

COUNTING ON LITERATURE

Combining literacy with math education doubles opportunities for learning

By Judy Reinhartz

Weaving children's literature into mathematics has been gaining traction in education for many reasons. One of the most important has been that math proficiency is linked to reading proficiency. Supporting math learning through literature offers opportunities to double children's learning. Math is more than a content game — it also is a language game. But most importantly, books spark students' interest, and in doing so promote the use of math vocabulary, engage students in meaningful math talks and encourage them to make connections.

Using literature has many benefits, among them humanizing math learning, making math more relatable and approachable, and serving as a purposeful tool that demonstrates interconnectedness in learning. I am currently sharing with several teachers, as part of the MathAmigos literacy and math initiative, many merits of using literature to teach various math concepts in grades K-6. Many of the books suggested below have been field-tested by the participating teachers. I am happy to report their students are taking to these books with great enthusiasm as they are used to introduce, review and reinforce specific grade-level math concepts.

I'm Trying to Love Math by Bethany Barton (2019) takes students on an incredible and humorous journey, demonstrating how math is used. This book draws readers in and gets them to reflect on their feelings toward math. By the end of the book, they will see math in a new light. The dialogue in this book states what all of us at one time or another probably felt about math; it is validating to put these feelings into words. What a rich discussion parents and teachers can have with their children and students, starting with the line, "If you ask me, math is not very lovable." Getting kids to attach emotion to a subject such as math is an important first step in understanding it, and Barton's book gets the conversation started.

Literature takes readers on vicarious math journeys, embedding real problems and situations of interest through their characters, settings and plots. Literature does its best work when it gives math a human face; otherwise it is reduced to arithmetic. In his poem, "Arithmetic," Carl Sandburg describes it as "numbers you squeeze from your head to your hand to your pencil to your paper till you get the answer."

Take for example, this hypothetical discussion between two students: "That's not a square! It's too fat!" "I'm telling you, it is a square. It's got four straight sides, see? One, two, three, four! It doesn't matter that I made it fat." *The Greedy Triangle* (2008), Marilyn Burns' book on shapes and polygons, explores the students' dilemma by tracing the life of a bored triangle, who visits a shape-shifter to add more and more sides and angles to his shape to make his life more interesting.

Where would we be without the zero? That's the question addressed in Joan Holub's book *Zero the Hero* (2012), where the caped superhero shows his value is innumerable. *Coyotes All Around* (2003) by Stuart J. Murphy addresses the topic of rounding. In these books, and many others that can be found on the *Tumbleweeds* website, sftumbleweeds.com, readers are taken to faraway places to solve problems, meet challenges and focus on different predicaments. By asking children math-related questions while reading a book, learning math becomes a language game. When given the encouragement to explain what is taking place in the book, readers are learning math and they don't even realize it. Asking them how they would have solved the problems affords opportunities to use math terms and symbols to explain their ideas. By reading a



In *The Lion's Share: A Tale of Halving Cake and Eating It, Too* (2009), Matthew McElligott embeds multiplication and fractions in a lively illustrated book. An ant is invited to the lion's dinner party where all should be on their best behavior, but in the end they are not, eating all the cake and leaving none for the host. Stop reading after the partygoers displayed less than their best behavior and ask the question, "How would you solve the dilemma of not having any dessert to share?" Then continue reading on to see how the ant solved the problem.

To keep the fraction action going, read Bruce McMillan's delicious tale *Eating Fractions* (1991), *Apple Fractions* (2002) by Jerry Pallotta, or *Pizza Pizzazz* (2002) by Carol A. Losi. Pallotta's book is an excellent introduction to the topic, and using a real apple as you read models the fractional parts of the apples in the book. Or, read about Mario the Pizza Man, who bakes the perfect pizzas at his Pizza Planet for two teenagers, three firemen, five farmers and a woman with seven dogs. I think you get the idea: The pizzas are cut into different numbers of pieces based on the sizes of the groups.

In the beautifully illustrated book *One Grain of Rice: A Mathematical Folktale* (1997) by Demi, readers are swept off to a country across the globe and introduced to a different culture and a new word for a king: *raja*. The question to answer is this: How does one grain of rice make a difference? Students use six- and seven-digit numbers to keep track of how much rice Rani, a village girl, accumulates after receiving a doubling amount of rice for each of 30 days. The first day one grain, the second day two grains, the third day three, and so on. What do you think happens after 30 days? You will want to read the book to find out. This fascinating folktale embeds the concepts of place value. Often, students struggle with making the number 4,096 — one of the numbers they encounter — because it has a 0 in it. This may be a good time to read the book *Zero the Hero*.

In *The Great Divide* (1991) by Dayle Ann Dodds, readers become part of a thrilling race. Before they know it, they have solved a math problem to narrow the field of racers as they take part in a cross-country mathematical marathon. The competition starts with 80 racers side by side, but after encountering many natural obstacles, "half take a tumble, their tires go pop! Half carry on, never to stop." Dodds demonstrates division by telling a story rather than describing how it works. With its colorful illustrations, readers are drawn into the book without realizing it.

Yet another book that reinforces the concept of division is Stuart J. Murphy's *Divide and Ride* (1997). It is a great way to get readers to use math vocabulary including "groups of," "sets of," "remainder," number of kids "per" seat, "divide" and "left over" in retelling the story. The author includes several activities at the end to get readers to "mine" additional math content from the book.

Many people think of children's literature and math as an unlikely power couple. They underestimate the role that literature can play in strengthening children's math understanding, knowledge and skills. Somewhere along the line, it was decided to teach mathematics and language arts in subject silos that rarely intersect. But here, mathematics and language arts are two sides of the same coin.

For me, literature serves as a natural catalyst to stimulate children's thinking as they learn about the world of numbers in their daily lives and to make sense of them. Math-themed stories or poems take the readers to carnivals and parties and on trips close to home or to far-away places, connecting math with high-interest storylines, providing starting points for meaningful conversations that enhance number sense, celebrate math as a language, integrate math across the curriculum and facilitate visualizing mathematical concepts outside of unexciting workbooks. Literature empowers readers to think, talk and write outside the math box.

Judy Reinhartz is a professor emerita at The University of Texas at El Paso, MathAmigos Coach and a board member of the Santa Fe Alliance for Science.

