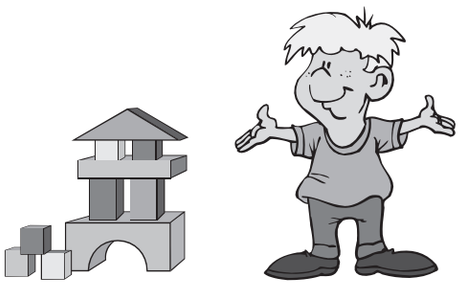


# 6

# How Many Cookies Do You Want?

## Teaching Mathematics That Is Relevant to Young Children

Teaching mathematics involves more than counting to 100 and being able to read numbers. Concepts such as bigger, smaller, more or less, and the ability to compare amounts, organize information, and think logically are all part of mathematics. When children start to truly understand numbers and what they represent, they become empowered. Decisions and understanding about all aspects of their daily activities are enhanced. If you think about it, we would be stymied if we couldn't use numbers and mathematical concepts to communicate. I'm sure you could add to the following examples:

You can have 10 pushes on the swing.

Would you like a half cup of juice?

You have to wait two turns before you can use the bike.

How many cookies would you like?

Cleanup time is in five minutes.

We only have three fire engines, and so we have to share.

Would you like half of my play dough?

Are you ready to go down the slide? When I count to three—1, 2, 3!

Get your coat on before I count to three—1, 2, 2¼, 2½, 3.

Stir the batter six times, and then it is Kyle's turn.

Three more pails of water and the water table will be full.

We need to line up by two's.

The recipe says "two cups of sugar."

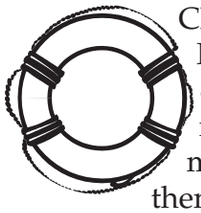
Mathematical learning should take place all day long. Provide a rich environment for the children to explore, and be ready to engage them in mathematics whenever the opportunity presents itself.

# 65. Help children understand one-to-one correspondence

## I CAN COUNT

Four-year-old Wayne rushed into the classroom. "Guess what?" he said. "I can count to twenty, Grandpa taught me. You want to hear?" Of course I did. Wayne then began, saying the numbers very quickly, "One, two, three, four, five, six, seven, eight, nine, ten, eleventeen, tweleveteen, thirteen, fourteen, fifteen, sixteen, septeen, eighteen, nineteen, twentyteen." When he finished he had a big grin on his face, and he just beamed with pride.

## HELP!



Children just love to rote count (saying the numbers in order). I have spent many a happy moment patiently listening to children go all the way to 100. However, just because they can recite numbers does not indicate they understand what they mean. To help children learn what numbers represent, have them count objects. Tell them to touch each object as they say a number. Since they are so familiar with rote counting, frequently their mouths (saying the number out loud) will move much faster than their hands. You will probably need to remind the children to slow down and say a number only when their hand touches an object. This approach will help them to grasp the concept of one-to-one correspondence. Mathematics has to start on a firm base of tactile (touching) experiences. As children mature they will be able to count in their heads and not have to touch the objects. Moving to that step too quickly will cause them to be less sure of themselves and their understanding of mathematics.

Touching and counting objects outside of the classroom can include steps, nails on a fence, or trees on the playground. When the child no longer needs to touch objects, you can move on to such interesting things as counting cars, trucks, worms, and birds.

*One and one make two. That's great. What's a two?*

*—Bill Cosby*

## ASK YOURSELF:

Do you respect the child's need to touch and handle materials?

Are interesting materials (seashells, leaves, raisins, toys) provided for counting?

# 66. Provide meaningful mathematical experiences

## HOW MANY CRACKERS?

One day, at snack time, I asked each child in turn, "How many crackers do you want?" Most children said three or four. It had been my experience that children usually ask for the same number as their age. Kenesha was watching me very carefully as I responded to each child's request. When I finally got to Kenesha and asked her how many crackers she wanted, she smiled very broadly and with a twinkle in her eye said in a bold voice, "I want seven crackers." I acknowledged her request and carefully counted out the crackers. Fortunately for me I had only two more children at the table, and they both requested three crackers. Needless to say, many of the children noticed how many crackers Kenesha was given.

## HELP!

Here was a situation where a child clearly understood that seven was more than three or four, and was able to use that knowledge to her benefit. Try to provide situations where counting is not just an exercise but has real meaning for the child. Counting carrot sticks, pretzels, or spoonfuls of raisins, which the children know they are going to consume, will get the undivided attention of most youngsters. When they truly learn the meaning of the numbers, there may have to be some limits—such as three to five carrot sticks today. Giving the children the power to determine how many pieces of food they can take (within reasonable guidelines) is a meaningful way to teach mathematics.

- On the subject of food, have children make half or quarter sandwiches to eat.

*Is it not joy to use knowledge you have gained?*

*—Confucius*

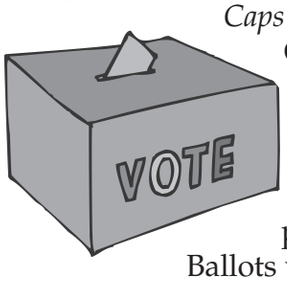
## ASK YOURSELF:

Do you provide meaningful mathematical experiences for the children?

# 67. Make mathematics an integral part of classroom activities

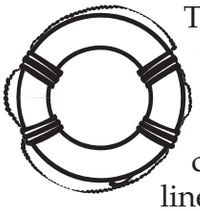
## ELECTION DAY

Living just inside the beltway in the Washington, D.C., area meant that Election Day was extra special. One year I decided to try to have an election in our four-year-old classroom. Rather than voting for personalities, we were going to vote for which book would be read at story time. The choices were *Caps for Sale* or *Whistle for Willie.* I prepared simple ballots.




On a single sheet of paper I had an illustration to represent each of the books. The children were told to color in the picture of the book they wanted read later that day. I was pleasantly surprised at how seriously the children took making this decision. During free play those who wanted to vote, colored in their choice. Ballots were collected in a shoe box. (I hope they never sell shoes in plastic bags!) At the end of free play we gathered on the carpet and counted the ballots. Interest was so high that I decided to post the ballots on a wall so the children could count them during the course of the day. I lined up the ballots in two straight lines so that it was clearly visible which story had gotten more votes. *Whistle for Willie* was declared the winner!

## HELP!



This was a good activity, and like so many things we do with young children, multiple subjects were touched on. Reading, small motor control, mathematics, vocabulary, and the voting process itself were explored. Displaying the objects to be counted (in this case the ballots), so that they are carefully lined up and the children can visually see which group is larger, is something we should try to do whenever the counting of two or more sets is involved. If possible, try to line the items up from left to right, and then immediately under that form another line of objects for easy comparison. One line will be longer than the other, and visually help the children understand that the higher number represents more.

Equal spacing and size of objects is important when comparing sets. Jean Piaget, the noted child psychologist, would remind us that three spread-out coins would appear to be more to a young child than five similar coins that had been scrunched together.

## ASK YOURSELF:

Do you try to use mathematics as an integral part of classroom activities?

Do you incorporate visual clues, such as the size of a group, to help children grasp number concepts?

# 68. Turn the calendar into a mathematical learning tool

## WHEN ARE WE GOING TO THE FIRE STATION?

I tried to keep the calendar interesting and meaningful to the children. At the beginning of each month, I would post symbols on the calendar to represent significant dates. For example, if Ricky was going to turn four on the 20th, on a small piece of paper I would draw a picture of a cake with "Ricky" written on it. I would tape the piece of paper to the location on the calendar that coincided with his birthday. I did the same thing for class trips, special events, and holidays. I even posted little houses for Saturday and Sunday when we stayed at home and did not go to school.

## HELP!

Children would invariably ask, "How long until my birthday?" or "When will we go on our trip?" This now became a counting experience. We would go over to the calendar and count days (represented by the empty boxes) until the special event. Many children caught on to the idea and would do this without the help of an adult. They were in fact learning to use a calendar.

## ASK YOURSELF:

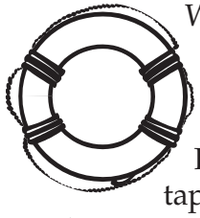
Do you use the calendar as a mathematical learning tool?

# 69. Create simple graphs

## CLOUDY WITH A CHANCE OF SHOWERS

"What is the weather today?" is one of the most frequently asked questions at group time. I think it is a great question for several reasons. It encourages observation, is easy for children to answer, and the weather changes. We can observe that it is raining at 10 a.m., and then have clear sunny skies by 2 p.m. Another golden opportunity buried in this question is the chance to track the weather for the month or even longer.

## HELP!



When dealing with children who are so young that any number greater than five is not meaningful, I use the calendar in the following way. I prepare pre-cut symbols to represent the weather—for example, sun, cloud, umbrella, and snowman. Each day during group time we observe the weather and then tape on the appropriate symbol in the little square where the number is usually written. At the end of the month we clear off the old symbols, re-label the name of the month, and start all over again.

Keeping track of the weather using symbols stimulates good conversations about how many sunny days we have had this month, or how few rainy days. The concept of more/less is visually presented to the children. They can readily see, for example, that we had a lot more suns than snowmen. Those interested may want to count how many rainy days we have had as compared to snowy days. On Monday, be sure to post the weather for the past weekend so that the tally for the month is correct.

In older classes, where you write in the dates on the calendar, you can create a simple bar graph for each month using weather symbols. On a 9-by-12-inch piece of paper use separate lines for Cloudy, Rainy, Snowy, and Sunny. Each day, draw on the graph an umbrella, a sun, or whatever is appropriate for that day. Again, as the month goes on you can talk about how many suns there are, compared to umbrellas—or other symbols. If space permits, you can post the graphs for all the months on a wall at the children's eye level. Now the children can, on their own, tally up how many snowy days we have had so far this year, or decide which month had more rainy days, or make any other comparisons they

care to. This simple graphing activity stimulates mathematical discussions. One year, I had some children who decided they wanted to know how many rainy days we had had that year, and then proceeded to count all the umbrellas I had drawn for the months of September through May. The children help create the weather graph, watch it grow, and are therefore drawn to it.

If you use special shapes (leaves in September, pumpkins in October, turkeys in November, etc.) on which you write the correct date, do not throw them away at the end of the month. Children enjoy playing with them, and some will recreate the sequence of dates for themselves.

## ASK YOURSELF:

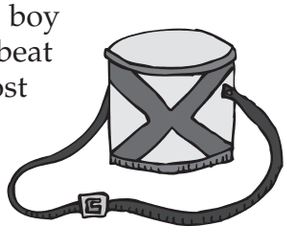
Do you create simple graphs with the children?

Do you display graphs at the children's eye level in the room?

# 70. Develop activities that involve pattern recognition

## DRUM BEATS

A popular story I told to my four-year-old class led to an interesting mathematical learning opportunity. The story is about a boy who goes out in the woods. He has a drum that he can beat on to send coded messages to his father. The boy gets lost and is in danger when a bear gets too close for comfort. The boy frantically beats a message to his father, and the father in turn beats back a message saying he is on the way. Of course there is a happy ending with father and son safely reunited.



Later in the week we made drums out of coffee cans and oatmeal boxes. I was delighted when Susan and Mary started recreating the story. Susan went to the block corner and started tapping out a message. Mary at the other end of the room used her drum to respond.

## HELP!

I made sure those drums were available during free play for the next few weeks. The re-enactment of the story expanded and soon the children were copying drum beat patterns back and forth. The varieties are endless, two quick taps, one long, four loud beats, two soft ones, and so on. The children were inventing all kinds of codes, and in the process of playing their games they were counting drumbeats and remembering sequence as well. It turned out to be a good mathematical learning experience.

Counting, sequencing, and pattern recognition can also be taught by playing games. For example, you can clap your hands in a particular pattern, such as two fast followed by two slow, or tap different parts of your body, such as one tap on the nose followed by two taps on the leg. Then ask the children to match your pattern. The hardest part for the children is being patient enough to wait to observe your pattern before they try to copy it. Of course, the children should have an opportunity to challenge the adult and be able to originate patterns of their own. I caution you that this can get very complex.

Helping children to develop the ability to create and recognize patterns involving counting and sequencing builds on the teaching of the prior chapter in which children were introduced to classifying, matching, and seriating activities.

## ASK YOURSELF:

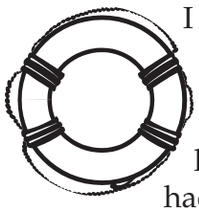
Do you expose children to activities that involve counting, sequencing, and pattern recognition?

# 71. Use measuring tools to create mathematical learning opportunities

## HOW LONG IS YOUR ARM?

One of the more popular activities in my class was hooking plastic links together to form long chains that the children then used as necklaces or bracelets. On one occasion I had the yardstick out to measure some paper for a mural. I offered to measure one of the chains to see just how long it was. What a great response I got. All of the children wanted to know exactly how long their chain was. We carefully lined them up next to the yardstick and measured. Soon there was heated competition among the children to create the longest chain. Fortunately, in the interest of making the chain as long as we possibly could, the competitors decided to combine each of their portions into one giant chain. The final product was longer than the classroom and reached out into the hallway. It was a wonderful cooperative effort. Interest in the exact length of the chain was intense.

## HELP!



I decided to capitalize on this interest in measuring and brought a few 12-inch rulers into the room. We measured toy cars, blocks, crayons, anything that wasn't nailed down. Some of the children were even starting to guess at just how long an item might be, or who had the longer pencil. We also had fun when we started to measure hair, fingers, arms, and other parts of our bodies. Once again, using real tools to answer real questions became a teaching opportunity.

- Don't forget that we can also measure liquids and sand, rice, and other materials. The water table and sandbox should have measuring cups, spoons, and containers of different sizes for the children to experiment with.
- Scales and simple balances should be available for the children to use.

## ASK YOURSELF:

Do you build on the interest of the children to create mathematical learning opportunities?

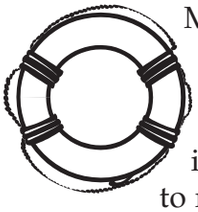
Are there rulers, scales, spoons, cups, and containers of varying sizes available for the children to use?

# 72. Create games and activities involving mathematics

## MATH AS A SOURCE OF PLEASURE

When I was growing up, all the boys in my neighborhood were well versed in the most recent statistics of the Brooklyn Dodgers baseball team. While my brother showed no interest or particular talent in mathematics as an academic subject, he was a whiz at doing percentages. In the days before pocket calculators, he would sit in front of the TV set with a stack of paper and a pen doing mathematical calculations after every hit, home run, error, and strikeout that occurred during the course of a game. To me it looked like an endless homework assignment. To my brother it was a compelling interest and source of pleasure.

## HELP!



Math can be fun. There are many games children can play that involve number recognition, counting, addition, subtraction, and fractions. Modifying the materials used in these games to ensure that they do not frustrate the children is the key to success. Playing cards and dice, which are easy to modify, are good materials to use to teach and reinforce mathematical concepts.

- The card game "War" is based on the idea that the larger number on the face of the card wins over the smaller number. It is a very simple game and excellent for teaching counting and the concept of more/less. To make the game practical for young children, you need to stack the deck. If you feel the children are comfortable and reasonably familiar with recognizing and counting the numbers from one to five, then those are the only cards that you should use. Remove any cards with higher numbers as well as the picture cards. By removing the other cards, you limit the game to the numbers the children can work with effectively. By controlling the deck you can make the game simpler or more challenging, depending on the children's needs.

- Children enjoy tossing dice. By creating your own die, you can challenge, but not overwhelm the children. Use a cardboard square box about four by four inches. Cover it with white paper and then paint on the number of dots that you think will challenge but not

frustrate the children. It can be kept as simple as having only three dots as the maximum. Just putting a die on the table with a few plastic chips creates a simple counting game. A child rolls the die and gets to keep the corresponding number of chips. When all the chips are gone the game is over, and we can start again if the children want to. Some players may choose to count up all the chips they have collected, and that is a good way to take the activity to a more challenging level.

Be creative; do not restrict the use of dice to numbers alone. Letters, colors, and shapes can also be used to create developmentally appropriate games.

## ASK YOURSELF:

Do you provide games and activities that involve counting and number recognition?

Do you modify materials to challenge but not frustrate the children?

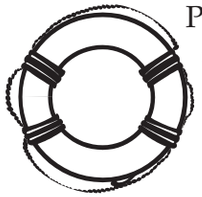
Are more advanced mathematical opportunities provided to those children who are ready for them?

# 73. Provide opportunities for children to make estimates

## GUESS HOW MANY

Irene brought an opened can of tennis balls to school, a present she had received from her aunt. At group time she proudly showed it to the class. I asked the children, "How many tennis balls do you think are in the can?" The children answered my question with everything from a shrug of the shoulders to "a hundred, hundred." Naturally we had to solve this mystery. Irene took the lid off the can and let the balls roll onto the rug. We counted two tennis balls.

## HELP!



Providing opportunities for children to gain an understanding of what constitutes a reasonable estimate plays an important role in developing their mathematical abilities, and it is fun to do!

Fill a large plastic fish bowl with objects, for example, tennis balls, golf balls, blocks, puzzle pieces, rocks, mittens, socks, crayons, or pencils. Use only one set of objects at a time. Choose the size and number of objects that will challenge but not frustrate the children. After the children have had enough time to look things over carefully and guess at the quantity, count the items by removing them one at a time. This also provides a good opportunity to reinforce one-to-one correspondence. With older children you can fill the fish bowl with large items and then repeat the activity with a set of similar smaller items, for example, tennis balls and then golf balls, or vice versa.

- There are many materials we can use to encourage children to estimate quantities. For example:
  - Flowers in a vase
  - Dishes or bowls in a stack
  - Soccer balls in a pillow case
  - Blocks in a basket

- We can ask the children to estimate:
  How many cups of water it will take to fill a bottle

  How many crayons will fit in a box

  How many books will fit on a shelf

  How many cups of sand it will take to fill a pail

- Encourage the children to make measurement estimates, such as the length of their fingers, the width of a table or the number of steps it takes to cross the playground.

## ASK YOURSELF:

Do you provide opportunities for the children to develop the skill to make reasonable estimates?

# 74. Use flannel board number songs to teach mathematical concepts

## HOW DO YOU LIKE TO MAKE THREE?

I enjoy doing flannel board number songs. The children who are able to read numbers or are ready for addition and subtraction problems can be challenged, while those who just enjoy a good song are being entertained. I have created a set of four-by-six index cards with the numbers 1–10 written on individual cards. I also include a card for zero as well. When I have five ducks on the flannel board I show the index card with the appropriate corresponding number.

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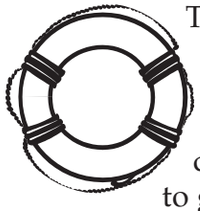


To keep this from becoming just a passive form of entertainment, I try to encourage the children to participate by challenging them. I will sometimes hold up the incorrect number on the index card, and of course, the children just love setting me straight. They can't wait for me to goof again. It is just so satisfying to correct an adult that I get their undivided attention.

Sometimes, I will hold up the fingers of both my hands to show how I like to make the number three. I use two fingers from my right hand, plus one from my left hand. When I move them close together I make three. Sometimes I choose to use three fingers from one hand only. Then I ask the children, "How do you like to make the number three?" The children get very serious about making this choice and concentrate hard on their fingers. Of course, as their skill increases, using additional fingers to make the various combinations of four, five, or higher numbers is even more challenging.

- Another concept that can be taught with a flannel board number song is that of "more or less." Are there more ducks at home, or over the mountain? Are there more frogs in the pool, or on the log? Carefully lining up the flannel board figures should make this visually easy for the children to determine. The answer to the more-or-less question will change as the song progresses. Counting the flannel board figures will help reinforce the concept. Four frogs on the log are more than one in the pool—illustrating the fact that four is more than one.

- Flannel board songs also present opportunities to use ordinal numbers and teach directional words. For example, the first duck to go over the mountain is followed by the second duck. Concepts such as up/down, front/back, and over/under are easily illustrated with flannel board figures.

Always use correct mathematical vocabulary. For example, the set of apples on the tree is greater than the set of apples on the ground.

## ASK YOURSELF:

Do you use flannel board number songs or other entertaining ways to engage the children in mathematics?

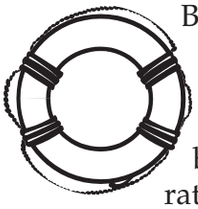
Are mathematical concepts and vocabulary, such as set, more/less, equal, big, bigger, biggest, first and second, used throughout the day?

# 75. Encourage activities that explore mathematical relationships and geometry

## BUMPY ROADS

Four-year-old Hy was a block builder extraordinaire. He spent most of his time in the block corner and delighted in using every block shape on the shelf. One day I brought in some small plastic cars, and he naturally set out to build a highway. It was a major undertaking and included bridges, tunnels, steep inclines, and tollbooths. When Hy was almost done he was faced with the problem of how to use the semicircle and triangle blocks. He experimented with using the shapes as decorations for the tollbbooths as he usually did with castles, but rejected that idea. He then hit on a very creative solution. Hy decided to use the semicircles and triangles to build a bumpy road. The semicircles created round bumps and the triangles sharp pointy bumps. The children just loved this new road and lined up for turns to use it.

## HELP!



Blocks are a wonderful experimental geometric playground. By handling and using different shaped blocks, children are exposed to basic geometric principles such as two semicircles can make a circle, or triangles when placed together can become squares or rectangles. Mathematical relationships and ratios are also discovered when the child realizes that two half-unit-size blocks equal one unit-size block.

Parents often fret that their children are just playing with blocks and not learning anything. We need to help them appreciate just how much thinking, planning, and mathematical learning are involved in block-building play.

## ASK YOURSELF:

Do you encourage children to play with blocks?

Is the supply generous and are they shelved according to their shape and size?

Do you provide materials such as geo boards so children can discover mathematical relationships and explore basic geometric shapes?

## Try This

Role model and show interest in counting objects:

- I wonder how many stairs we have to go down to get to the basement?
- How many paces to the door, wall, gate?
- How many leaves can you collect?
- How many buttons are on your shirt today?
- How many balls do we have in our room?
- How many balls are there in the room across the hall?
- How many red crayons do we have?
- How many books are on this shelf?
- How many napkins do we need for snack?

Create games using cards and dice:

- Have small cars numbered 1–5, and box garages also numbered 1–5. Ask the children to park the cars in the correct garage. Or have them toss a die to determine which car to park.
- Arrange an area on the other side of the room to which the children can bring things. Have a child toss a die to determine how many objects to carry. You can use small blocks, crayons, dolls, or other objects.
- Organize a treasure hunt. Give a child a card with a shape, for example, a circle. Then ask him to collect a set of things in the classroom that match that shape.

Create graphs to track things of interest:

- Number of children in class each day
- Number of times we drank apple juice, grape juice, or milk
- Number of times we had snow, rain, extreme cold, or heat and could not go outdoors
- Number of children wearing something red, blue, green, or another color
- Height of each child

In the middle of the table put a plastic tub that contains different colored pegs. Give each child a small peg-board. Starting at the simplest level, pick two blue pegs and put them in the middle of your peg-board, side by side. Ask the children to match your pattern. After a few successful matches, take the game to the next level. Create a pattern, show it to the children and encourage them to look hard while you slowly count to three. Then with some drama, like a

magician performing a trick, cover up your peg-board. Ask the children to try to remember the pattern and to recreate it on their peg-boards. After giving them enough time, uncover your peg-board and ask them to check to see if they have a match. After the children have several successful matches you can increase the complexity of the game by adding a third peg or varying the colors. Eventually, with some children, you can use as many as five pegs of different colors. This activity can be made even more complex by putting pegs in both vertically and horizontally. Playing this simple game requires great concentration. Children are asked to recall number of pegs used, color, sequence, and direction. You can also ask the children to create a pattern for you to match. Having them check to see if you got it right is another way to challenge them.

Establish a color or shape sequence for the calendar, for example, a square on Monday, followed by a circle on Tuesday and a triangle on Wednesday. Thursday you can start the pattern again.

Make number signs:

- License plates for the tricycles and wagons
- Numbered parking spaces

Collect large plastic lids and caps for the children to match and sort.