



# Introduction

“Look!” I hear Pablo exclaim from across the playground. He and a few of the other 4- and 5-year-old children in my class are huddled in a group, inspecting the ground beneath their feet. As I quietly draw closer, he asks the others, “How many do you think there are?”

“Like a million!” answers Neve.

“No, a million is too many,” Alessio replies confidently. “That’s a big number. There aren’t a million.”

Aimi says, “I think maybe one hundred.”

When they go back to studying the ground intently, I let them know I’ve joined them. “What are you looking at?”

“We’re guessing how many ants!” says Pablo. He points at a crack on the sidewalk where dozens of ants are crawling.

“Whoa, that’s a lot of ants! So how many do you think there are?”

As the children excitedly start repeating their guesses, I listen carefully and then ask them questions to uncover the reasoning behind their math thinking. “I wonder how we can estimate how many ants we see.”

Pablo points out, “There are six around my foot!”

“And I just counted nine,” adds Aimi.

“How do you know that?”

“I started counting the ones near my toes and then around my foot,” Pablo responds.

“I tried to count them all at once, but they’re too squirmy,” says Alessio, “They keep moving and I lose track.”

“It seems like it’s easier to count the ants around us. What if each of us counts the ants around our feet? What could we do with that information?” I ask.

“Add the numbers together!” Aimi laughs. “Then we can figure out how many there are altogether!”



Every day, I am amazed by children's interest, confidence, and fluency in exploring math concepts in their day-to-day conversations and interactions. As a teacher of children ages 3 to 6, it is my role to engage the children in meaningful, complex math experiences that are grounded in their observations and questions about the world around them. I create provocations for them to explore, ask questions that scaffold their understanding and challenge them to think more deeply, and invite them to take risks—and make mistakes. Math is everywhere, and so are the opportunities to teach and learn it.

This was not always my approach to teaching math to young children.

When I first started my career as an

early childhood educator, I considered math to be just a single, isolated part of a program's curriculum. Using textbooks and worksheets, I would diligently teach the children counting and number problems during the designated time in our schedule. When that time ended, I'd move on to other subjects, leaving math behind until the next day.

Looking back, I can see that my teaching practices were rooted in my own relationship with math. In school, I was successful in early math experiences where I could rely on memorized formulas and "tricks" (*A greater-than symbol [ $>$ ] is like an alligator—it eats the bigger number*). But as I got older and the math became more complicated, I struggled to understand and apply the abstract concepts I was being taught in practical situations. As a result, I lost both interest in math and confidence in my math abilities, and these feelings followed me throughout my education and well into adulthood. When I became a teacher, I tried not to let my own frustrations with learning math influence the way I taught the children, but sometimes it did.

It wasn't until years later that my mindset about what math is underwent a transformation. I read some intriguing works (see Boaler 2016; Parrish 2010, 2011) that helped me see that there were ways to teach and learn math outside of the limitations of drills and flashcards. In fact, by taking the time to intentionally look for math in the world around me, I found that the potential for engaging, meaningful math teaching and learning was *everywhere*. The songs we sing, the games we play, the everyday challenges we problem solve—it's all math! It was an epiphany, one that made me take a step back and wonder: What if, instead of treating math like an independent subject in the classroom, I tapped into the math already present in day-to-day experiences and gave the children (and myself!) a chance to play with math and see its creative applications?



Newly inspired, I started to see connections to how the inquiry-based, playful, emergent environment of the early childhood classroom could inform my math teaching approach. These are some of the most important realizations that helped to shape my practices and strategies moving forward.

**Children are naturally curious about math.** As children play and explore their world, their observations, questions, and ideas often incorporate math concepts, from noticing shapes and patterns in the environment to wondering how much taller they've grown since last year to counting the number of ants on the sidewalk, as the children in the opening vignette did. These are authentic and intuitive experiences with math. When a teacher steps in to connect those observations, questions, and ideas to math concepts in a concrete way, children are highly motivated to engage in creative problem solving, gather information, and build theories to support and grow their understanding.

**Teachers must cultivate safe, supportive learning spaces.** So that children see themselves as authentic mathematicians, they must be empowered to explore and try new things, persevere when challenged, and use mistakes as learning opportunities. A critical part of that empowerment is a nurturing environment, one where children feel that they have a voice and that their ideas are considered and valued. Children who see themselves (including their linguistic, cultural, family, and community backgrounds) reflected in the space around them and know that their thinking is being listened to develop the security and confidence to take risks in their learning, which often propels them forward in their mathematical explorations.





**Collaborative learning experiences are more effective.** Working together with peers introduces children to a wider range of math learning strategies than if they work alone. Children who explore mathematical situations with others see and hear different interpretations of a problem, experience alternative approaches to problem solving, and learn new representations of math ideas. When children have opportunities to talk about and play with numbers on a regular basis, they become more experienced and confident in exploring the relationships numbers have with one another (Flynn 2017; Parrish 2010, 2011).

**Children are valid contributors to math teaching and learning.** In the early childhood classroom, the teacher's role is not to be a math expert, but rather a learner alongside the children. Every child has her own set of ideas, interests, strengths, and experiences (*or funds of knowledge*). This means that every classroom has an impressive collective body of knowledge and skills that's just waiting to be drawn on! Honoring the classroom as a democratic space and trusting the children as creative and capable learners who are able to explore complex math concepts makes for math learning opportunities that are more exciting, energizing, and effective.

## About the Book

The more I discovered the power of exploring and analyzing life through a mathematical lens, the more eager I became to share this approach. This book highlights some of the practices and strategies I have used in my own classroom over the years. To make this resource as practical as possible for other educators working with preschool and kindergarten children, it is organized into three main parts.

In Part 1, you will discover how to create math learning experiences for children using open-ended materials and strategies. Each chapter features examples that demonstrate how effective intentionally selected materials and activities can be for engaging children in math explorations that capitalize on their interests and help meet content standards.

Part 2 explores what math looks like in an emergent, integrated learning environment. When math concepts are connected to other content areas like science, literacy, and art, children are better able to see and learn math in ways that are relevant and meaningful to them. The chapters in this section highlight how to embed math concepts, materials, and tools in all areas of the classroom.

Finally, Part 3 describes how the questions children have about the world can turn into authentic, complex inquiries that incorporate or focus entirely on math concepts. As you read these examples about young children asking questions and finding answers through hands-on problem solving, it is my hope that you will be inspired to foster and generate math-rich inquiries sparked by children's wonderings.

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Your role in supporting children's growth as creative-thinking, engaged mathematicians is critical. If math conjures feelings of anxiety and frustration for you, I hope the examples and ideas in this book inspire you to reimagine the possibilities for teaching and learning math in the context of playful, child-centered, inquiry-based approaches. Along the way, I encourage you to take the same advice you extend to children as they explore and understand the world through a mathematical lens:

Take risks. Make mistakes. *Have fun.*