.

- Each guide includes a section on the learning environment and begins with math-related children's books. A section titled Assessment Ideas concludes each section.

- CLAM guides are available on the Arkansas Better Beginnings website, www.ARBetterBeginnings.com. They can be viewed online and downloaded at no cost.

CLAM Trainings

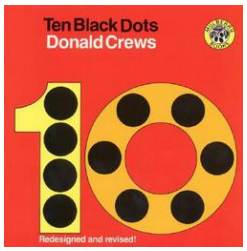
Professional development opportunities are available for educators working with ages 3-5. Sessions are listed on the UAFS Early Childhood Professional Development Facebook page/group, https://www.facebook.com/groups/UAFS.PreK.Prof.Dev. You may also contact Sheri Young, sheri.young@uafs.edu, 479-788-7249, to schedule a training.

About the Author

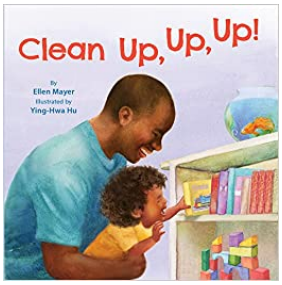
Dot Brown is President, Early Childhood Services, Inc., and is currently focusing on developing professional development opportunities for Arkansas's early childhood professionals. The Connecting Literacy and Math (CLAM) curriculum was designed and developed by Dot Brown and Beverly C. Wright.

More Magnificent Math Books for All Ages

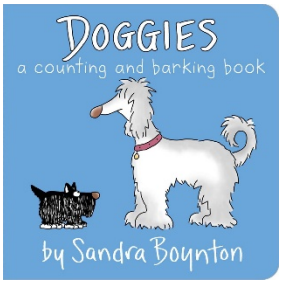
Books for Infants and Toddlers



10 Black Dots
Donald Crews, board book edition by Greenwillow Books, 2010
Black dots can represent many different things in this bright, simple counting book. Invite a child to touch each dot as you read together.

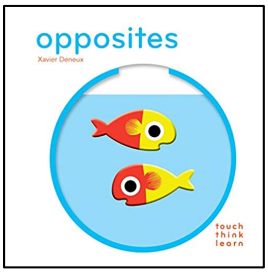


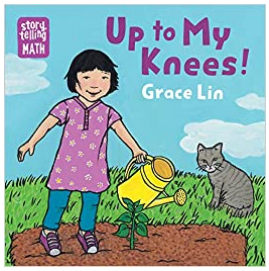
Clean Up, Up, Up
Ellen Mayer and Ying Hwa-Hu, Star Bright Books, 2018
A father and child explore spatial relationships like up, down, inside, and outside as they pick up toys together. This book is part of the highly recommended *Small Talk* math series.



Doggies
Sandra Boynton, Simon and Schuster, 1984
Woof, yap, and ruff-ruff-ruff your way through this whimsical counting book featuring dogs of all sizes.

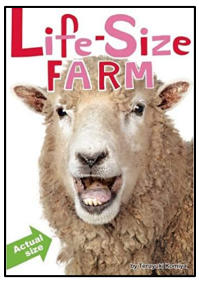
Touch Think Learn: Opposites
Xavier Deneux, Chronicle Books, 2013
Unique raised and indented pages invite children to explore with their fingertips as they enjoy this colorful book about attributes and opposites.



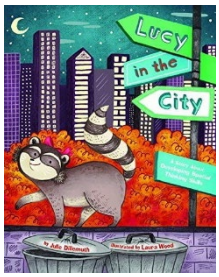


Up to My Knees
Grace Lin, Charlesbridge, 2020
A little girl plants a sunflower seed and measures as it grows up to her knee, up to her waist, up to her shoulder, and beyond. This book is part of the *Storytelling Math* series, perfect for toddlers and young threes.

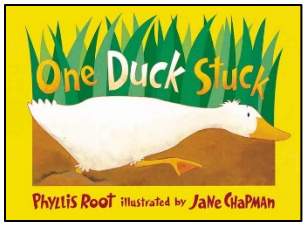
Books for Preschoolers



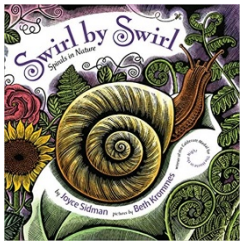
Life-Size Farm
Teruyuki Komiya, Seven Footer Press, 2012
High-quality farm animal photos are shown in actual size, inviting children to measure, estimate, and compare. Because there are some fold-out parts, you'll want to share this book with small groups or one-on-one until children get the hang of handling the pages.



Lucy in the City
Julie Dillemuth and Laura Wood, Magination Press, 2015
When a little raccoon gets separated from her family, an owl's eye view helps her find her way home. This book provides exciting opportunities for children to think and talk about spatial relationships.

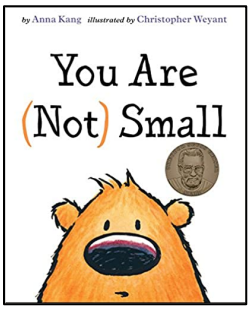


One Duck Stuck
Phyllis Root, Candlewick, 2004
Rhythmic text and satisfying sound effects make this "mucky ducky counting book" a great pick to read aloud with groups. A seek-and-find element adds fun for one-on-one sharing, too.



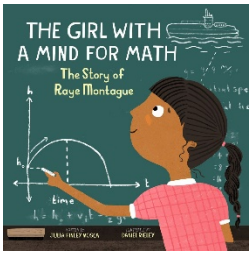
Swirl by Swirl: Spirals in Nature
Joyce Sidman and Beth Krommes, HMH Books, 2011
A simple poem and fascinating scratchboard illustrations invite children to notice and appreciate spirals in the natural world.

Triangle
Mac Barnett and Jon Klassan, Candlewick, 2017
This book, along with *Circle* and *Square*, make up Barnett's Shape Trilogy. The witty stories and unique use of stamped shapes make these books ideal for an author and illustrator study.



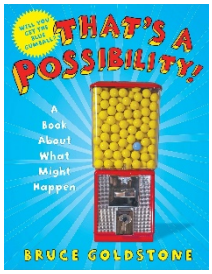
You Are (Not) Small
Anna Kang and Christopher Weyant, Two Lions, 2014
Sometimes, our perception of size depends on what we're comparing! This funny book invites children to compare sizes and debate whether bears are small—or not.

Books for Schoolagers

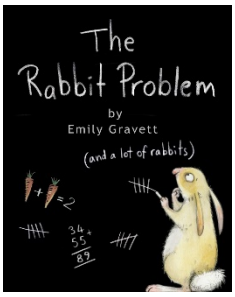


The Girl with a Mind for Math: The Story of Raye Montague
Julia Finley Mosca and Daniel Rieley, Innovation Press, 2018
This simple, rhyming story tells the true-life story of a girl from Little Rock, Arkansas who grew up to engineer ships for the US Navy. A timeline and additional biographical information at the back of the book could inspire a study of this inspiring Arkansan! Ages 5 and up.

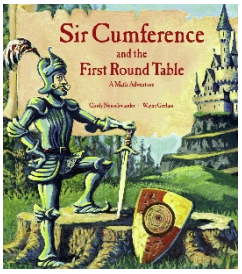
A Hundred Billion Trillion Stars
Seth Fishman and Isabel Greenberg, Greenwillow Books, 2017
This book invites readers to marvel at massive numbers and fun facts about (approximately) how many gallons of water make an ocean, how many trees make a forest, how many people make a city, and more. Ages 5 and up.



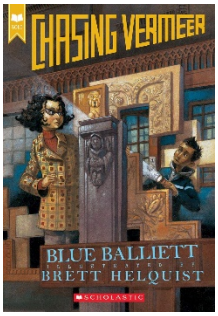
That's a Possibility: A Book About What Might Happen
Bruce Goldstone, Henry Holt & Co., 2013
Vibrant photographs and engaging scenarios introduce the concepts of impossible, possible, and probable. Ages 5-9.



The Rabbit Problem
Emily Gravett, Simon & Schuster, 2010
How many rabbits will there be in one year? A classic math puzzle inspires this witty introduction to predictive modeling. Ages 6-10.

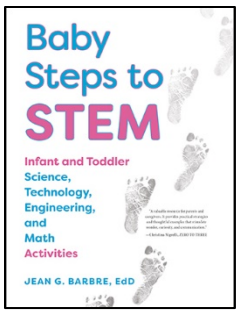


Sir Cumference and the First Round Table
Cindy Neuschwander and Wayne Geehan, Charlesbridge, 1997
Written by an elementary school teacher, this and other books in the *Sir Cumference* series use humor and puns to highlight mathematical concepts and problem-solving skills. Ages 8-12.

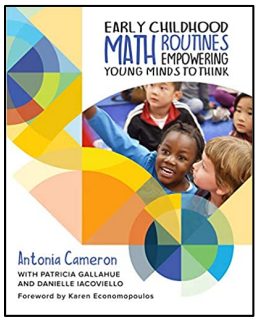


Chasing Vermeer
Blue Balliet and Brett Helquist, Scholastic, 2005
A fascinating mystery hinges around a missing painting. To solve it, readers and the story's young protagonists search for clues, crack codes, and figure out patterns. Ages 9-12.

Recommended Reading for Educators

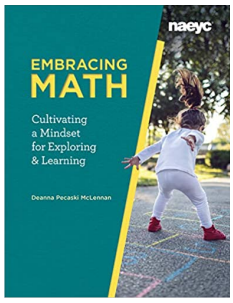


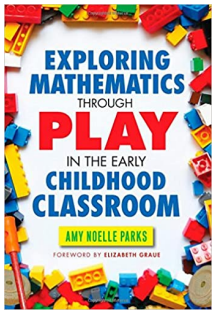
Baby Steps to STEM: Infant and Toddler Science, Technology, Engineering, and Math Activities
Jean Barbe, Redleaf Press, 2017
This resource offers 60 play-based invitations for infants and toddlers to explore and investigate. It also invites educators and parents to consider their role in children's learning.



Early Childhood Math Routines: Empowering Young Minds to Think
Antonia Cameron, Stenhouse Publishers, 2020
What happens when we flip rote classroom rituals—like calendar time—to increase engagement and spark deeper learning? Concrete examples in this book will be beneficial for educators working with ages 4-7.

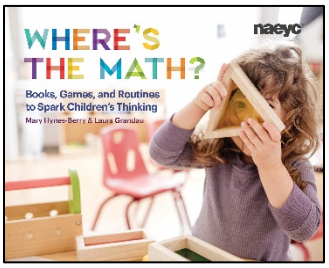
Embracing Math: Cultivating a Mindset for Exploring and Learning
Deanna Pecaski McLennan, NAEYC, 2020
Math is all around us. This book focuses on ways to support meaningful math learning in the context of everyday play, exploration, and interaction in preschool and kindergarten.





Exploring Mathematics Through Play in the Early Childhood Classroom
Amy Noelle Parks, Teachers College Press, 2015
This book supports educators in recognizing and expanding math and problem solving as a part of everyday free play.

Where's the Math? Books, Games, and Routines to Spark Children's Thinking
Laura Grandau, Mary Hynes-Berry, NAEYC, 2019
This book focuses on five children's own math-related questions, using them as a guide for planning ways to think, talk, and solve problems together using math.



More Online Resources for Educators

Development and Research in Early Math Education (DREME)
http://prek-math-te.stanford.edu/

DREME teacher educator resources provide comprehensive information about children's mathematical development, along with a wealth of playful, targeted activities to share with children from birth to age eight.

DREME Family Math
https://familymath.stanford.edu/

Dreme Family Math is for families and professionals who support families. Educators will find ideas for talking with families about children's math development and resources to answer math questions. Dozens of learn-at-home ideas are provided for families with children from birth to age eight.

Early Math Collaborative
https://earlymath.erikson.edu/

The Erikson Institute's Early Math Collaborative provides more information about 26 "Big Ideas" at the heart of children's mathematical development from birth to age eight. Their mission is to help every teacher and child succeed with math.

NAEYC's Math At Home Toolkit
https://www.naeyc.org/math-at-home

The National Association for the Education of Young Children (NAEYC) offers tip sheets in English and Spanish for simple math experiences using household materials. The Math at Home toolkit may be especially helpful if distance learning/AMI resources are needed.

YouCubed
https://www.youcubed.org/

YouCubed focuses on mathematical mindsets and the belief that everyone can enjoy and succeed with math. There's a free course for educators and creative ideas to share with students. YouCubed focuses on K-12 but may also be of interest to early childhood educators interested in thinking about math in new ways.

Crazy 8's Club
https://crazy8s.bedtimemath.org/

Crazy 8's Club provides resources for math clubs for school-agers in grades K-2 and 3-5. The club is designed for afterschool settings, with kits available to support three, eight-week-long sessions for each age group. A commitment from an adult facilitator is required, but kits are free.

Exploratorium Tinkering Studio
https://www.exploratorium.edu/tinkering/projects/

San Francisco's Exploratorium Tinkering Studio provides a collection of over two dozen hands-on STEM activities for school-agers. Young people can strengthen math and reasoning skills as they create balancing sculptures, design chain reactions, build scribble robots, and more!

What about math apps?

Apps and game sites offer amusing ways to play around with – and practice – math concepts. However, games like these aren't necessary for math learning, and many children already spend excessive amounts of time in front of screens at home. Some early learning and out-of-school time programs opt to be screen-free.

If you choose to share apps or websites with children, consider these guidelines.

1. Only use games that are guided by sound educational practices. Common Sense Media recommends these top picks.

   For ages 4-5
   - Funexpected Math
   - Kahn Academy Kids
   - PBS Kids Lab (web-based)

   For ages 6 and up
   - MathTango
   - Prodigy Math
   - DragonBox series

   Always preview games to make sure that content is age-appropriate. Avoid games with advertisements.

2. Check in with children while they play. Invite them to show you what they're doing and explain their reasoning as they solve in-app challenges.

3. After a little while, unplug and do something more active together. No app can substitute for real life investigations in your vibrant program!

Rethinking Circle Time

A group of four- and five-year-old children make their way to the large, soft rug at one end of their classroom. It's time for circle time! Like circle time in hundreds of other preschool classrooms around Arkansas, this is a teacher-initiated, whole group gathering. It's a long-standing tradition in many programs, but is it a good use of children's time? How do we know if this circle time is a fit for these children?

The first and most important clue about the suitability of circle time comes from the children themselves. Their eagerness to participate shows that they relish this time of day. Perhaps their teacher starts with a "hook"—the singing of a favorite welcome song, the taking down of a special puppet from the shelf, or the announcement of something new and exciting to try. A strong circle time is **playful** and **vibrant**, and many children are excited to begin. Notice how children bounce to the rug and find their places, leaning in with bright eyes. They know, "This is going to be good!"

A few children might opt *not* to join the circle, and that's OK, too. Some children might prefer to finish a drawing or something else that feels important to them at this moment. Some children might want to listen from a distance, from a place in the room where they have their own space. Just like adults, some children do their best listening and thinking when they have something to do with their hands. A strong circle time is **voluntary—**not forced—and **flexible** to accommodate every child in the group.

Next, we see the suitability of a circle time in the quality of activities shared. Many educators identify circle time as one of their favorite times to teach and practice math concepts with children. However, circle time math events must be genuinely **thought-provoking** and satisfyingly **challenging** for children. Being an engaged learner isn't about sitting still and quiet while the group runs through a tired series of rote activities. Being an engaged learner means being keenly involved—thinking, moving, figuring things out, and communicating ideas.

Picture it again: a relaxed, joyful group of children making their way to the rug for circle time. They find space, sitting however they are comfortable. (One small girl lies on her belly, chin propped on her cupped hands.) The positive energy is evident as they are invited to participate in activities that are well-matched to their interests and abilities.

- Perhaps they work together to figure out how many members of their classroom community are present today and which classmates are absent.

- Next, children might chant along with one of their favorite books. The story inspires an animated discussion about shoes, and soon pairs of children are invited to huddle together to figure out how their shoes are the same and how they are different.

- A "question of the day" might be a tradition for this group. As they arrived this morning, they placed name cards on a chart with a photo of a melon that asked, "Have you ever tasted cantaloupe?"

  Now, at circle time, they quickly count and compare. Seven children have tasted cantaloupe; nine have not. Their teacher shares that cantaloupe in their garden *might* be ready to pick today and children cheer. They've been watching their melons grow and change for weeks now!

- Perhaps there is a problem to solve together. A teacher might remind children that, yesterday, there was frustration when trike and scooter-riding children crossed into the area where classmates were making chalk designs. Can children think of a solution? A child proposes using traffic cones to divide the concrete pad into two zones, and other children nod in agreement. Good idea!

- Maybe children pass around a basket of rhythm sticks and laugh at the wild, happy cacophony of tapping that erupts before they settle in to play a call-and-response pattern tapping game. "Pat on the floor… tap together-tap together…pat!"

These are just some of the meaningful activities that children might enjoy as they gather together. Did you notice the math opportunities embedded in each one? These experiences are diverse, but all of them invite children's active engagement.

Although educators might collect dozens of ideas like these, it's likely that today's group only takes part in one or two. Others are saved for a different day. Because young children have limited attention spans, strong circle times are **brief**! Wise educators watch for cues that children are becoming restless and ready to move on to other things. They know that a 10 or 15-minute gathering is suitable for most preschoolers. As they come to know this particular group, they'll be able to refine plans by keeping in mind their unique needs and aptitudes.

Circle time concludes with a closing ritual such as a favorite dance or a transition game. Today's purposeful circle time has come to an end—one small part of another amazing preschool day!

Putting It All Together:
Components of a strong circle time

- ✓ Begins with an opening ritual
- ✓ Playful, vibrant tone and sense of community
- ✓ Voluntary, flexible, and comfortable
- ✓ Challenging, thought-provoking, and active
- ✓ Brief and attuned to children's interests
- ✓ Ends with a closing ritual

A positive, vibrant circle time is an enjoyable part of the day for many children and educators, but it may not suit every group.

It is absolutely acceptable to skip circle time to make more time for interactions with smaller groups and individual children.

Supporting Small Group Math and More

Four preschoolers sit with their teacher at a small table. They're deeply engrossed in comparison of sound and volume. Each child takes a turn to tap a rubber-tipped mallet against the homemade drums on the table: a metal mixing bowl, a cardboard box, and an overturned paint bucket.

Their teacher challenges them to remember what they heard as they arrange the drums from softest to loudest. Next, they'll investigate a fascinating new measurement tool—a decibel meter.

Music meets math in this deeply engaging small group activity. Small group activities are planned experiences that are carried out with just a few children at a time. Of all the ways of teaching and learning with young children, small group activities are one of the most effective. There's a large and ever-growing body of both research and anecdotal evidence that indicates that small group instruction is far more beneficial for children than whole group activities. Here's what makes small group learning so valuable.

Proximity
Children in small groups can see and hear better. No one is stuck at the back of the rug or the end of the line, and everyone can get "up close and personal" with materials.

Access to Materials
Unlike whole group time, small group activities always have a hands-on component. There is something for the child to handle and interact with. Because they don't have to wait for a turn with materials, most of their group time is spent actively *doing*.

Interactions with Peers and Adults
Compared with whole group gatherings, adults are better able to attune to each child in a small group. Children have more opportunities to share ideas with others, and their comments and questions are more likely to be responded to. Interactions in a small group are also more likely to be high-value serve-and-return conversations, with several back-and-forth exchanges.

Individualization
In a small group setting, adults are better able to respond to individual learners. They're more likely to notice each child's level of engagement and can adapt the activity to challenge and support each learner. Different small groups may also go in different directions, following the interests of the group members.

Another way to think about the effectiveness of small and large group interactions is to think about our own needs as learners. Imagine that you want to learn how to do something new. Perhaps you want to master an unfamiliar baking technique or maybe you would like to learn how to repair your car or play a new musical instrument. You inherently know that a crowded lecture hall is not the place to go. You would want to be part of a much smaller group where you could see and interact with materials, where the instructor could go at your pace, and where your questions and comments could be heard.

In our early childhood environments, some activities can be positive and powerful when shared with the whole group at once. As described in the *Rethinking Circle Time* article, you might share a welcome tradition, read a book that invites everyone to join in a rhyming refrain, or use a picture schedule to talk briefly about plans for the day. However, small groups are more comfortable, more enjoyable, and more effective for most math experiences and other elaborate activities.

Small Groups from Theory to Practice
Many educators acknowledge that small group learning is ideal but admit that they have a hard time incorporating small groups into their preschool day. On the pages that follow, you'll find some frequently asked questions about small groups, along with practical tips for success.

When we say "small groups," how many children are in a group?

How small is small? Typically, a small group consists of five or fewer children at a time. Up to seven more mature preschoolers might participate at once in simple, familiar experiences. It's essential to consider the ages, abilities, experience levels of children in the group, and the planned experience's risk and complexity.

Some programs are in the habit of defining half the class as a small group. If you have 12 children in total, you might have two small groups of six each. On the other hand, if you have 20 children, half the group is still too many participants to truly provide small group time benefits.

How do we decide which children to group together?

There are several ways to group children. Your grouping strategy will depend on the type of activity planned and your goals for learners within the activity. There may be times when small groups are child-selected. Children might sign up for groups or join any time there is space available. Child-selected small groups work well for experiences that are universally appealing and approachable. Those are times when you don't anticipate much need to simplify or extend the activity to meet learners' needs.

There may also be times when you want to group children by similar interests, abilities, or experience level. Imagine that children will prepare food for bird feeding stations. They'll experiment with various healthy foods for birds and record how much of each food is eaten. Picture children using butter knives to slice fruit for this activity.

Some of the older children in the group may have the dexterity to enjoy the challenge of slicing strawberries. Some younger and less experienced children in the group might find that overly difficult and frustrating. Bananas would be a better pick for them. The teacher prepares for small group time by assigning children to three groups by skill level. She explains to children that each group will be invited to slice a different fruit.

A third option is to group children to facilitate peer modeling. When more advanced or more experienced children have an opportunity to work closely with less advanced or less experienced children, that can be beneficial to both. The younger child benefits from a peer model, while the older child experiences a leadership role and the satisfaction of helping someone else learn. This strategy works well when there is something that children can work on together.

How do we fit small group time into our daily schedule?

There are two common strategies for scheduling small group learning experiences:

Strategy 1: Small Groups as a Stand-Alone Event
Some educators prefer a scheduled daily small group time. In a classroom with two adults, one group of children works with a teacher, another group of children works with a teaching partner, and one or two groups of children work on self-guided activities prepared for them. Typically, the second teacher's guided activity is less complex, allowing her/him to float to support children in self-guided activities as needed.

> Five children work with Teacher A. They're sorting, counting, and grouping a collection of buttons.
>
> Teacher B sits with five children. They are playing a new matching game. Children in this group enjoy interacting with their teacher but can continue to play independently if a child in another group needs her attention.
>
> Five children work at a nearby table with pegboards and geoboards.
>
> A final group of five children plays on the large rug. They are using magnet tile blocks and other geometric building toys.
>
> Children who prefer not to participate in their group's activity may look at books, work puzzles, or engage with other independent tabletop toys at another table.

The children will visit either the game table or the sorting table and try one of the independent activities during this morning's 20-minute small group time. They'll have an opportunity to try the other activities during the afternoon. These scheduled small group times make up only a minor portion of their overall day; there will be ample time for self-directed free play throughout the room before or after small group times.

Small groups as a daily event may be a good fit for groups with younger and/or less experienced children. It can reduce distractions during small group time and makes both teachers fully available to supervise and interact with children during free play center times.

Strategy 2: Small Groups as Part of Free Play Center Times

Some educators prefer a second strategy, "making themselves a center," as children play. Children may freely choose to join the small group when their turn comes, or they may opt to continue playing elsewhere. Physical cues—such as just four chairs at the small group table or a sign-up list—help children understand turns.

Meanwhile, a second educator moves around the room to supervise and interact with children engaged in free play. Educators often swap roles; they take turns acting as small group facilitators on some days and play facilitators on other days. There are also times when small group activities are not in session. During these times, both educators act as play facilitators.

> Teacher A works with children at a designated small group table. They're sorting, counting, and grouping a collection of buttons. Because there are five child-sized chairs at the table, children know that five people may participate at a time.
>
> Children who would like a turn have written their names on a waiting list. They know that their teacher will check in with them before the next group starts. The activity will be offered several more times today, so they know it's OK if they prefer to keep going with their play.
>
> Teacher B is in the dramatic play center, following the children's lead in an imaginative game. Soon, he'll move to interact with children in the block building area. Children move freely around the room, following their own interests.

Because this strategy offers more flexibility for small groups to finish early or linger longer, it may be a good fit for older and/or more experienced preschoolers. This less formal strategy also helps reduce the total number of transitions in the day and increases opportunities for child-led learning. Some classrooms strongly prefer one small group strategy or the other, while others use a combination of both.

What about children who have a hard time with small groups?

Small group time may be new for some children. When the activity is appealing, they may struggle with waiting for a turn. Focus on clear communication and visual cues to help children understand the system. With consistency, children will come to trust the process; when you promise they'll have a fair turn, they'll believe you.

It's also important to remember that children need time to explore materials before engaging in more structured work. For example, before using playdough for a guided activity about geometric shapes, children need ample opportunity to poke, squish, and interact with the dough in open-ended ways. If children have had many chances to interact with playdough during free play times, they may settle in quickly to the planned math activity. If it is a less familiar material, plan plenty of unstructured exploration time—even if it means saving the math lesson for another day. This isn't time wasted; observing children's open-ended exploration often provides incredible insights!

If a few children don't have any interest in the planned experience and don't want to join, that's OK. In fact, it probably speaks to the appeal of your larger learning lab—your classroom learning centers. But if most children don't seem to want to participate, the activity isn't a fit for the group or it hasn't been framed in a way that captivates their interest.

If children seem bored or restless during small group times, that's a clue that something isn't right yet. Educators can triage to fine-tune the experience.

- Are the workspace and materials prepared before children arrive? Is the workspace attractive and well-organized? Educators can plan ahead to prevent some problems. For example, if there is a tool that you don't want children to use yet, place it out of sight and reach until it is time.

- Are the educators prepared before children begin? Have they had a chance to read through and visualize the activity? Have they taken a moment to tune in and take a deep breath as they prepare to welcome their small group?

- Are children comfortable? Can they see and hear well? Do they have enough space to interact without crowding and the flexibility to find their preferred position for sitting and standing?

- Is the small group activity occurring at an optimal time of day? Children may struggle if they are tired or hungry or if it's been a while since they've been able to engage in active play.

- Is the small group activity paced well and about the right length for this group of children? Children have limited attention spans and lose interest if activities stretch on too long. Rather than reprimanding restless children, read their cues and shorten the group time.

- Does the educator inspire engagement? Children can tell when we're just trying to get through an activity. It feels far more interesting to work alongside an educator who is genuinely enthusiastic and fully present.

Even when an activity works well for most children, individual children will benefit from special support. The content of activities can be adjusted so that each child experiences success. It can be especially gratifying for children to explore skills that are slightly above their independent ability but possible with a little scaffolded support. Children with special needs can be included using adaptive equipment, language supports, or changes to the environment. Depending on the child's needs, a task might be broken down into smaller steps or simplified in another way. Our goal is for every child to feel welcome to participate as fully as they are able.

What happens when a child seems interested in the materials but off-task? We can usually pause to allow novel investigation before steering the child back to the task in a gentle, respectful way. Educators can also be open to the possibilities that arise as we follow the child's lead in a new direction. Skills like counting are important, but we don't want to stifle divergent thinking, creativity, and innovation in the name of basic academics.

Maintaining a Growth Mindset

Like many facets of our teaching practice, small group facilitation is a skill that grows stronger through experience and reflection. Educators and administrators can work together to think about what is working well and where there is room to grow. When challenges occur, teachers can talk them through with colleagues. What perspectives can other educators share, and what solutions have they found?

Occasional mishaps may occur as we carry out small group activities with children, but these are learning opportunities for *us*. Educators can ask, "If I had this to do over again, what would I do differently?" Just as importantly, and maybe more so, successes should be celebrated. Educators can reflect on the specific actions and interactions that make each experience a triumph. This allows us to carry new insights forward and replicate positive practices as we plan our next small group learning experiences!

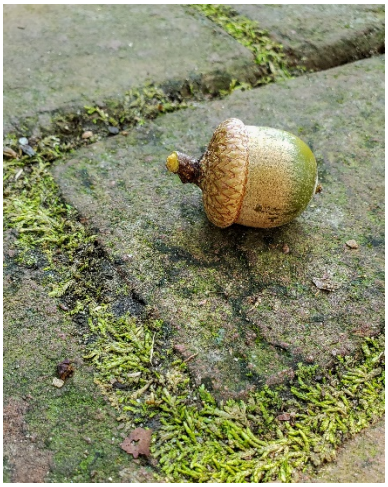
This article references *Loud, Louder, Loudest* and *Songbird and Squirrel Buffet*, two small group activities from the Explorers Preschool Curriculum. This free, inquiry-guided curriculum can be found under the resources tab at **www.ASUChildhoodServices.org**.

Discovering Math through Nature Exploration

Children are eager explorers of their world, and the natural world offers a wealth of opportunities to investigate. Wherever you are, you can find at least a little bit of nature to share with children any time of year. Here are a few possibilities.

Flowering Plants
Ice and Snow
Insects
Puddles and Mud
Shadows and Sunshine
Songbirds and Squirrels
Trees (Evergreens in Winter)
Wind

Take a peek outdoors. What is waiting to be discovered on this day, in this season? Once you find some approachable nature, the next step is to activate curiosity.



What do children notice? What do they wonder about? There are opportunities to count, measure, and use math in other ways as we seek answers. Toddlers might compare large and small pinecones that they have gathered. Preschoolers could make tally marks on clipboards to keep track of hummingbird visitors to a flowering plant, while school-agers estimate the height of a favorite tree.

Events in nature can inspire logical reasoning and mathematical prediction.

- Is it calm, breezy, or blustery today? How can you tell?
- Where did these unusual seed pods come from? How did they get here?
- When do we predict that those icicles will melt and why?
- What do raindrops on an umbrella sound and feel like? What happens when it rains a little harder or when rain tapers off to sprinkles?
- When and why do shadows change?

Anything that can be collected invites children to sort, classify, and compare. Gathering and collecting from nature can be carried out in low impact, environmentally friendly ways. "Tree droppings," like fallen leaves and twigs, can be gathered. Rather than pulling parts off living plants, try collecting photos instead. Close-up shots are especially fascinating! These can be printed for sorting, graphing, and more. Or, use thin paper and peeled crayons to make texture rubbings from several different trees. What differences do you notice?

Patterns and lines are plentiful in nature. They can be found in the angles of tree branches, in the concentric petals of flowers, and on insect wings. This might be a perfect time for observational drawing. Provide each interested child with a pencil or marker and blank paper, inviting them to draw what they see. Ask, "What is it about this [natural thing] that you would like to keep and remember?"

Growth and change are also recurrent mathematical themes in nature. These invite measurement, and there are predictable patterns of change to notice, too. When rain has passed, try using chalk to draw a circle around a puddle of water on the pavement. Return in an hour, and another hour more, circling the puddle each time. What do you notice? Plants in a garden change as they grow, and so do birds in a nest. Find ways to record observations.

How about our sense of place? As children connect with nature outside their door, they think about concepts such as *how far*, *next to*, and *beyond*. Spatial sense is strengthened on nature walks and investigation sessions. Older children may connect with maps and diagrams, charting places where bumblebees are spotted or tracing the tiny line of a creek on a map to see how it leads to a river and, eventually, the ocean.

These experiences and many more offer ways to understand the natural world more deeply and fully. Nature math is about far more than just using natural materials to "do math." It's about using math purposefully in pursuit of answers to our authentic questions about our world. What will you explore today?

Math Matters in School-age Settings

When talking about out-of-school time programming, it's easy to envision sports, art, creative writing, and other enrichment activities. But what about math? Summer and afterschool youth programs have the potential to strongly influence how young people feel about mathematics. High-value math activities in out-of-school-time (OST) settings can boost students' confidence and academic performance. On the pages that follow, we'll consider three powerful ways to incorporate math with school-agers.

1. Educational Support

Many afterschool programs include homework and study time in their daily schedules. At the time of this writing, school-age programs have also stepped up to support virtual and remote learning, a valuable service for families and communities in need. During study times, children and youth benefit from comfortable places to work that are quiet and conducive to concentration. Of course, homework success isn't just about hours logged in front of assignments. Trained out-of-school-time staff can support learners in numerous ways.

- We can highlight and encourage study skills such as organization and time management. Ideally, staff know what is going on with individual kids and follow up with sincere interest: "How'd it go with your math test today?" Every learner benefits from relationships with positive people who care about them.

- We can create a welcoming, non-competitive space. Out-of-school time staff can help young people feel good about working hard and accomplishing their own goals. Focusing on effort rather than ability helps foster a vital growth mindset for every learner.

Stories from the Field

"We've really worked on making an appealing study space. There are tables to work at, back-jack floor chairs, and comfy sofas for reading. There's also a big dry erase board on one wall.

Kids can find everything they need: water cooler, pencil sharpener, resource shelf, blank paper – it feels very grown up, but cool and fun at the same time."

- When a young person struggles with homework, we can provide scaffolded support. Would it help to reread the directions together? Is there a place in your textbook where you might find the information you need? What do you think the first step might be? Our goal isn't to give answers; it is to help young people gain the skills and confidence they need to figure things out.

  Some programs partner with high school or college students to provide tutoring and homework help. Subject matter expertise is valuable, but it is even more important for tutors and other homework support staff to receive training on child development and age-appropriate academic and emotional guidance strategies.

- We can also partner with school-day educators. Out-of-school-time staff can become familiar with the grade-level academic standards for their group. They can also reach out to grade-level educators at the school(s) their program serves. This is an opportunity to share information about the homework and study component of the OST program and emphasize our willingness to support young learners.

Stories from the Field

"I work with second and third graders. One of their teachers shared copies of the folder games that they use in their classroom math center. Now, if children don't have homework or finish early, they can pick a math game to play with a partner. They LOVE it!"

Educational Support: Questions for Reflection

- What does our homework and study space look, sound, and feel like? Is this a comfortable place to work?
- How do we ensure that studying and working on school work at our program feels positive and productive—never punitive?
- How do adult leaders connect with each learner and support their unique educational needs?
- How do we help each young person gain confidence in their abilities?

2. Playful and Purposeful Math Interactions

Many programs use games and group traditions to add a little fun and inspire a sense of community. What happens if we mathematize some of those playful interactions? Here are some examples.

- A kindergarten and first grade group gathers in a circle to play a pattern game. A child claps his hands together once. Everyone imitates him. The next child claps once and then pats her knees. Everyone imitates clap-pat. The third child adds a snap of the fingers, making the pattern clap-pat-snap. The string of actions gets longer and longer as play continues around the circle.

Key idea: Non-competitive games like this one create a sense of teamwork and unity. No one feels put on the spot, and no one has to sit out. This game offers plenty of challenge without a sense of risk.

- As second graders arrive in their afterschool room each day, they find a riddle written on a dry erase easel. Sometimes it is a math riddle. Today, the board asks, "What did the triangle say to the circle?" Children can think and talk about the riddle any time throughout the afternoon and even overnight. They'll find out the answer to today's question tomorrow afternoon.

  Yesterday, children found this challenge: "You just got hired to put number decals on 100 mailboxes. How many number three decals do you need?" Today, their leader asks if anyone worked on the problem.

  Marisa: I did! I need 10 number three stickers for the mailboxes, please!
  Mr. James: Hmmm. How did you come up with ten, Marisa?

  Marisa: (counts on fingers by tens to 100) – and every set has a three.
  Mr. James: You're right that the number three repeats in each set of ten. Could there be any other threes that you haven't thought of yet? Guys, Marisa and I could use your help.

  Aaron: What about the 30s? There's 3s in ALL of the 30s!
  Marisa: Oh, yeah. I forgot about the 30s. And what about 33? It has two 3s. I need to work on this some more.

Marisa and Aaron grab scratch paper and head to a table to figure it out. Moments later, they return to the group to share their final answer – 20! They laugh as Mr. James slaps imaginary decals into their palms. "Marisa and Aaron's Mailbox Shop is open for business!"

Key idea: It's thinking about math and explaining our reasoning that matters most! When Mr. James said "not yet" instead of "that's wrong," he made it safe for Marisa and her classmates to take risks.

- Members of the early elementary group plan to work in teams to poll preschoolers and older school-agers. They will make tally marks on clipboards as they ask, "We're planning a booth for the back-to-school carnival. Which sounds more fun to you—ring toss or fishing booth?"

  Their group leader asks them to think about a potential problem. If some children are polled by more than one team, the poll results may not be accurate. Children decide on a systematic solution: Two teams will visit each of the other groups. One team will poll girls, and the other will poll boys. After polling is done, they add up their results. The fishing booth wins!

  When they take a more in-depth look at the data, they discover that ring toss was far more popular with the oldest group of school-agers, but they were outnumbered by preschoolers in the total count. One pollster suggests, "Maybe we should make a ring toss, too, so that the big kids have something they like to do." There's more math involved in deciding whether this is possible. Will they have enough space? Enough volunteers? Enough prizes?

Key idea: Math is part of real life. Through experiences like the one described above, young people discover that math can be a powerful way to gather information and figure things out.

- A trio of third and fourth graders are hanging out at a picnic table with Ms. Pearl. Noticing that they seem a little bored, she asks if they would like to play the Robot Game. She'll be the robot first.

One of the children calls out a number: 23. Using her best robot voice, Ms. Pearl responds, "30." Another member of the group calls out 109, and the robot replies, "116." After all three children have had a chance to give the robot a number, they work together to figure out the robot's function. This one is easy: "Robot adds seven!"

Now, one of the children takes a turn as the robot. 16 becomes 61. 72 becomes 27, and 200 becomes 2. "Robot reverses numbers!"

Key idea: Math games can be shared formally or informally, but the tone should always be playful. (This isn't a pop quiz!) Games like this one support collaboration between learners and are flexible enough to include players with differing skill levels.

Playful and Purposeful Math: Questions for Reflection

- What games, traditions, and playful habits are an ongoing part of our out-of-school time program? Do any of them include math?
- Are there any new ideas that we would like to try?
- How do we assess cognitive challenge, emotional safety, and overall success in the context of games and traditions? How might it feel to be a child/youth participant in these activities?

3. Math in Service of Intellect and Investigation

Many young people develop intense interests in hobbies and extracurricular activities. The out-of-school time setting can offer opportunities to build skills and connect with others who have similar interests. By incorporating authentic mathematics into clubs, focus groups, and teams, adults help children and youth see that math isn't just a textbook or a block of the traditional school day. Consider these examples.

- A group of kindergarten and first graders gathers around their cooking cart. They're making fruit pizza as part of their afterschool STEM program. That means measuring, timing, arranging, and dividing!

- A dance club contemplates the mathematics of choreography. They explore symmetry, shape, and pattern as they create a new routine. As they think about ways to view their practice in different ways, they decide to mount a camera on a basketball goal. The overhead perspective provides new insights about lines and spacing.

- In the game room, a group leader invites young people to invent their own games. A supply table offers dice, numbered spinners, a stopwatch, playing cards, and plenty of open-ended materials like colored masking tape and large paper. Once games are designed, peers test them out and provide feedback. Games are refined before a final "share fair" event.

- A summertime fiber arts club explores patterns with macramé, weaving, quilt-making, and crochet. They become especially enthralled with the idea of creating temperature tapestries. Different colors of yarn are used to represent daily high temperatures: Deep red yarn if a day tops out at 100 degrees or above, hot pink for 95-100 degrees, bright orange for 90-95 degrees, and so on. Eventually, they'll have a piece that shows summer heatwaves and cooling trends at a glance.

- A middle school mountain biking group hones their skills with maps and scale. They have a particular interest in elevation changes on topographical maps. Math also comes into play as they log miles biked so far this year and investigate how bicycle gears relate to effort and speed.

When mathematics connects to hobbies and interests, young people are likely to feel optimistic about their ability to use math in

purposeful ways. Kids are also eager to investigate the world around them. Real-life events can offer opportunities for collaborative learning among peers who might not otherwise work together.

Imagine that a group has received permission to add a small pet to their afterschool space. Now, research about the needs of geckos and salamanders is underway. They discover that temperature and humidity must be monitored when caring for a reptile or amphibian.

What mathematical insights might emerge in each of the following occurrences?

- A large tree is knocked down by an overnight storm. Children are eager for a closer look.
- The out-of-school time facility is remodeling its gym. Kids notice workers unloading tools and flooring from a truck.
- School-agers are interested in taking care of the environment. They wonder if they might organize a composting program for their afterschool program.

Each of these events inspires questions. How do you keep a salamander healthy and happy? What can we find in the branches of a fallen tree? What's going on in the gym? What if we could reduce food waste? Would that be good for the earth?

Questions like these, in turn, spark investigation. Young people use math, literacy, science, and other skills to find answers to their own questions. That's inquiry-guided learning in action, and it is one of the most valuable ways to support cognitive development!

Math and Investigation: Questions for Reflection

- When and how are young people invited to pursue interests and seek answers to their questions?
- How confident are we in our ability to mathematize learning experiences in authentic, meaningful ways?
- Which people or resources could we connect with to enhance and extend real-life math in our program?

About Arkansas Children's Week

Did you know…

- Arkansas Children's Week (ACW) has been a statewide tradition for more than 30 years! ACW is a celebration of children of all ages and their educators and families. Through ACW, early educators and youth development professionals highlight the needs of children and families and the accomplishments of the adults who work with them.
- ACW is always an April event. It coincides with NAEYC's Week of the Young Child.
- Each year's Arkansas Children's Week has a topic, guided by suggestions from the field. This year's topic is mathematics. Other recent topics include inquiry-guided learning, messy sensory play, outdoor play and nature, and imaginative dramatic play.
- Workshops typically take place in many communities across the state. In 2020, more than 1000 educators took part in ACW workshops! The 2021 ACW workshops will use a virtual format.
- Many programs celebrate Arkansas Children's Week with families and their larger community. Events include a variety of activities such as displays of children's artwork, parades, topical family funfairs, and more!
- Copies of current and past Arkansas Children's Week books can be found under the resources tab at www.ASUChildhoodServices.org. These can be viewed online, downloaded to your favorite device, or printed in part or whole.
- Although we celebrate Arkansas Children's Week only one week during the year, we hope that the knowledge, skills, and relationships built through the ACW tradition will serve you well for years to come!

See you next year!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