Finding the Math in Books:
Ideas for Teaching Staff

Children's books help open the world to young children. Books offer teaching staff a powerful tool for expanding young children's mathematical vocabulary and supporting their developing mathematical knowledge.

Through book reading, children can have mathematical experiences in a familiar and engaging activity. As children and teaching staff talk about the math concepts and relationships they find in the story or illustrations, children build their conceptual understanding and their math-related vocabulary. Problems found in books can stimulate children's mathematical thinking.

Through book-reading experiences children can
- practice their developing mathematical skills,
- develop their abilities to reason about mathematical situations,
- solve problems,
- express their thinking through their actions and words, and
- increase their natural interest in math.

Introduction

Sharing books with children is a way for teaching staff to learn more about what children know and understand about math and to expand children's understanding of math. This guide provides information on how to use books to highlight math learning. Teaching staff may also want to share this information with the families of the children in their classroom.

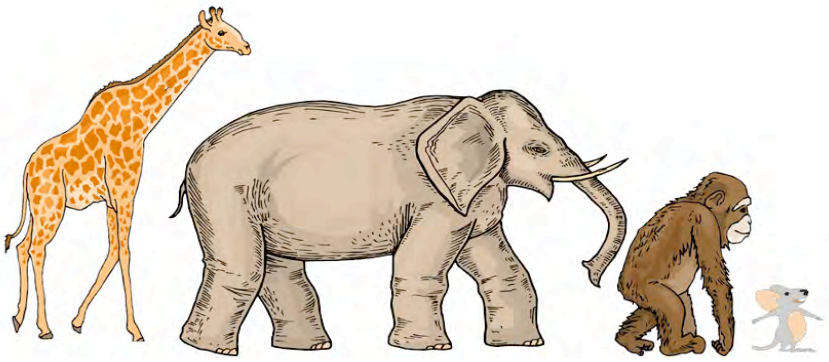
Children often reveal what they know about math as they interact with books. For example, children will often spontaneously count objects in a book or make comments about the size or position of characters in a book ("That dog is so big!"). Children's questions and

their responses to adults' comments let us know (1) what they know and (2) what they are thinking.

Teaching staff can use books, with individual children or small groups, to assess children's mathematical understanding and help them to solidify and expand their knowledge and their vocabulary.

Many children's books are rich in math and math-related content. Some children's books focus specifically on math concepts. These range from simple counting books to books that embed math concepts or problem solving in the story or pictures.

Others, including many favorites, are not specifically mathematical but include situations in their text or illustrations that invite "mathematizing." Such books allow teaching staff to intentionally expand children's understandings and their vocabularies.



For example, *Goodnight Gorilla* is a story about a zookeeper saying goodnight to each of the animals in the zoo. While this is not specifically a number book, teaching staff can encourage children to count the animals, to talk about the sequence of events in the story ("Who did the gorilla let out last?"), and to learn ordinal number words (first, second, third, etc.).

Note: Consider the cultural context of individual families when selecting books.

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How do teaching staff "mathematize" book reading? It is helpful for teaching staff to read the book to themselves before reading it to children. This enables them to identify vocabulary words and concepts that they want to focus on to expand children's knowledge.

Teaching staff can enhance the book-reading experience in these ways:

- Use a variety of mathematical vocabulary to describe pictures or events in the book, for example "The **two** little kittens are in the **middle** of the rug."

- Draw children's attention to mathematical relationships, such as same, more than, less than.

- Encourage children to solve problems posed in the story line.

- Pose natural mathematical questions that follow from the text or illustrations of the book, for example "How many relatives came?"

- Use children's natural interests to introduce new math concepts. For example, use a child's interest in animals to talk about the number of animals on each page.

- Carry the mathematical concepts and language from a book-reading experience to real life activities/experiences. For example, after reading *The Carrot Seed*, plant seeds and keep a record of how long it takes for the seeds to come up.

The following list is a small sample of children's books, with a brief summary of each book and examples of the mathematical ideas that each book contains. You and the children may find many more.

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Goodnight Gorilla by Peggy Rathmann
Spanish edition: ***Buenas Noches, Gorila***

About the book . . .

This book relates a story with pictures and very few words. As the zookeeper says "Goodnight" to the animals one by one, the gorilla unlocks their cages one by one, and all the animals follow the zookeeper home.

Using this book . . .

- Appropriate for toddlers and preschoolers
- This is a nice book to share with family members who may have a wide range of reading abilities. The story line is easily picked up from the illustrations, and family members can be encouraged to talk about what's happening in their own words.
- Talk with toddlers about what's happening in the pictures—for example, "The gorilla opened the cage door. The giraffe is coming out." and "Where is the little mouse now? He's sleeping in the drawer."
- Encourage preschoolers to notice the story's repeating pattern, to count the animals, and to identify which animal gets out of the cage first, second, and so on.

Finding the Math in Books:
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Goodnight Gorilla by Peggy Rathman
Spanish edition: ***Buenas Noches, Gorila***

Mathematical ideas . . .

Number—counting, cardinal numbers, ordinal numbers

- Count the animals with the children to find out **how many** there are altogether. "Let's count the animals on this page . . . **one, two, three**. That's right, there are **three**!" Encourage preschoolers to count by asking questions like "How many animals are following the zookeeper?" (cardinal numbers)

- Ask preschoolers to identify which animal is **first, second, third** in line. "The gorilla is walking behind the zookeeper. He's the **first** animal in line. Which animal is **second**? Which animal is **third**?" (ordinal numbers)

Measurement—size comparisons

- Compare the animals by size. "Which animal is **tallest**? Which animal is **fattest**? Which animal has the **longest** tail?"

Spatial sense—position

- Describe or ask the children where the animals are sleeping. "The mouse is sleeping **in** the drawer." "Where are the elephant and the lion?" "Yes, the elephant and lion are **on** the floor." "Who is sleeping **in** the bed?" "The gorilla is **beside** the zookeeper's wife **in** the bed."

Patterns—repeating patterns

- Encourage the children to notice the **repeating sequence**—the zookeeper says goodnight, the gorilla unlocks the cage, and each animal follows one by one. "The zookeeper says good night to the animal. Next the gorilla unlocks the door. And then the animal gets in line and follows the zookeeper and the other animals. The line of animals keeps getting longer."

Finding the Math in Books: Ideas for Teaching Staff

Goodnight Moon by Margaret Wise Brown
Illustrated by Clement Hurd
Spanish edition: ***Buenas Noches, Luna***

About the book . . .

This lyrical book with its warm, detailed illustrations is a favorite for generations of children. At bedtime, the bunny takes us on a tour of the "great green room" by naming the special things in it. Then he says goodnight to each one—and to a few things he hasn't named before—and then he falls asleep.

Using this book . . .

- Appropriate for infants and toddlers, and very young preschoolers

- As the bunny bids goodnight to all the things in his room as well as the moon and other things he sees out the window, notice that his words form a simple repeating pattern of "goodnights."

- Infants enjoy hearing the words and looking at the pictures. Point to the objects as you name them. Stress the number words when pointing to multiples, such as two kittens and two mittens.

- This is an excellent book for supporting toddlers and young preschoolers' number sense, spatial sense, and vocabulary.

- Family members will be pleased to hear that this popular book can help very young children to begin to learn math concepts. Share some ideas for supporting children's learning about two and three.

Finding the Math in Books:
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Goodnight Moon by Margaret Wise Brown
Spanish edition: ***Buenas Noches, Luna***

Mathematical ideas . . .

Number—very small number words (**one, two, three**), identifying "**how many**," counting, comparing

- As you read the book, stress the numbers of things that are named and/or pictured. "There are **three** bears in the picture." "I see **two** kittens and **four** mittens."

- Many things in the "great green room" come in groups of **two** (socks, clocks, slippers, etc.) Ask "Where are…?" questions that emphasize number. "Where are the **two** kittens?"

- With older toddlers, ask "**How many**?" questions. "**How many** clocks are there?" "**How many** windows do you see?"

- Compare numbers of things (**same number, more than, less/fewer than**). "There are **more** mittens **than** slippers."

Spatial sense—position, spatial vocabulary

- Describe the cow jumping "**over** the moon" and the bears "sitting **on** chairs." Use these words as a starting point to talk about position. "The kittens are **on** the rug." "The bowl, comb, and brush are **on** the table." "The little bunny is **in** bed."

- Ask "Where's the mouse?" Even very young children enjoy finding the mouse that moves from place to place on different pages and pointing to it. Use spatial position terms to describe where the mouse is. "The mouse is **on** the floor." "Oh—now the mouse is **in front of** the fire." "The mouse is **on** the window sill looking **out**."

Pattern—repeating pattern

- Young children come to anticipate that each "goodnight" is followed by the name of whatever is pictured on that page. They may begin to participate in the reading by saying "goodnight" and/or naming what is pictured.

Finding the Math in Books:
Ideas for Teaching Staff

Is it Larger? Is it Smaller? by Tana Hoban

About the book . . .

In this wordless book, beautiful photographs show a wide variety of objects, and sometimes people, of various sizes—some large, some small, and some middle-size. The objects in the photographs also vary in shape, color, number, and other qualities.

Using this book . . .

- Appropriate for toddlers and preschoolers
- This book provides many opportunities to "mathematize." Draw children's attention to size relationships in the photographs by using words such as bigger/smaller and longer/shorter. There are lots of things to compare on every page. The more you look, the more you find to compare.
- When reading this book with toddlers, focus on identifying big and little objects and counting small numbers of objects.
- When reading this book with preschoolers, compare the sizes of objects using a variety of comparison terms.
- Share with family members ways to use comparison terms when looking at the pictures. Family members and children may also enjoy making real life comparisons – for example, comparing the size of parent's hand with child's hand when looking at the photograph of the hands.

Finding the Math in Books:
Ideas for Teaching Staff

Is it Larger? Is it Smaller? by Tana Hoban

Mathematical ideas . . .

Measurement—size comparisons, measurement vocabulary (**big, little, small, middle-sized, short, long; larger, smaller, shorter, longer; largest, smallest**)

- With toddlers, you may want to simply identify, and eventually have the child identify, the objects by size (**big**, **little**, etc.) "Here's the **big** fish, and there's the **little** fish."

- With preschoolers, use comparison terms to order objects by size (**larger, smaller, longest, shortest**, etc.) "Which leaf is the **biggest**?" "Which leaf is the **smallest**?" "Which one is **middle-sized**?" "The blue pitcher with the pink flowers is **larger** than the white pitcher with the yellow flowers."

Number—counting, comparing

- Count the objects in the photographs. Ask "**How many**?" questions. "**How many** hats are hanging on the wall? Let's count them—**one**, **two**, **three**, **four**."

- Count and compare numbers of objects by type, size, or other properties such as color or shape. "**How many big** hats are there?" "**How many little** hats?" "I see one big pig. Let's count the little pigs." "There are **two white** shoes and **two black** shoes."

Finding the Math in Books:
Ideas for Teaching Staff

Just a Little Bit by Ann Tompert
Illustrated by Lynn Munsinger

About the book . . .

An elephant and mouse are at the park and want to play on the seesaw together. Their animal friends come to help them out when they encounter the obvious problem.

Using this book . . .

- Appropriate for preschoolers
- Encourage children to talk about their own experiences with seesaws. "What happened when you sat on the seesaw by yourself?" "What happened when your friend got on the other side?"
- This book could be used along with classroom activities related to weight and balance, introducing words such as heavier, lighter, and same weight as.
- Share with family members that this book about friends cooperating is also about solving a problem involving weight. Family members and children can talk about the problem that the mouse and elephant face, using words such as lighter and heavier. Questions such as "What should the animals do now?" encourage children to think about the problem and suggest solutions.

Finding the Math in Books:
Ideas for Teaching Staff

Just a Little Bit by Ann Tompert

Mathematical ideas . . .

Measurement—weight and size comparisons and vocabulary

- Compare the sizes and weights of the various animals (**heavy, light, big, small; heavier, lighter, bigger, smaller**). "Which animal looks **bigger**—the bear or the monkey?" "Which animal do you think is **lighter**—the lion or the ostrich?"

- Compare the collective weight of the animals on the mouse's side of the seesaw to the weight of the elephant. "How can you tell if the elephant weighs **more** than the mouse, giraffe, and zebra all put together?"

Problem solving involving concepts of weight, size, and balance

- Ask the children to predict what will happen as each friend joins the mouse on his side of the seesaw. "What do you think will happen when the bear gets on?"

- Ask the children to give explanations for why it's not working when different animals get on the seesaw. "Why didn't the seesaw **go down**? What should the animals do now?"

Finding the Math in Books:
Ideas for Teaching Staff

"More More More," Said the Baby:
3 Love Stories by Vera B. Williams
Spanish edition: ***"Más Más Más," Dijo el Bebé: 3 Historias de Amor***

About the book . . .

This book consists of three short stories about adults interacting with babies they love. Each of the beautifully illustrated stories depicts a similar sequence of catching the running baby, picking the baby up, holding the baby close, and kissing and playing with the baby until the baby laughs, "More More More."

Using this book . . .

- Appropriate for toddlers
- The overall sequence of events in each story forms a sort of simple repeating pattern: We meet the baby; the adult picks up the baby, plays with and talks to the baby; etc. This repetition helps the very young child follow the story and begin to anticipate what will happen next.
- Share with family members that while reading this book, they may want to playfully do the same actions as those described in the book and encourage use of the word "more."

Finding the Math in Books:
Ideas for Teaching Staff

"More More More," Said the Baby: 3 Love Stories by Vera B. Williams
Spanish edition: ***"Más Más Más," Dijo el Bebé: 3 Historias de Amor***

Mathematical ideas . . .

Pattern—repeating pattern

- The sequence of events in each story forms a **simple repeating pattern**. After hearing the book a few times, toddlers may repeat some of the words and phrases as you come to them in the book. Toward the end of a story, ask "And, then, what did the baby say?"

Number, spatial sense

- The dynamic illustrations bring to life concepts such as speed (running **fast**), motion (swinging **all around**), and position in space (lifting **up high**), all in relation to the baby's own experience and body. "Little Guy is **running fast**. Let's see if his daddy can catch him."

- Other concepts include number and quantity (**two eyes, ten toes; more**) and location (**middle, side, end**). "Grandma is tasting Little Pumpkin's **ten toes**. Let's count your ten little toes." "Here's your belly button. It's right in the **middle** of your tummy."

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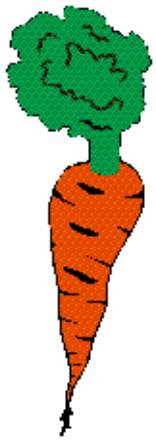

The Carrot Seed by Ruth Krauss
Illustrated by Crockett Johnson
Spanish edition: ***La Semilla de Zanahoria***

About the book . . .

This classic favorite tells the story of a little boy who plants a carrot seed. No one but the boy believes the carrot will come up. He pulls the weeds and waters it carefully day after day and, finally, a very big carrot grows!

Using this book . . .

- Appropriate for preschoolers
- Along with many other important concepts, the story illustrates the passage of time in a way that is understandable and interesting to young children.
- Extend these time concepts to other activities. For example, plant seeds and keep track of how long it takes for them to come up.
- Share with family members that this story about growing a carrot can encourage children to think about and begin to understand time concepts and words related to time. They can point out the passage of time and the order of events by asking questions such as "What happened first? Next? Everyday?"

Finding the Math in Books:
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The Carrot Seed by Ruth Krauss
Spanish edition: ***La Semilla de Zanahoria***

Mathematical ideas . . .

Time—passage of time, ordering of events in time, time-related vocabulary

- Encourage children to think about and retell the order of events in the story. "What did the little boy do **first**?" "What did the boy do **every day** to make the carrot come up?"

- Try to figure out how long it took to grow the carrot. "How many **days** do you think it took for the carrot to come up?"

Measurement—size comparisons, ordering by size

- The carrot that the boy grows is very, very big. Ask children to **compare** the **size** of the carrot the boy grew to the size of the little boy. "Which is **bigger**—the carrot or the boy?"

- Compare the size of the carrot in the story to the size of real carrots. "Are the real carrots that we eat this **big**?" "**How big** are they?"

- Bring in carrots for snack and compare their sizes. Help the children to put the carrots in order by size. Talk about **same size, longer, shorter,** and **middle-sized**. "These carrots look like they're the **same size**." "Which carrot is **longer**—your carrot or my carrot?"

Finding the Math in Books:
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The Very Hungry Caterpillar by Eric Carle
Spanish edition: ***La Oruga Muy Hambrienta***

About the book . . .

This classic children's book tells the story of a caterpillar and what he eats in the one week before he spins a cocoon and, two weeks later, turns into a butterfly! On Monday he eats through one apple. Each day after, he eats one more fruit than the day before—up to five oranges on Friday. On Saturday, he eats 10 things and grows very big!

Using this book . . .

- Appropriate for toddlers and preschoolers
- For toddlers and younger preschoolers who are learning to count, provide plastic fruit that they can use to practice counting.
- Older preschoolers may enjoy acting out the story or retelling the story with a felt or flannel board.
- Share with family members that they can use this book to help their children learn to count. Together with their children they can notice the pattern of one more fruit each day and count the number of fruits the caterpillar eats each day.

Finding the Math in Books:
Ideas for Teaching Staff

The Very Hungry Caterpillar by Eric Carle
Spanish edition: ***La Oruga Muy Hambrienta***

Mathematical ideas . . .

Number—counting, comparing

- Count the items the caterpillar eats each day. "On Wednesday the caterpillar ate plums. **How many** plums did he eat?" "**How many** things did he eat on Saturday?"

- Compare the amounts the caterpillar eats each day. "Did the caterpillar eat **more plums or more strawberries**?" "Did he eat **more on Friday or more on Saturday**?"

- For very small numbers (**one, two, three**), children may just want to say the number without counting. Encourage children who are learning counting to count two or three items.

- Ask older preschoolers to show how many items the caterpillar ate by holding up the **same number of fingers**.

Number operations, number patterns

- Point out the pattern in the story. "For the first five days, the caterpillar eats **one more fruit each day**."

- Ask children to make predictions. "The caterpillar ate three on Wednesday. Each day he eats **one more** fruit. **How many** will he eat the **next** day?" Ask older preschoolers, "**How many** will he eat on Thursday?"

Finding the Math in Books: Ideas for Teaching Staff

Whistle for Willie by Ezra Jack Keats
Spanish edition: ***Sílbale a Willie***

About the book . . .

Peter wants so much to be able to whistle for his dog, Willie, to come to him. The book follows Peter's adventures as he practices and practices his whistling around the neighborhood and at home. The book is full of very rich language describing Peter's actions. These actions come to life in the simple but vivid illustrations.

Using this book . . .

- Appropriate for preschoolers

- Read the book outside with the children. Then give them chalk and encourage them to draw their own paths on the playground. Talk with them about where their chalk lines go using different spatial vocabulary.

- Share with family members that they can use this book to help their children develop spatial concepts and language. Suggest that they talk with their children about the various places that Willie practiced whistling using position/location words such as in, on, and in front of.

- After reading the book, ask the children to imitate some of the things Willie did—turning around and around, walking on a crack or line, jumping, hiding in a box. Ask them to tell you what they're doing, and model using spatial words. For example, "You're walking on the chalk line you drew." "Rashad and Emily went under that big box."

Finding the Math in Books:
Ideas for Teaching Staff

Whistle for Willie by Ezra Jack Keats
Spanish edition: ***Sílbale a Willie***

Mathematical ideas . . .

Spatial sense and vocabulary

- As Peter practices his whistling, he whirls **around and around**, he hides **in** a carton, he draws a **long line**, and so forth. Ask, "Where did Peter practice his whistling?" Help children to use spatial vocabulary when they reply: **on** the sidewalk, **in** the carton, **in front of** the mirror, and other places.

- Follow the path of the long line that Peter draws, and talk with the children about where the line goes. "Where did Peter's line go?" Again encourage the children to use different spatial words as they describe where the line goes: **out of** the box, **around** the corner, **along** the sidewalk, in a **circle around** the girls jumping rope, in **another circle around** the barber pole, and right **up to** Peter's door.

Geometry—shapes

- Find other **circles** in the pictures. "Where else do you see a **circle**?" Encourage the children to find other shapes (lots of **rectangular shapes**). "What shapes do you see on the building?"

Number—counting

- Count the locations in the book where Peter tried to whistle. "**How many** different places did Peter practice his whistling?"