Leveraging Children's Multicultural Literature to Support Students' Math Identity and Problem Solving

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Abstract

This article explores how multicultural children's literature for elementary classrooms can be leveraged to develop students' mathematical understanding and foster positive math identities, particularly for multilingual learners. By integrating diverse stories into mathematics instruction, teachers can create culturally relevant contexts that invite meaningful problem-solving in tandem with rich mathematical discourse. This article features a classroom vignette in which a third-grade teacher uses the book *Too Many Tamales* to engage students in an equal share task, demonstrating how students' cultural experiences enhance their conceptual mathematical understanding. Several pedagogical strategies are highlighted as effective ways to support mathematical reasoning and understanding through authentic mathematical discourse. Drawing from classroom practice and supported by research, the authors advocate for the use of multicultural texts to provide meaningful opportunities for students to connect their lived experiences to mathematical ideas, empowering them to see themselves as capable mathematicians.

Discussion And Reflection Enhancement (DARE) Pre-Reading Questions

1. How do you represent your students' home cultures in your math lessons?
2. What connections can you make between texts that represent different cultural and linguistic backgrounds and students' math identities?
3. What strategies have you or would you like to use to engage students in academic discourse in math?
4. How do you select or plan to select texts that represent diverse students and support opportunities to engage in authentic conversations in ways that are connected to their lived experiences?

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Introduction

Integrating literature and mathematics can create meaningful, context-rich learning experiences for multilingual students. In today's math classrooms, many teachers have underutilized literature, perhaps worried about time constraints or moving focus away from math instruction. In this article, we argue that by incorporating multicultural literature into math instruction, students can develop deeper understandings of mathematical concepts as they engage in meaningful conversations that reflect their own experiences and backgrounds. Moving beyond word problems, literature offers opportunities for mathematical thinking, context and cultural relevance. Leveraging children's literature that highlights diverse characters and communities can support multilingual students' mathematical understanding and foster positive math identities. Often, students of color do not see themselves represented in the texts they read (Education Trust, 2023). Using multicultural texts to introduce and explore math concepts gives learners space to ask their own questions, and make connections among stories, their lives, and the world around them (Iliev & D'Angelo, 2014). Selecting books that reflect the diverse cultural and linguistic backgrounds of our students can provide relatable contexts for investigating math. It is important for multilingual students to see themselves and their languages, including translanguaging, in the stories they read. Monolingual students benefit by seeing multilingualism represented and celebrated, which can expand their worldviews (Fan et al, 2015). There is a strong research-base for weaving literature into mathematics lessons. Buchhheister et al. (2021) used Shel Silverstein's

"Band-Aids poem" to showcase how content-implicit literature can lead to mathematics lessons that are focused on "fairness and equity in a real-world situation" (p. 16). Integrating children's literature in elementary mathematics can lead to significant gains in student understanding and retention of mathematics concepts (Thomas & Feng, 2015).

We offer a starting point for how teachers can support students with exploring and investigating math through story. For example, how might different cultures relate to this problem? How might students see themselves or relate to the math problem in the story? Reflecting on these questions are ways to promote a positive math identity for students. Mathematics identity refers to the "dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives" (Aguirre et al., 2013, p. 14). Introducing math vocabulary connected to math stories can further support students with understanding what it may look like to halve something or double something. Students can explore what it means to share something *equally.* Math investigations, inspired by multicultural literature, can provide authentic opportunities for students to communicate and work together as a community as they persevere to solve problems presented in stories. To illustrate how multicultural literature can bridge math and culture in the classroom, let's look at an example from Ms. Hernandez's third grade class, where she thoughtfully integrates literature into a math lesson that reflects both the cultural and language backgrounds of her students and springboards into key mathematical concepts. She uses the book *Too Many Tamales,* where a young girl named Maria helps her mother make tamales for a holiday celebration. While cooking, she tries on her mother's diamond ring and later realizes it's missing and probably lost in the tamales. Maria and her cousins secretly eat all the tamales trying to find the ring. In the end, they confess, only to discover the ring was never lost. The story highlights themes of family, honesty, and holiday traditions.

This article is based on the work from a 5-year IRB-approved project funded by the National Science Foundation as a collaboration between a university and a large school district in southern California. Together, we developed professional development opportunities to support teachers working with English learners in integrated English Language Development math classes with students in grades 3-5. Classroom observations and teacher reflections inform the vignette and ideas shared below.

Vignette

Ms. Hernandez's third-grade class gathers on the carpet for their weekly read-aloud during math class. The learning objective is posted on the board behind her: *Students will develop a conceptual understanding of division by solving equal-sharing problems from story*. The teacher begins by sharing the book cover with her students. "Today, we will be reading the book *Too Many Tamales*, by Gary Soto. Can anyone tell me what you think this book will be about?"

An eager student named Veronica waves her hand with excitement. When she finally gets to share, she says, "I think it will be about tamales! I love tamales! I make tamales with my abuela in December. We always make dozens and dozens so maybe this book will be about how long it took them to make all the tamales, what kind of tamales they made, or which family members ate the most tamales. I am hungry now, Ms. Hernandez! Do we get to eat tamales afterwards?"

Ms. Hernandez giggles and praises Veronica for her excitement and for sharing her experience and asks others to relate to what Veronica said. Some students spoke about other foods their family prepares for special occasions and how they share them with extended family and neighbors. Anh says he thinks he is really good at math because he measures all the ingredients needed to help make his family's famous shrimp dumplings. He also keeps track of the time and temperature needed to cook dumplings. Anh is excited to find out if the tamale story includes a lot of information about measuring, time, and temperature.

Ms. Hernandez proceeds to read the text aloud. She stops along the way to ask students to retell what is happening in the story. She has students talk about what tamales are since some students may not be familiar with this food. She asks students to identify quantities of tamales shown in the illustrations. She asks students to make connections to the problem in the story. She then presents the class with a math investigation from the story:

> *In the story, there were 24 tamales. Maria and three other children ate all the tamales. If each child ate the same amount, how many tamales did each child eat?*

Students work in groups of four using cornhusks and play dough, as manipulatives, to represent the tamales and come up with their solution. Ms. Hernandez circulates to listen to all the groups' conversations. Some students question their peers, suggesting a different solution. Students explain in greater detail why they think their solution is correct in order to convince peers that seem to disagree. Ms. Hernandez asks a few groups to share aloud in front of the class. She also asks students to create some new math investigations that could be tied to the story.

Math Identities and the Role of Multicultural Literature

In the vignette above, many of Ms. Hernandez's students were able to connect with the story, *Too Many Tamales*. Some felt connected because they saw themselves in the characters. Others felt connected because they related to close familial ties represented in the book. Others were able to relate to family gatherings which often included special foods. Using this story played a facilitating role in fostering students' positive math identities, which are deeply influenced by their cultural and linguistic backgrounds. According to Leonard et al. (2013), multicultural literature makes math more relevant and accessible to students from diverse backgrounds. The act of engaging with literature, alongside math, helps students see themselves as mathematicians. These books also highlight contributions from different cultures, allowing multilingual students to see themselves represented in math stories. This can result in increased engagement and foster a sense of belonging (Altun, 2023; Colby & Lyon, 2004; Robinson, 2023). Representation matters in fostering a positive math identity.

Positive math identities are crucial for academic success and personal growth. Students belong to multiple microcultures related to race, culture, gender, family, faith, and language, all of which shape their identities (Safi et al., 2021). Our identities have also been shaped by educational experiences in both positive and negative ways. Math identities are complex and change over time. It is critical to explore the math identities of our students and provide opportunities for them to see their funds of knowledge and assets (Civil, 2016; Moll, 2014; Wilson et al., 2020) represented in texts.

The Different Roles of Multicultural Literature

Multicultural literature offers students opportunities to engage with math in meaningful and culturally relevant ways (Leonard, 2008). To fully understand how these texts support students' mathematical development, it is essential to explore the different roles that multicultural literature can play in the classroom—whether it's attending to culture, language, or mathematical concepts themselves.

Attending to Culture

Multicultural literature can play a significant role in affirming cultural identities, in supporting cross-cultural understandings, and in promoting inclusivity (Wheeler & Hill, 2023). Multicultural books can provide students with characters and stories who reflect their lived experiences, values, and traditions. By representing diverse cultural and linguistic backgrounds, books can validate and celebrate the identities of students in our classrooms. In Bishop's (1990) seminal work, she describes books as windows, mirrors, and sliding glass doors that serve to reflect the student's culture (mirror), offer a view into others' lives (windows), and invite students to participate in different cultural experiences (sliding glass doors). Multicultural literature can also foster cross-cultural understandings, dismantle stereotypes, and build empathy by exposing students to diverse cultural experiences and perspectives. Stories that authentically depict the complexities of different cultures and experiences help students develop a deeper understanding of others, challenging monolithic or prejudiced perspectives (Briceño & Rodriguez-Mojica, 2022). In addition, multicultural literature often incorporates themes and narrative that resonate with specific cultural values, struggles, and triumphs. They provide a medium to explore topics like bilingualism, immigration, generational conflict, and racial identity (Wee et al., 2021). In the book, *That's Not My Name!* by Anoosha Syed (2022), the central character Mirha shares her frustrations with having her Arabic name repeatedly mispronounced. Multicultural literature can also enhance social and emotional learning by presenting diverse life experiences and nurturing empathy, resilience, and cultural competence (Gay, 2021). For example, in *Areli is a Dreamer* (2021), Areli Morales shares her story of being a Dreamer as a Deferred Action for Childhood Arrivals (DACA) recipient,

mirroring other's experiences and providing a window for others to develop cultural competence. This book can be used to explore concepts of estimation, measurement of time, sequencing, and unit conversions.

Providing students with familiar contexts, such as leveraging the proportional reasoning involved in making watermelon smoothies or coconut pudding in the Pacific Islands, enables learners to make connections with more rigorous content and strengthens their identities as doers of mathematics (Hunter & Restani, 2021). Using multicultural texts with math connections allows students to see that math is not just a "western thought" but that ancient civilizations around the world have used math for thousands of years (Hunter & Hunter, 2023). For example, Seneb and Merti are the two main characters in *If You Were a Kid Building a Pyramid* by Schimel who share what they know about the materials and tools used to build Egyptian pyramids, exploring concepts of geometry, ratios and proportions. In the book *Mararíki*, authors Brown and Parkinson use rich imagery as well as Maori and English text to explore how the Maori people navigated their boats at night by stars, exploring concepts of measurement and statistics.

Attending to Language Through Translation and Translanguaging

While culture plays a central role in how students engage with literature and math, language is also important. In fact, language, especially in multilingual classrooms, is a powerful tool for deepening mathematical understanding and building math identities. Language is a central part of students' identities (Darvin & Norton, 2017). Garcia and colleagues (2017) discuss the value of allowing students to use their full repertoire of language, which includes students' languages, dialects, and registers. Hence, there is great value in books that reflect students' linguistic backgrounds. Furthermore, books that use translation and translanguaging expose children to multiple languages, whether or not they are familiar with those languages. Many books use translanguaging to highlight the language and cultural aspects that are embedded into the story, such as *Isabel and her Colores go to School* by Alexandra Alessandri (2021). The author wrote most of the book in English and uses Spanish terms when describing colors, feelings, or artwork that the main character expresses when thinking in her first language. Exposure to translanguaging in books is a helpful resource for students when setting the stance that they are allowed to use their full linguistic repertoires for learning and when communicating ideas during classroom instruction (Garcia, Ibarra Johnson, & Seltzer, 2017). Some books touch upon this idea by translating in multiple languages, such as books from the Story-Telling Math series like, *¡Hasta las rodillas! Up to my Knees!* (2022), which is written in both Spanish and English and features measurement for young children 0 - 3 years old.

Attending to Mathematical Concepts

Stories involving math provide contextual opportunities for students to engage with math concepts through story. Integration of literacy and mathematics provides ''context and engaging scenarios for students to grasp difficult mathematics concepts'' (Koellner et al., 2009, p. 38). Some texts center around math concepts as the core of their narratives, providing students with concrete and relatable ways to explore ideas such as fractions, measurement, and division. For example, the *Sir Cumference* series (Neushwander, 2007) and *Fractions in Disguise* (Neuschwander, 2005) are stories that center math concepts, but do not necessarily provide a multicultural context. After reading Fractions in Disguise, students can sort fractions into "disguises" of the same number or create a fraction gallery featuring equivalent fractions. In a book from the series, *Sir Cumference*, students are introduced to the concept of pi and circles in a fun and engaging way. This story can spark a series of inquiries about circles, pi, and the geometry involved, where students can experiment with drawing circles, measuring diameters, and calculating areas. *Spaghetti and Meatballs for All* (Burns, 2008) is a mathematical story that explores the distinction between surface area and perimeter, specifically while the various configurations of the eight tables have the same surface area, the same cannot be said about the perimeter. By presenting mathematical concepts and vocabulary through literature we can provide students with the "context and engaging scenarios to grasp difficult concepts" (Koellner et al., 2009, p. 38).

Attending to Culture, Language, and Math

Focusing on the math ideas found in multicultural books provides students with opportunities to learn mathematical concepts in meaningful contexts. These opportunities are necessary in making mathematics accessible and for helping students use literature and mathematics to make sense of their lives (Lo Cicero, Fuson, & Allexsaht-Snider, 1999). *Luna's Yum Yum Dim Sum* (Yim, 2020) is an example that integrates many of these concepts, by using a playful problem about equal sharing in a multicultural context to explore fractions and division. On Luna's birthday, the whole family goes out for dim sum -- but Luna and her brothers can't agree on how to share their pork buns fairly. How can three people divide up five buns? Comprehending the story is dependent on understanding the equal-sharing math investigation presented in the book. The problem also invites students to consider how food is shared during family gatherings, which is a common cultural practice in many Asian communities. By framing the math problem in a familiar cultural setting, students can better relate to the task and feel more invested in solving it. This promotes a positive math identity where students feel they are do-ers of math. Students are able to have authentic conversations about equal-sharing problems in ways that are meaningful and connect to their lived experiences. The book incorporates vocabulary (e.g. baba, dim sum, char siu bao) that may be part of a register familiar to some and unfamiliar to other students. *Luna's Yum Yum Dim Sum* is available in English and also in a bilingual (Spanish/English) version. In the latter, the story is written in Spanish with English on the same page under the Spanish text. This allows for native Spanish speakers to see and hear the story in their native language along with the English text under it, supporting dual language development. By reading the text in both languages, students strengthen their vocabulary and language skills in both.

Although it is beneficial for books featuring math concepts to be written in multiple languages, it differs slightly from the power of translanguaging where both languages are used simultaneously. For example, *¡Mira Abuela! Ni Elisi! Look Grandma!* (Coulson, 2022), another book from the Story-Telling Math series for ages 3 to 6, covers all aspects of multicultural texts that feature math. First, there is the option of reading a Spanish-English bilingual version or a (mostly) English version. Second, both versions include Cherokee words interspersed throughout the book because the main characters are Native American. Third, the story uses a Native American context where the main character plans to sell traditional marbles for the Cherokee National Holiday festival. Lastly, the main character uses spatial reasoning and his understanding of volume/capacity to find a container that is the right size for all the marbles. By using texts like, *Luna's Yum Yum Dim Sum* and *¡Mira Abuela! Ni Elisi! Look Grandma!,* teachers can deepen mathematical understanding by leveraging cultural context and linguistic repertoires.

Revisiting Veronica, a student in Ms. Hernandez's classroom, the book *Too Many Tamales* has an authentic cultural and linguistic context that provided a scaffold for the mathematical concepts of equal-sharing using fractions and division. Her own family's tradition of tamale-making and the use of vocabulary that was familiar to her (e.g. tamales, masa) positioned her as an expert in the classroom. Given that the context was familiar to Veronica, the equal-sharing problem presented by the teacher is likely to lead to deeper understanding of mathematical concepts. At the same time, other students who may not be familiar with the context were provided opportunities to expand their cultural competence and make connections to their own lived experiences (e.g. Anh's connection to dumplings).

Using Literature to Promote Authentic Mathematical Discourse and Problem Solving

By using stories that are culturally relevant, teachers can encourage students to solve problems collaboratively, apply mathematical reasoning, and communicate their thinking in ways that are meaningful to them. Multicultural math stories can provide a context that students can connect to and engage with each other in conversations. These discussions allow students to justify their approaches, listen to others' perspectives, and refine their reasoning through peer feedback. The collaborative nature of solving problems through literature promotes the development of key mathematical skills such as logical reasoning and the ability to articulate and critique mathematical arguments. Using multicultural math stories can also promote students' ability to solve a math task in multiple ways. For example, in Luna's *Yum Yum Dim Sum*, students may solve the problem by distributing three pieces of dumpling to the three children in the story. Others may decide to use

a division algorithm (e.g., 5/3 because there were five dumplings and three sharers). These opportunities allow for students to see there is not just one right way to solve a math task. The math story allows students to think creatively, ask questions, and approach math with confidence as they share their thoughts with peers.

Math permeates our everyday lives, no matter what our cultural backgrounds are. Multicultural stories can help contextualize mathematical concepts within real world scenarios that are meaningful to students (Desai et al., 2021). For example, Anh (in the vignette presented above) makes a connection to the math he uses at home when making shrimp dumplings. He is eager to talk with peers about how he makes shrimp dumplings and shares the recipe his family uses. He also shares with the teacher and class about the different measuring cups and spoons he uses when helping his family make the dumplings. He discusses halves and fourths and how sometimes his family doubles the recipe. His engagement in the story and in the math task has already been established because of the connections he has made. He is ready to work and talk with his peers in solving the equal-sharing problem about tamales.

Let us revisit students in Ms. Hernandez' class as they work on the equal-sharing problem: Anh, Veronica, Kareem, and Sarah work together to solve the problem from *Too Many Tamales,* the book Ms. Hernandez read aloud to them. Veronica decides to get the group going and reads the problem aloud to her group.

Veronica: Pues, I will start by reading the problem: In the story, there were 24 tamales. Maria and the other three children ate all the tamales. If each child ate the same amount, how many tamales did each child eat?

Kareem: I think we should use the corn husks to help us figure this out. Let me count out 24. (Starts counting and plays around with the husks.)

Sarah: Pero, I don't think we need the corn husks - can I just draw them out instead? (Gets dry erase marker and whiteboard.)

Anh: Okay, so Sarah drew all the tamales for us. Make sure you drew 24. Let's figure out how many each kid gets. We have to split the tamales between the three kids and we have to do it the same…like equally.

Veronica: Right, cierto? - like each kid has to get the same amount. How about we label each tamale with who it goes to? Like the first one goes to child 1 who is probably Maria, then the second one goes to child 2, 3 for child 3. What do you think?

Sarah: Okay sounds good. (Sarah starts to label each tamale as her teammates count aloud with her.)

Anh: Wait you are confusing me - what do the numbers mean? Why are you putting numbers above the tamales?

Sarah: The numbers represent the kids. So, 1 is kid #1, 2 is kid #2, 3 is kid #3.

Veronica: Okay so I am going to count up all the tamales for kid #1. I got 8.

Anh: I counted 8 for kid #2 also and 8 for kid #3.

Sarah: Okay so each kid gets 8 piezas then, verdad? Kareem, are you going to help us out or are you still playing with the corn husks?

Kareem: Let me see what you did. How did you get 8? I don't think that is right? hmmm ... Oh you forgot a kid! We actually have to split them between four kids. You are forgetting it's Maria and three kids, so that is a total of four kids.

Anh: Oh that is right - I saw three in the word problem and was going with that. Oh no! We have to start over!

Sarah: It's okay, let me just erase the numbers again and we can redo it but this time label 1, 2, 3, then 4.

Kareem: The answer is 6 tamales for each kid.

Veronica: Wait - how did you get that so fast? Let us wait and count it all up after Sarah puts the numbers on top of each tamale.

Anh: Okay let me count…1, 2, …(the others start to count with him). Okay so the answer is 6 tamales. Do we all agree?

All the kids nod their heads. They are ready to report back to Ms. Hernandez.

Students in this group worked together to make sense of the problem, discussed how they would represent the tamales, and persevered to come up with a solution. This exchange also provides examples for how group work can promote community evidenced by the confidence with using primary language and holding each other accountable for learning. After re-engaging Kareem, he noticed an error saying, "We actually have to split them between four kids". The group asked questions when they were confused (e.g., "what do the numbers mean?"), co-constructed meaning through multiple exchanges, reevaluated their thinking, and revised their solution. Students also paid close attention to the term *equally* and understood they had to give the same amount of tamales to each kid. Guiding questions from the teacher can be used to facilitate authentic mathematical discourse where multilingual students can go deeper to clarify and negotiate their thinking (Kazemi & Stipeck, 2009). Teachers often ask guiding questions after students work together to solve a problem connected to the story. Students actively engaged in meaningful mathematical discourse because they were genuinely interested in the problem drawn from the book. The context of the story increased their motivation to solve the task, making the math feel relevant and enjoyable. This engagement was further supported by the teacher's intentional cultivation of a problem-solving culture, where students felt encouraged to share ideas, take risks, and collaborate.

Conclusion

This article contributes to the field of mathematics education by offering asset-based, culturally and linguistically responsive ideas for integrating multicultural children's literature into math instruction. Drawing on classroom-based examples, the article demonstrates how literature can serve as a powerful tool for mathematical thinking, discourse, and identity development. By integrating multicultural literature into math instruction, teachers can not only enrich students' mathematical understanding and language development but also help them develop a strong, positive math identity. It is important for educators to rethink how literature and math can work together to support multilingual students in becoming confident mathematicians who see themselves and their cultures reflected in the math they learn. Using children's multicultural texts (e.g., Table 1) to support students' math identities and problem solving, especially for multilingual learners, can result in greater math achievement. Using texts that highlight bilingual characters and communities can help develop students' identities as mathematicians as well as validate their cultural identities. Since most texts used in the classroom often do not reflect the experiences of students of color, educators should make a conscious effort in changing this. Using multicultural texts about math concepts gives learners space to ask their own questions, build confidence and curiosity, and make connections between stories, their lives, and the world around them. Further, these texts can be beneficial for promoting authentic mathematical discourse in the classroom.

Visit https://education.ucdavis.edu/building-students-academic-language-mathematics for resources, recommended book lists, and extensions for the classroom.

Table 1

Multicultural Texts That Can Be Used in Mathematics

Book Title and Author	Category (Attending to)	Grade Levels	Math Concepts
Too Many Tamales by Gary Soto	Culture, Language	TK-3	Estimation, counting, problem-solving
That's Not My Name! by Anoosha Syed	Culture	TK-2	Counting, comparing quantities, data collection, graphing, categorization
Areli is a Dreamer by Areli Morales	Culture	TK-4	Measurement of time, sequencing, estimation, unit conversions
Isabel and Her Colores Go to School by Alexandra Alessandri	Language	TK-2	Counting, sorting
Luna's Yum Yum Dim Sum by Natasha Yim	Culture, Language, Math	TK-2	Fractions (equal sharing and division)
Sir Cumference Series by Cindy Neuschwander	Math	2-6	Geometry, measurement, logic, fractions
¡Hasta las rodillas! Up to my Knees! by Grace Lin	Language	TK-1	Measurement, comparison
Fractions in Disguise by Edward Einhorn	Math	3-5	Fractions, equivalence, problem-solving
Spaghetti and Meatballs for All by Marilyn Burns	Math	TK-3	Area, perimeter, multiplication, division
¡Mira Abuela! Ni Elisi! Look Grandma! by Art Coulson	Culture, Language, Math	TK-2	Spatial reasoning
Matariki by Kitty Brown, Kirsten Parkinson	Culture, Language, Math	TK-3	Numbers, counting, geometry, measurement, statistics
If You Were a Kid Building a Pyramid by Lawrence Schimel	Culture, Math	TK-5	Measurement of time, geometry, measurement, ratios, proportions

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Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. Where are there opportunities to use multicultural literature in your math classroom?

2. How will you engage students in mathematical discourse using multicultural literature in order to promote problem solving?

3. Try this: Select a multicultural storybook from Table 1 in the article . Identify stopping points in the book where you may pause and discuss with students so that they understand the context or the mathematical features involved in the problem-solving activities.

4. Try this: Write a collaborative book with your class that represents the students' cultural and linguistic backgrounds and focuses on a math concept you are currently exploring.