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Creating Spaces for Change Through Community: It Starts With You

Beyond Literature Connections: Storytelling in Math

Teresita Cuesta (teresitacuesta@gmail.com)

The Math Teacher Continuum

What is your relationship with math? How did you become a math teacher?

It is a well-documented fact that math aversion is pervasive in the US adult population. That, of course, includes teachers and parents who sympathetically tell their children, "I understand. I was never good at math either." The non-profit *Change the Equation* found in a 2009 survey that 36% of Americans admit to often saying they can't do math. Among Americans aged 18 to 35, the number went up to 53%. Also, almost one third said they would rather clean their bathrooms than do a math problem! Many studies have documented parents' and teachers' fears around math and connected their anxiety to their children's achievement. Respondents are quoted as saying things like, "It's not my strong subject, and I don't enjoy it," and "I'm afraid of teaching a concept I'm not familiar with." One study concludes that "the way teachers feel in the classroom and the indirect messages they convey through their practice may be an important factor shaping student math learning." (BSU, 2018)

I've never liked math.	I don't like math that much.	Math is just a subject I teach.	I learned to love math as an adult.	I've loved math since I was a kid.

Where are you on the continuum? How did you become a math teacher? What are your fears as a math teacher?

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The Heart-Mind Connection

In the past decade, neuroscientific research in education has revealed the profound impact of emotions on the brain and learning. Utilizing this research has become part of standard best practices, which include reducing anxiety, fostering enthusiasm, and creating a sense of community support (Edutopia, 2014)

What do you know about the brain and learning? What techniques do you use to promote optimal brain conditions in your children?

Storytelling in Math

Children grow up hearing and telling stories. It is a natural part of their development rooted in humankind's development. Once they enter school, story time is a constant in most students' lives. This familiarity can be used as a bridge to math. Storytelling is different from making connections to literature. Storytelling can be harnessed as a culturally relevant tool to affirm students' identities and promote a sense of belonging and ownership. By weaving it into their lessons, teachers can build confidence, spark curiosity, develop algebraic thinking, strengthen communication skills, and foster metacognition. Additionally, storytelling is an effective way to differentiate instruction.

How have you used storytelling in your teaching? How have you used it in math?

The Math Student Continuum

Children start establishing their identity at a very young age. They also establish their identity as students in the early grades. Part of that identity is their relationship with math. This is particularly important for girls. Several studies have found that children as young as 5 or 6 already have gendered beliefs about academics that can be summarized as “math requires brilliance and boys are more brilliant than girls” and “girls do reading and boys do math.”
Independently of their gender and whether they fall into these stereotypes or not, students tend to gravitate more toward one subject than the other (The Atlantic, 2017).

***Loves story lines, gets attached to characters** ***Process-oriented** ***Numbers are just words**	***Likesnonfiction** ***Enjoys the process, wants the results** ***Has number sense.**	***Loves patterns, logical premises, and quantities** ***Results-oriented** ***Has difficulty explaining in words**

Using storytelling in math fosters growth at both ends of the spectrum. For those who are more verbal-oriented, storytelling plays to their strengths and preferences, replacing fear of math with a positive bond while strengthening their understanding of math concepts. For those who are more analytical-oriented, storytelling facilitates a focus on process that will enhance their understanding and their ability to communicate their thinking.

Think of a few of your students at each spot in the continuum. How have you addressed their needs?

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The Literacy-Numeracy Intersection (not Parallel!)

Over the years, there have been myriads of initiatives to promote literacy development at home. Programs and recommendations come from all sources at all levels: local libraries, churches, school districts, nonprofits, social services providers, pediatricians, county governments, national task forces, etc. The ubiquitous bedtime story gained traction with an endorsement of the American Pediatric Association; no corresponding effort has been put forth for math.

Three important components are common to these recommendations:
*Make reading an integral part of the child's life: read every day, read everywhere, read with your child, make it fun and special, make it social, etc.
*Incorporate different elements around reading: talk, sing, ask questions, act it out, make predictions and connections, connect to other disciplines, etc.
*Model: Let your child see you reading and talking about what you read.
(Reach Out and Read, 2022; Goodling Institute, 2022; Edutopia, 2020)

What is the numeracy equivalent of this? What is the equivalent of going to the library? Or to the bookstore? What is the equivalent of bedtime stories? Or book clubs? What recommendations do you give parents regarding numeracy? Where do you see parallels and connections between literacy and numeracy?

How about Culturally Responsive Teaching?

In her book *Culturally Responsive Teaching and The Brain*, Zaretta Hammond establishes the connection between brain science and how CRT accelerates learning for *all* students.Although it shares initials with that other CRT, culturally responsive teaching just means approximating students' cultural learning styles and tools to leverage the brain's established structures. Many students come from cultural traditions that transmit knowledge orally and actively: storytelling fits this modality perfectly and, by using familiar processing systems, students free up more brain power! (Cult of Pedagogy, 2015) Hammond offers three strategies:

How can you *storify* your math content?

The Literacy-Numeracy Intersection (not Parallel!) -continued

Different studies have found that parents engage their children in numeracy activities less frequently than literacy and that parents believe literacy to be more important than numeracy (EdWeek, 2020). With the push for more and better STEM education, organizations which previously devoted significantly more attention to literacy have become more balanced, for example PBS or BrainPop. A search on the American Psychological Association database shows an increase in studies linking early literacy and numeracy development, yet they represent only 10% of all research Additionally, "a parallel shift in policy or practice relating to program funding or instructional development has yet to occur," and an imbalance persists: twice as much time is dedicated to reading as math in both the home and school "***even though both can be instructed together***." (Policy Insights from the Behavioral and Brain Sciences, 2018).

Recommendations to promote numeracy include national educational campaigns, the effective use of appropriate curricula and interventions in schools, and supporting early mathematics development in the home and in the classroom, on all of which teachers can become involved. Much of this involvement can be grouped in three categories:

*Explicit instruction: teach numbers, addition and subtraction facts, name shapes, etc.
*Math in context: engage in projects and activities such as shopping, cooking, building, or planning a trip or a schedule (US Dept. of Education, 2009)
*Numeracy-Literacy parallels AND connections: do for math what you do for reading, teach them in tandem (Get Ready to Read, Bedtime Math)

"Not everyone loves reading. But all kids are encouraged to spend time reading, not just for school assignments, but on their own. Just so, not everyone loves math, but everyone should be encouraged to spend time doing math on their own, not just for school assignments. If a kid has a bad experience with trying to learn to read in school, or is bored with the particular books the teacher assigned, few parents would say "Well, maybe you just aren't a reader." Instead, they would try hard to find some other way to help their kid with reading and to find books that would be exciting for their particular kid." (Miles Kimball, 2014)

What do you do for literacy that you could do for numeracy?

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What literary genre are Number Stories?

Mysteries, of course! Like all stories, number stories have a beginning, middle, and end. They have characters, a setting, and a plot. They are interesting and engaging. They might be realistic or pure fantasy. They are ALWAYS chapter books. What are some number story subgenres?

Reading a Number Story

How do you go about teaching a *reading* lesson? Use the same approach in math!

Activity: Summarizing a Number Story

What is *happening* in the story? Write a short summary in words. **DO NOT USE ANY NUMBERS.**

What is the *mystery*? Explain it in your own words.

What subgenre is this story?

DON'T DO ANY CALCULATIONS. Just write a sentence for the answer. You may include a blank or a symbol to represent any numbers.

Now, organize your story on the **felt** and write a summary in numbers and symbols here:

Finally, write the solution to the mystery in a complete sentence.

Activity: Close Reading a Number Story

1. Tell students you are going to practice a slow way of looking at number stories, the same way you take time to explore books.
2. Model **reading the number story**, one idea at a time, following this procedure:
    a. Each partner has a copy of the story. One is the Reader and one is the Listener.
    b. The Reader reads out loud while the Listener follows along looking for when an idea ends and a new one begins.
    c. When the Listener thinks an idea has ended, they ask the Reader to stop and mark that point on their copy of the story.
    d. The Reader re-reads the story, one idea at a time, based on the marks they made, as the Listener rephrases each idea out loud.
    e. The Listener summarizes the story ***without using any numbers***.
    f. Together, the partners discuss what they are being asked to find, make logical predictions about the solution, and discuss approaches to find the solution.
3. Have students work in partners reading the story by following the procedure described above.
4. Model **taking notes**, one idea at a time, following the same procedure as above, with these two variations:
    a. This time, the Listener writes the information by using the form below (see examples at the end).
    b. The partners discuss, agree on, and write the **number model** and **a solution sentence *without any numbers***.on the form.
    c. The partners brainstorm, agree on, and try a strategy to figure out the solution.

	What happened?	**How many?**	**What?**
1st idea			
2nd idea			
3rd idea			

Number model:_____
Solution sentence: _____

5. Have the partners switch roles and work on taking notes by using the variations and the form above.
Examples:

	What happened?	**How many?**	**What?**
1st idea	Some chickens were sad because their friends had left	We don't know	chickens
2nd idea	At the beginning there were more friends	5	chickens
3rd idea	Some ran away to see the world	3	chickens

Number model: ? = 5 - 3
Solution: After their friends ran away, there were _____ sad chickens.

	What happened?	**How many?**	**What?**
1st idea	Luke planted veggies in their garden	100	veggies
2nd idea	Some are tomatoes	We don't know	tomatoes
3rd idea	Some are peppers	45	peppers

Number model: 100 = ? + 45
Solution: Luke planted _____ tomatoes in their garden.

The Writing Process and Number Stories

Students can create number stories using the familiar sequence of prewriting and drafting followed by the cycle of feedback, revising and rewriting before the final steps of editing and publishing.

Activity: Writing from an outline

Prewriting: *What kinds of characters will you include? What will they be doing?* **DO NOT INCLUDE ANY NUMBERS.**

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Prewriting: *Look at the outline in numbers and symbols. What will be the mystery?* **DO NOT INCLUDE ANY NUMBERS.**

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Drafting: *Set up the outline on the* ***felt*** *and write a paragraph for each chapter. Follow the sequence and include the numbers from the outline.*

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Revising: *Check that your story makes sense, solve the mystery and explain it in a complete sentence; add detail, action, dialogue, precise and vivid language, etc.*

Editing and Publishing: *Check spelling and punctuation. Draw a picture.*

A sequel: *Use the same outline to write a different story.*

A trilogy: *Use the same outline to write yet a different story.*

Activity: Creating an outline

Prewriting: What kinds of characters will you include? What will they be doing? **DO NOT INCLUDE ANY NUMBERS.**

Prewriting: What subgenre of number story do you have in mind? In what chapter will you include the mystery? **DO NOT INCLUDE ANY NUMBERS.**

Prewriting: Use the ***felt*** *to outline your story in numbers and symbols. Then write the outline here.*

Prewriting: Use the ***felt*** *to outline your story again using different numbers. Then write it here.*

Prewriting: Use the ***felt*** *to outline your story again using yet different numbers. Then write it here.*

Drafting: Choose one of the outlines and write a paragraph for each chapter.

Revising: Check that your story makes sense, solve the mystery and explain it in a complete sentence; add detail, action, dialogue, precise and vivid language, etc.

Editing and Publishing: Check spelling and punctuation. Draw a picture.

Activity: Treasure Boxes

Prewriting: Set up your treasure box. What kinds of characters will you include? What will they be doing? **DO NOT INCLUDE ANY NUMBERS.**

Prewriting: What subgenre of number story will you write? Where will you include the mystery? **DO NOT INCLUDE ANY NUMBERS.**

Prewriting: Use the ***felt*** *to outline your story in numbers and symbols. Then write the outline here.*

Prewriting: Use the ***felt*** *to outline your story again using different numbers. Then write it here.*

Prewriting: Use the ***felt*** *to outline your story again using yet different numbers. Then write it here.*

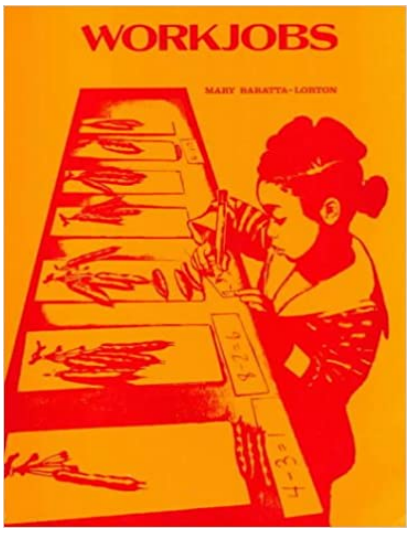
Drafting: Choose one of the outlines and write a paragraph for each chapter.

Revising: Check that your story makes sense, solve the mystery and explain it in a complete sentence; add detail, action, dialogue, precise and vivid language, etc.

Editing and Publishing: Check spelling and punctuation. Draw a picture.

A sequel/ A trilogy: Use the same outline to write different stories.

All credit to Mary Baratta-Lorton and her *Workjobs (1972)*, which you can still find on Amazon!



You can also download the book at http://www.center.edu/Workjobs.shtml.

The publishers of the *Bridges in Mathematics* curriculum, [The Math Learning Center](), offer lots of free materials, including *[Problem Solving with Story Boxes]()*, *which is based on Workjobs.*

Ashley - 78004 Motivation Phrase Mini Whiteboard Eraser 

Feel free to use my presentation and handout, which you can access by using the QR codes below (just give me credit, please).

HANDOUT

PRESENTATION

Bibliography

Articles:

A Game-Changing Practice Fuses Math and Literacy, by Emelina Minero (edutopia.org 2019; retrieved 10/19/23

Early Math Matters: A guide for Parents of Preschoolers, by Kristin Stanberry (National Center for Learning Disabilities, retrieved 10/19/2023)

How Students Should Be Taught Mathematics: Reflections From Research and Practice, by Jo Boaler (youcubed.org, 2017; retrieved 10/19/23)

Mathematics and Reading Develop Together in Young Children: Practical and Policy Considerations, by David Purpura, Ellen Litkowski, and Valerie Knopik (*Behavioral and Brain Sciences*, Vol 6(1), Cambridge University Press, 2019)

Mathematizing Read Alouds, by Alison Hintz and Anthony Smith (*The Reading Teacher*, Vol. 67(2), International Reading Association, 2013)

Numbers Game – Increasing Math Literacy in Children, by Sue Smith-Heavenrich (originally retrieved from mathandmovement.com, 2007; no longer available)

Picture-Book Math, by Bob Krech (Everyday Learning Corporation, 2002)

Books:

Culturally Responsive Teaching & The Brain, by Zaretta Hammond (Corwin, 2015)

Deepening Students' Mathematical Understanding with Children's Literature, edited by Eula E. Monroe and Terrell A. Young (NCTM, 2018) *Online resources for the book include Annotated Bibliography of books by level and strand.

Hands Down Speak Out: Listening and Talking Across Literacy and Math K-5 by Kassia Wedekind and Christy Thompson (Stenhouse Publishers, 2020)

Number Wonders, by Catherine Jones Kuhns (Crystal Springs Books, 2006)

Strengths-Based Teaching and Learning in Mathematics: 5 Teaching Turnarounds for Grades K-6, by Beth Kobett and Karen Karp (NCTM, 2020)

We Got This, by Cornelius Minor (Heinemann, 2019)

Websites:

https://www.mathplusliteracy.com/
https://www.mathsthroughstories.org/
https://naturalmath.com/
(picture books)

Slide deck for the presentation

Activity: Creating an outline

Prewriting: What kinds of characters will you include? What will they be doing? **DO NOT INCLUDE ANY NUMBERS.**

My story will be about puppies finding their chew toys

Prewriting: What subgenre of number story do you have in mind? In what chapter will you include the mystery? **DO NOT INCLUDE ANY NUMBERS.**
I'll make a change story with the mystery in the second chapter

Prewriting: Use the ***felt*** *to outline your story in numbers and symbols. Then write the outline here.*

? - 5 = 1

Prewriting: Use the ***felt*** *to outline your story again using different numbers. Then write it here.*

? - 35 = 10

Prewriting: Use the ***felt*** *to outline your story again using yet different numbers. Then write it here.*

? - 123 = 248

Drafting: Choose one of the outlines and write a paragraph for each chapter. Then, write a question for the mystery.

For ? - 5 = 1, Their person loved the puppies so much and bought them a bunch of chew toys. But the puppies were so hyper, they just chewed and chewed until there was only one chew toy left. Their person was just happy that the puppies were happy and bought them more toys. How many toys did the puppies have at the beginning?

Revising: Check that your story makes sense, solve the mystery and explain it in a complete sentence; add detail, action, dialogue, precise and vivid language, etc.

Editing and Publishing: Check spelling and punctuation. Draw a picture.