

Making a Mark for Math

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Introduction

This year I was moved from my 16-year position as Second Grade Teacher to teaching First Grade. It turned my world a bit upside down and wiped out my previous DTI unit idea as I will explain in greater detail in my Rationale. This required rethinking my plans. Fortunately, after multiple contacts with my seminar coordinator regarding my dilemma and concerns about teaching a lower grade, the act of putting my worries to paper finally started some writing juices flowing. My declaration that I had no idea how I was “supposed to teach them something about text and graphic features (my original unit basis) when they couldn’t even put their names on their papers” was in fact the genesis of this unit.

Promptly after writing those words I began to think about the story “The Name Jar” by Yangsook Choi that I read my students each year. In the story a young Korean girl struggles to find an American name for herself when the students can’t pronounce her given name, but finds strength in the name stamp given to her by her grandmother to recall her heritage. In the end the name stamp helps her to maintain her identity and make new friends.

I’ve always focused on the need for inclusion and building community when sharing this story but suddenly the very basic idea of identity being conveyed through a simple, personalized stamp or “mark” took on new importance. I began to wonder what my first graders might be able to create that would allow them to take ownership of their work in a more symbolic way than just their name.

Realizing the importance of symbolic representations of numbers in daily math activities further shifted the focus of my unit. While I want students to explore ways to represent themselves in a way that can carry across work formats and create a sense of accomplishment, I want them to do this by increasing their understanding of visual representations of numerical concepts. After studying the history of numeral systems, they will have the opportunity to blend new math understanding and the latest technology to create a usable, meaningful tool for representing themselves.

Demographics

Population

I teach first grade at Keene Elementary school in the Christina School District. Christina has historically been the largest district and is actually spread out between the City of Wilmington, Suburban Newark, and the nearby region of Bear.

Our school is considered a Title 1 school and over 70% of our students receive free or reduced lunch. The majority of our students come from non-traditional households. Many of our families have a single parent or another relative (grandparents, aunt or uncle, older sibling) as the care provider. It is not unusual for a family to have transportation and technology issues. We also have a large population of English Language Learners from a variety of regions and cultures: Asian, Hispanic, Middle Eastern and the Caribbean. These circumstances are not particularly unusual for many schools as typical urban difficulties have become more widespread. Despite these challenges, Keene is a close-knit family. We are continuously working on building community through Restorative practices and Positive Behavior Support programs.

There are significant behavioral issues across the grade level and I have multiple students on the autism spectrum in my classroom. I am dual certified, so I have Special Education students assigned to my room. These students' IEPs range from Speech Therapy only, to Occupational Therapy, Learning Disabilities, Autism, and Severe Oppositional Disorders. There are also children with 504 Plans for Attention Deficit Disorder. I do have a full time Special Education teacher who comes in every other day and a para professional on the interim days. We find ways to motivate and engage these students by providing as many hands-on opportunities as possible. Using a Project-based approach to content helps keep the students vested in their own learning.

Location

William B. Keene Elementary School is located in a region known as "Bear" in New Castle County, Delaware. The school address is technically "Newark, Delaware" but our location is far from the bustling college town of that name. Despite the school's proximity to some of its feeder neighborhoods, its location between a major highway, and a strip of woods, means that all students are either bus riders, or car riders, not walkers. This corridor of the highway has a very transient population and many of our students come and go throughout the K-5 grade span of the school.

Neighbors

In the last few years we have had multiple homicides in the neighborhoods immediately adjacent to the school, including one near a bus stop as students were being dropped off. It is not unusual for us to experience security lockdowns due to other local crimes including bank and pharmacy robberies. Our location is also next to the Troop Two State Police Barracks, which is a mixed blessing. We have the benefit of quick security response but proximity to the comings and goings of criminals.

Last year we were directly impacted by the tragic murder of a Troop 2 officer in the middle of the day, at a convenience store just up the road from the school and next to our students' neighborhoods. We were on lockdown for the remainder of the school day while the perpetrator was located and eventually killed in a drawn-out standoff at his home in another community. Our students were deeply saddened by these events. We created cards of condolence for the family and the other officers, and our entire school walked over to Troop 2 in tribute to the fallen officer, and all the First Responders that regularly risk their lives. Other vigils and ceremonies took place there over time. Our students were acutely aware of the gravity of the situation but also newly concerned about their personal safety and that of their loved ones. This school year we have already had 3 lockdowns lasting a few hours each. These events are indicative of the overall uncertainty with which our students live daily.

Our school strives to provide a safe haven. Using a variety of instructional strategies and motivating units of study helps keep our challenged population engaged and excited about coming to school.

Rationale

While I have almost 30 years of teaching experience in Middle and Elementary schools, the last 16 years I have taught second grade at Keene Elementary school in the Christina School District. Second graders are full of curiosity and are typically motivated to learn. I have found my students to be capable of much higher levels of learning when they are presented with novel concepts tied to their everyday experiences. They become even more inquisitive and will actively explore additional related topics. Our administration is very supportive when it comes to incorporating varied educational opportunities. My first two DTI units were developed within these conditions, but this year, things have changed.

State level cuts to the Education Budget impacted all the districts throughout the state. Our district, along with others, had to make personnel cuts that included classroom teachers. While the cuts directly affect teachers with less seniority who lose their classrooms or jobs, all other teachers feel it indirectly as class sizes must increase, and some teachers are moved to fill the vacancies. Increased class sizes mean fewer teachers at each grade level which also necessitates teacher movement between grade levels. The districts really held out hope that the state would come up with some other way to save money but unfortunately that never happened.

At the beginning of this school year I found myself dealing with the reality of being involuntarily assigned to teach 1st Grade. While that may seem like a small shift, moving from 2nd to 1st, the reality is that it is a whole new ball game. While it is the same basic reading curriculum, there are new skills and themes. The focus for reading is on decoding

and building fluency so there is minimal content in the anthology stories. There are new science kits or social studies units but no time to train in them. For math, the entire district has adopted a completely new curriculum that they presented to us on our first day back, that has two separate complete programs and a plethora of new routines and materials. “Overwhelming” is an understatement.

Having created two previous units which seemed to be easily scaled up or down, I couldn't understand why I couldn't adapt. I think the difference is my having to do the adaptation versus someone familiar with the grade level making the adjustments.

Fortunately, seminar is how all that began to change. The professional communities of Delaware Teacher Institute and Yale National Initiative provide opportunities to build background knowledge, discuss “what ifs” and encourage us to dive under frustration to rediscover our innovative selves. The support of other DTI fellows led me to greater exploration of my students and classroom.

I had been running simultaneous discourse with Bobby Graham, another DTI fellow and DTI Steering Committee member, trying to come up with new unit ideas. Bobby also happens to be the art teacher at my school and we have collaborated on multiple units. This year Bobby wrote a Donors Choose Grant and was funded for a 3-D printer. He immediately offered to use the printer to turn the students' symbols that they would create for the unit, into actual stamps that they could use in art class and elsewhere to “sign” their work. He ordered special materials and we have been working on some prototypes.

I had planned on my unit being cross curricular like my previous units because I have found that students tend to build much stronger connections when immersed in content. I started out doing research on personalized graphic seals (Sigillography) and the vast cultural usages and history. Whole tomes in the libraries of universities are dedicated to the collection and categorizing of seals. Much information and incredible artifacts are available to anyone wishing to follow that vein. Trying to compile that information into something that was digestible and meaningful for my first graders had me once again feeling overwhelmed. It wasn't a good fit. Colette Gaiter, my seminar leader, kindly suggested that maybe the unit would be more effective if it in fact just focused on the mathematical concepts. While I still incorporate literature in the lessons, they are only as representation of the mathematical concepts, not separate reading comprehension goals. I felt that there was still room for history and geography but as they relate to number systems.

We often talk about children needing to be literate, but rarely do we talk about their mathematical understanding as their being numerate. Google “define numeracy” and the variety of responses includes dictionary sites but also many educational sites, as well. Our data driven society is in desperate need of numeracy, the ability to reason with and

utilize numbers in daily decision making. There has been a world-wide movement to increase numeracy since the turn of the century. The increased availability of numerically represented information through social and news media has made the need for numeracy even more imperative, especially given recent national and international events. While we have always known that words have power, this last year in politics has shown us the power of numbers when used to persuade the masses.

Content Objectives

Background

If we were to look at the history of numeral systems, we would discover the progression of symbolism in the representation of numbers. In his book, *The Universal History of Numbers: From Prehistory to the Invention of the Computer*, Georges Ifrah details the complex history of our use of various systems as they occurred often simultaneously across the globe. It takes us through the earliest recorded counting systems such as tally sticks that are twenty to thirty thousand years old, using hand counting, knotted strings and pebbles.¹ Another informative read is *The History of Counting* by Denise Schmandt-Besserat which is a picture book that is written at a late elementary level but could still be shared in part with younger students, and maintains high content for upper levels, too. This book is particularly useful in illustrating ways of counting in other cultures that do not follow the Arabic number system we tend to perceive as universal². I believe we can set the stage for more thoughtful interactions with numerals by challenging students' existing numeric understanding

One immediately helpful resource suggested by another fellow in my seminar was *The Joy of X^3* by Steven Strogatz. Written as a compilation and extension of a math series the author had done for the *New York Times*, the novel's intention is to make math concepts less elusive for the general population. Strogatz covers mathematical concepts from emerging numeracy to collegiate complexity.⁴ In the second chapter the author shares the work of Paul Lockhart in *A Mathematician's Lament* where the emphasis is on looking at numbers as concrete objects, specifically as rocks. There are many numeric representations that are suddenly much clearer when represented by the rocks. A specific example is the squaring of numbers when one observes that rocks for those numbers can form actual (2x2, 3x3) whereas other numbers do not.⁵

With second graders, I always felt that the concepts of odd and even numbers were easily taught through the concept of "fair share" but my first graders are not quite there yet. They are too quick to want to "break the cookies to share" at this stage (fast forward to fractions!) Strogatz illustrates Lockhart's thinking with creating rectangles, or two even rows with the rocks. The numbers that can create the rectangle are all even while the one with the little bit of extra rock are the odd numbers. It further shows that combining the two sets with "an extra rock" results in a complete rectangle (odd + odd = even).⁶

This act of concretely representing numbers is very much at the heart of the new math program adopted by our school district this year. It is actually two programs in one. The first is *Bridges in Mathematics*, and the second is *Number Corner*, published by The Math Learning Center of Salem, Oregon.⁷ Both programs are heavily based on manipulatives and visuals throughout the elementary curriculum. The programs are still very new to us and require significant amounts of teacher preparation for each lesson. We tend to refer to *Number Corner* as Calendar Math on steroids. Each month the calendar has a new set of “markers” which are the date cards that display visual representations of numeric concepts.

September starts off predictably enough with one-to-one correspondence between the date and the number represented. The numbers are represented by images of popsicle sticks, tally marks, and ten frame dots, in a repeating pattern. These images are in keeping with counting techniques used throughout the first-grade program. Students make predictions about each marker prior to it being revealed based on the patterns they observed from the calendar so far. While September is fairly straightforward, students are immediately challenged in October where there is no longer one-to-one correspondence to the date. Instead, students must make observations about the objects each day in comparison to what has come before. Their thinking reflects their learning from September, while adapting to the new patterns. It is important to note that there is a high level of frustration as they initially use the previous patterns to make their predictions for the new markers, only to find disconnect. The program forces them to try to look for new patterns. We were introduced to the October calendar in a training session and experienced the surprise and frustration first hand and it was very helpful to share that experience with my students. I was able to tell them that the new markers did create discomfort in my thinking and I had to think about it a lot and often wait for additional markers for things to be clearer. This idea of representing numeracy visually pushes the boundaries.

There are many components to the *Number Corner* program that help the patterns become more obvious, such as creating number trees and written equations (Spoiler: October pattern grows by 1). One of the other components in October is a graph created from random selection of pattern blocks from a mystery bag. As previously stated, there is a ton of prep involved with all of these lessons, so in our training we were looking for any possible shortcuts. Rather than create paper pattern shapes to stick onto the graph we wanted to just stick the actual foam or plastic pattern blocks onto the graph. It was explained to us that the importance of using the paper cut outs in addition to the actual pattern blocks was to help students practice the transfer of physical data into visual representations of that data.

This was a huge light bulb moment for me. It makes the extra steps of creating the cut-outs worthwhile because I could see the importance and need to distinguish between

actual and visual representations. There is no doubt that this was a missing piece of emphasis in our previous curriculum. I got to see firsthand how important this concept is when I recently assessed my students on some basic word problems. They had been confidently representing number sentences on their whiteboards based on ten frame dots, dominoes, and other examples. They could give me addition sentences using pictures of ten frames or dominoes and actual math equations. The assessment gives them a word problem about dogs at a park and some more joining them, and asks them to show their math using pictures, numbers, or words.

My previously confident students fell apart because they didn't know how to draw the dogs or the park. They missed the idea of using those other symbols to represent other objects or numbers. In *The Joy of X*, Strogatz talks about a *Sesame Street* video where the character learns to represent the same lunch order by multiplying other characters by a number instead of just repeating the order over and over. He explains that is a great revelation in the ease and use of numbers, but immediate complexity follows when one realizes that the number 6 is an abstraction that can be applied to anything, not just a lunch order.⁸ I realized that this is the exact problem my students had encountered. They had tied their learning to the visual cues used, without transferring to the greater concept of the numbers. Clearly, I have work to do with that.

On October 7, 2005 I participated in a District professional development workshop with Greg Tang, author of award-winning children's books about math (Listed in Resources). I know the date because I took detailed notes and kept them. It was the fall of my fifth year teaching elementary math and his suggestions were simple and fresh. I specifically quoted him in my notes as saying, "The whole game in math is not teaching them to count – its teaching them *not* to count."⁹ That was my first exposure to teaching the concept of subitizing, or number recognition by pattern versus counting. It made so much sense particularly as he modeled each idea. He brought with him some math card games he had created to practice the concepts along with copies of his books and I purchased several. I still use his one card game, *Numskill*¹⁰ in my math centers but have gone beyond that as I will explain later in the next section. Greg Tang is still presenting, writing and creating and I highly recommend a visit to his website to explore his many materials and interactive games for children. He has partnered with Houghton Mifflin on a math series, as well.¹¹

Teaching Strategies

In my classroom everything is labeled numerically. My vast library is categorized and kept in bins by a corresponding numeric label. Cubbies, mailboxes, textbooks are all numbered and my students are numbered, too. These systems help reinforce numeric concepts daily by students ordering groups, storing materials, and paying attention to

sequence. I often use their class numbers during transitions for lining up, forming groups, and so on. (“If your number is greater than 10 and less than 25, line up”) I reassure parents in the beginning of the year that the students aren’t relegated to a number without regard to their individual personalities, and I still call children by their names, as well. There is great power in using their assigned number, particularly when grading work objectively, etc. My hope was for them to find a way to incorporate their class number with their name symbol to create their “mark” or seal. Behind this somewhat simplistic end product will be lessons in the significance of visual imagery in building numerical understanding.

Identity through numeric representation is also something I typically explore during our 100th Day Celebration activities. We do an activity where students identify 10 items from 10 categories that represent them. I thought that this idea could be explored as it relates to their class number. The trick is that most “Math about Me” or “Numbers about Me” activities involve students selecting either a favorite number and finding ways to represent it or by representing multiple numbers that relate to them (#number of siblings, how many teeth lost, etc.). For my purposes I want students to use a number that is assigned to them and find ways to show how it applies to them personally. This is a bit of a challenge given that we start at the number 1. I will need to encourage them to consider different things that the number could represent for them. I will also have to discourage associations based on number rankings since just last week I overheard one of my students reciting some rhyme regarding “first is the worst, second is the best...” which I quickly squashed.

Our District writing curriculum is *Explorations in Nonfiction Writing*. It includes a strategy known as “R.A.N.” which stands for Reading and Analyzing Nonfiction. The authors reimagined the standard KWL chart and came up with a new graphic organizer called the R.A.N. Chart.¹² This is the fifth year I have used this chart in my classroom for a variety of topics. I often use it in conjunction with Social Studies and Science content. One of the major distinctions of this graphic organizer is its categorization of “What we think we know” details, into either “Confirmed”, or “Misconception” so students can recognize when they have made adjustments to their schema. Finally, the strategy has students identify “New Learning” and “New Questions” which is a crucial component of a Project-based approach.¹³ As has definitely been the case with my own research for this unit, when students think about how the new information impacts their understanding it sparks the desire to know more. The resulting chain reaction engages students in ownership of and direction for their own learning, a key component in developing life-long learners.

Activities

Lesson - Developing the R.A.N Chart

Have a group discussion regarding where the students think our numbers and counting systems originated. Ask them why they think we count as we do or use numerals to represent other things. Record their thoughts under “What we think we know”. Add to the chart throughout the Unit, having students discuss their thinking.

Lesson - Read Aloud

Read aloud *The History of Counting* by Denise Schmandt-Besserat

Essential Questions:

1. What new information does the story present regarding numeral systems?
2. How does this new information expand our thinking about numbers?
3. What new questions do we have?

EQ 1) Have students utilize Turn and Talk with an Elbow Buddy prior to sharing their partner’s thoughts with the class. This is the best gauge of whether the students have grasped the intended lesson content prior to proceeding to writing on the chart

EQ 2) Utilize either a Reading Journal or a Project Journal for recording their written response regarding their expanded thinking

EQ 3) Students share their responses in small groups to determine new questions they may have.

Lesson – Math Stories

Additional math picture books such as the Greg Tang books, and others, should be shared and their numeric representations discussed. It is important to have students critically analyze if their numeric understanding is increased by the representations used within the book. Can students generate math equations to represent the wording in the story. This is an expected skill, as well as eventually creating their own math stories. It also serves to strengthen students’ ability to “show their work” using pictures, numbers and words.

Lesson - World Geography

Following the reading of *The History of Counting*, have students locate and mark the various regions identified on a world map. As you continue to learn about other number systems, you can add to the map. I recommend using physical maps in addition to Smart documents so that the information is always on display. Using colored dot stickers is an easy way to categorize the map locations.

Lesson – Numbers through History

Create a timeline of number systems complete with pictures, or models, and descriptions. Particularly as you study written number systems, students can add examples either through posters or a class reference book. It would be important to point out that some of the systems were developed contemporaneously.

Essential Questions:

1. What number systems existed in ancient times?
2. Which systems overlapped in timing?
3. What systems are still in use during current times?

EQ 1) Begin a timeline of ancient number systems using both pictures and words.

EQ 2) Discuss systems that overlapped in timeframe, compare them regionally, as well.

EQ 3) Discuss why some of the ancient systems are still in use/

Lesson – Math Tool Production

Students will create a variety of math tools starting with tally sticks, then working on pebble counters, clay counters, number strings and such. Much like the way we look at the benefits and drawbacks of nonstandard and standard measurement techniques, we can discuss what made different counting systems more, or less, effective for various uses. These activities can also occur during art class which will allow for the use of a wider variety of materials, such as using actual clay to make counters as they did in ancient times.

Essential Questions:

1. What tools were necessary for each counting system?
2. Who needed to use this system and when?
3. What are the pros/cons of the system?

EQ 1) Have students identify needed materials and create the various math tools

EQ 2) Small group discussions can provide the context for each system while they are creating the tool

EQ 3) Students will practice using the math tools for different scenarios to determine the useful applications for the various types. This is a prime time to discuss the efficiency of the symbols that are selected to represent the numerical concepts.

Lesson – Math about Me

Students explore what numbers or numerals represent about themselves. Do they have favorite numbers, and if so why? Are the quantities that are meaningful about themselves or is there something about a particular numeral that appeals to them. They do not need to directly associate these numbers or numerals with their assigned class number, that will be reserved for the next activity.

Culminating Activity

Lesson – Making a Mark

Have students select one of the numeral systems to represent their assigned class number. They will then use their selected method to create a picture version of their number. Using either graph paper, drawing paper, or a design program in the art room, the students will develop a design that will be translated into an actual stamp using a 3-D printer. The designs can be created on a larger scale then reduced to create a small stamp. They may choose to use Roman Numerals or a picture of a “bone” or stick with tally marks, a picture of body part counting (feet and hands for #20), or any of the visual representations they have learned through the math curriculum.

Read Aloud Resources

Math Fables by Greg Tang
Math for All Seasons by Greg Tang
The Grapes of Math by Greg Tang
Ten Flashing Fireflies by Philemon Sturges
Ten, Nine, Eight by Molly Bang
Ten Black Dots by Donald Crews
Goodnight, Numbers by Danica McKellar
Domino Addition by Lynette Long
One Is a Snail, Ten is a Crab: A Counting by Feet Book by April Pulley Sayre and Jeff Sayre

Appendix

Implementing District Standards

Operations and Algebraic Thinking

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

While these math standards start at Kindergarten level, it is to create a sound foundation for understanding numeral systems. They are appropriate for beginning First grade instruction as well as Math Intervention instruction for students that are working below

grade level. As they progress to the First-grade standards it would include the ability to represent math stories or word problems.

CCSS.Math.Content.K.OA. A.1

Represent addition and subtraction with objects, fingers, mental images, drawings¹, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

CCSS.Math.Content.K.OA. A.2

Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

Represent and solve problems involving addition and subtraction.

CCSS.Math.Content.1.OA.A.1

Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.¹

CCSS.Math.Content.1.OA.A.2

Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

The students learning of the history of counting systems and tracking the time and place of those systems are clearly based in historical analysis.

History Anchor Standard Two: Students will gather, examine, and analyze historical data [Analysis] K-3a: Students will use artifacts and documents to gather information about the past

¹ Georges Ifrah, *The Universal History of Numbers: From Prehistory to the Invention of the Computer*, Introduction

² Denise Schmandt-Besserat, *The History of Counting*

³ Steven Strogatz, *The Joy of X*

⁴ Steven Strogatz, *The Joy of X*

⁵ Steven Strogatz, *The Joy of X*, p. 7-13

⁶ Steven Strogatz, *The Joy of X*, p. 3-5

⁷ Bridges in Mathematics Second Edition Grade 1, 2016

⁸ Steven Strogatz, *The Joy of X*

⁹ Greg Tang, 2005

¹⁰ Greg Tang, Numskill 2005

¹¹ Greg Tang, <http://gregtangmath.com>

¹² Tony Stead and Linda Hoyt, R.A.N. Chart, *Explorations in Nonfiction Writing*, Resources, 295-7

¹³ Tony Stead and Linda Hoyt, R.A.N. Strategy, *Explorations in Nonfiction Writing*, Resources 297-305

Bibliography

Frykholm, Jeff, Allyn Fisher, Michael Matassa, and Margaret Roberts. *Bridges in mathematics*. Salem, OR: The Math Learning Center, 2016.

Curriculum Guide for our Mathematics Program

Ifrah, Georges. *The universal history of numbers: from prehistory to the invention of the computer*. New York: John Wiley, 2000.

An extensive and in depth look at numbers across history. Written by a teacher who was inspired by the questions of his students. The Introduction alone is full of useful information.

"Literacy and Numeracy | Numeracy." Government of Alberta. Accessed Dec. & Jan. 2017. <https://education.alberta.ca/literacy-and-numeracy/numeracy/everyone/numeracy-support-documents/>.

Many articles related to the importance of Numeracy

Math, Greg Tang. "Greg Tang Math." Educational Math Games & Classroom Materials for Elementary Students. Accessed Nov. & dec. 2017. <http://gregtangmath.com/>.

Excellent resource for online and printable numeracy practice. Also highlights his books and games.

"Homepage." Homepage | Mathematical Association of America. Accessed Dec. & Jan. 2017. <https://www.maa.org/>.

Website for a multitude of math resources but type "Numeracy" into search box for specific articles

<http://www.peterliljedahl.com/wp-content/uploads/NR-Numeracy.pdf>.

Informative article about the importance of numeracy and its relationship to mathematics.

Number corner. Salem, OR: The Math Learning Center, 2016.

This is the second part of our new math curriculum, but it is primarily based on visual representations of the numeric concepts. It is an exciting and motivating program that really gets students to think about patterns and relationships.

Pearse, Margie, and K. M. Walton. *Teaching numeracy: 9 critical habits to ignite mathematical thinking*. Thousand Oaks, Calif: Corwin, 2011.

Excellent resource for both theory and immediate practice.

Schmandt-Besserat, Denise, and Michael Hays. *The history of counting*. New York: Morrow Junior, 2000.

A picture book that gives wonderful insight to the varied forms of counting and numeracy not only across time but also across cultures.

Stead, Tony, and Linda Hoyt. *Explorations in nonfiction writing*. Portsmouth, NH: Heinemann/Firsthand, 2011.

Writing curriculum guide. Of particular note is the creation of R.A.N. chart which is an interactive and advanced KWL chart/

Strogatz, Steven H. *The joy of x : a guided tour of math, from one to infinity*. London: Atlantic Books, 2014.

Excellent resource for illustrating diverse ways of representing numbers as discussed in the unit. Overall informative read to enhance teacher background.