Viewpoint. Finding Joy in Kindergarten Mathematics

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"I hate math" is something I used to say all the time. Ask a roomful of early childhood teachers, "Does anyone here struggle with math?," and many will immediately raise their hands. But imagine if we asked instead, "Do you struggle with reading?" No hands would go up. Why do we consider these two subjects differently? More important, as educators, how do our attitudes toward mathematics impact our students?

Research with young learners indicates that a positive attitude about math matters just as much as IQ because it enhances memory and allows children to engage in problem-solving (Chen et al. 2018). We also know that children are very sensitive to the attitudes and indirect messages teachers and other adults express about math ability (Aguirre, Mayfield-Ingram, & Martin 2013). One study found that female teachers who exhibit high math anxiety pass on their anxiety to their female students (Beilock et al. 2010). Long term, this can have serious consequences. Despite no evidence of gender-related differences in ability to do math, women are underrepresented in advanced mathematics courses and STEM fields. This is just one example of how negative attitudes toward math harm children.

Research also shows that early math skills are crucial to overall academic achievement. A large study found that children's early math abilities are strong predictors of later school success—even stronger than literacy, attention, and social and emotional skills (Duncan et al. 2007). To help all students experience success in learning math, teachers need to have not only a strong understanding of the content but also deep knowledge of multiple strategies for teaching and of common student misconceptions (Hill & Ball 2009). Teachers' aversions to or

insecurities about math can be barriers to students' gaining this necessary knowledge.

How can early childhood professionals find joy in math so they can pass on that joy to children? I offer some practical ideas learned throughout my own journey from hating to loving math.

Begin within

To spark joy in our students, we must first find it in ourselves. How do you feel about math? What experiences in your schooling have shaped these feelings? A teacher once told me, with tears in her eyes, "When I was in school, girls were not allowed to take math classes. We had to take sewing instead." Another shared, "When I first moved to the United States and could not speak English, math became my best subject. I was very proud of that. But now, with the new ways of teaching math, I feel confused and I have a difficult time admitting it and asking for help."

Here's an exercise you can try: Think of your best math- related memory. Where were you? What age? What happened, and how did you feel? Now think about your worst math-related memory. How have these experiences contributed to the way you feel about math today? Share your stories with colleagues, and listen for clues about barriers to participation in math lessons and moments that provided meaningful access to learning. How might these apply to you? How might they apply to your students?

When I think back on my formative math experiences, most are clouded with feelings of anxiety and frustration. I do, however, have a proud math-related moment that occurred in third grade, which I consider to be my best math-related memory. As a result of intense studying, I was the first student in my class to pass all of our multiplication Mad Minutes quizzes for fact families 1–12. But in fourth grade, when the calculations became more complex, my memorization skills no longer held up, and I received my first-ever F on a homework assignment. Ashamed, I tore the paper into tiny bits, flushed them down the toilet, and concluded I was just not a math person.

Many of the influential women in my life also disliked math and instead enjoyed writing. This led me to assume that math was a "boy thing" and therefore not for me. From that point on, I struggled with numbers, formulas, and shapes, always terrified of making one fateful mistake that would lead to an incorrect answer. In contrast, I excelled in my English classes because I felt comfortable learning through conversation and creativity. I also benefitted from the routine of writing rough drafts, which reduced pressure and increased my motivation to improve, as I knew I could go back and make changes later. These methods were absent from my math classes; as a result, I never grasped the concepts behind math procedures until I started again as an adult learner.

For this new learning to occur, I needed to change my beliefs and recognize that

everyone is capable of learning math, regardless of age, gender, interests, culture, or home language. I missed out as a child because of unintended exclusionary messages and math teaching methods that were a poor fit for me as an anxious student. I did not realize this until I was a kindergarten teacher, and I became determined to ensure that all of the children in my classroom have genuine opportunities to learn math. Instead of avoiding math-related workshops, I began to seek them out; I owed it to my students.

Increasing your knowledge

The surest way to find—and to pass on—joy in math is to deepen your understanding of mathematics. While teaching kindergarten, I participated in professional development provided by Erikson Institute's Early Math Collaborative, based on the organization's *Big Ideas of Early Mathematics* book (2014). It was my chance to learn the math content I had missed in my own schooling and to see what teaching and learning math look like in early childhood classrooms through lesson examples and videos of teaching and student thinking (available at earlymath.erikson.edu). With my new knowledge and the confidence that came with it, I was able to draw attention to mathematical situations that arose during play, model more mathematical language, and adjust the curriculum to better fit my students' interests. One particular memory stands out.

Five-year-old Elliott had difficulty sitting with the rest of the class during whole group time. He would wander off to stare at a fan or find light switches to flicker. A scrap of paper could entertain him for an hour. He was full of brilliant questions. But he had difficulty making friends— his curiosity was often too much for other children. Elliott had been tested for autism twice, with both assessments being inconclusive.

My new mathematics understanding inspired me to adjust the curriculum. Math was slated to be taught during a whole group lesson followed by worksheets in which children could practice applying their new math knowledge. Instead of using the worksheets, I led small groups while the rest of the children engaged in free play using math manipulatives. During this time, Elliott often chose to play with Linking Cubes. I would glance up now and then to see him deeply focused.

On Fridays, I joined the children in math play, jotting notes about their activities and asking questions to provoke their mathematical thinking. Elliott was busy making "spinners." He would take six Linking Cubes and arrange five in a plus sign, with the sixth on the bottom as a base. I decided to join him and construct a spinner of my own. Unfortunately, mine would not spin. Looking at Elliott's example, I realized I needed to leave the peg on the sixth cube pointing down for the spinner to rest on. I tried again to twirl my spinner, successful this time and amazed at Elliott's creativity. My top twirled rapidly, the red and blue cubes blending together to appear as a purple circle, and Elliott squealed with delight.

Over the course of a month, other children noticed Elliott's top making and made spinners along with him. This evolved into a gleeful game in which several

players would spin their tops at the same time to see which one could remain on the table the longest without being bumped off by the others. The tops became more and more elaborate, and all the while the children unknowingly studied force, motion, balance, and more.

When symmetry arose as a topic in our curriculum, I replaced the butterfly worksheets that were part of the curriculum with a lesson about Elliott's tops. From then on, everyone wanted to be Elliott's friend, and everyone had a deeper understanding of the math concepts that were demonstrated naturally during their spinner play.

Play with your colleagues

Another way to find the joy in mathematics is to engage in play with other educators. In my current role as a coach and professional development facilitator, I witness laughter as well as productive struggle as we launch workshops with adult learning activities. During a recent session focused on sets and sorting, 20 teachers gathered in the front of the room, each wearing only one shoe. Their other shoes were being silently sorted into three groups by one of the participants. We played What's My Rule?, focusing on the shoe attributes that defined each set. With smiles and curiosity, the teachers studied each set closely and began to share ideas based on color, shape, and style.

"Is it sandals, gym shoes, and flats?" one teacher wondered. "I thought that too, but this one isn't a sandal," another said, pointing out a black ballet flat with a decorative buckle across the front. "Maybe it has to do with the heel height?" a different teacher suggested, inspecting the bottoms of a few shoes.

Others joined in to see if the shoes in the group had similar heels. "Oh, I see! It's buckles here, laces there, and no closures over there!" exclaimed another participant.

Activities like this shoe sort are fun for adults and translate directly to early childhood classrooms; children love using their own shoes! Other activities are much more advanced, including my favorite, Shepherd's Counting, which challenges participants to make sense of a historic sheep- counting system that has number names such as yan, tan, and tethera (Hynes-Berry & Itzkowich 2009). This requires creative thinking and perseverance because it differs from the Hindu-Arabic system we know so well as adults. While teachers decode, explain, and create symbols for the unusual numbers, they appreciate the complexity of our system and how tricky it can be for a young child.

Playful experiences like this remind teachers what it feels like to be a young learner. They also allow us to exercise the Common Core standard for mathematical practice, "Make sense of problems and persevere in solving them," so that we can nurture it in our students (CCSSO & NGA 2010).

These adult learning opportunities can be brief activities at the start of staff

meetings. Our coaching team occasionally begins our time together with Which One Doesn't Belong? activities (based on the book by Christopher Danielson [2016] and available at wodb.ca). These thought-provoking puzzles feature images of four items and have multiple correct solutions as to why one item might not belong to a set. Everyone shares ideas, with a focus on explaining mathematical thinking—not right answers—which helps us cultivate growth mindsets.

As a child, I would have benefitted from a math culture like the one these adult activities embody, in which everyone participates, mistakes are expected, and there are multiple ways to approach a problem. This is similar to writing multiple rough drafts in English class, because it emphasizes the process— where learning takes place—not just the final product.

Enjoy the math in stories

Many early childhood educators may struggle with math, but most of us *love* stories. It's easy to find the joy in a book and spread that joy to our students. So why not find the math in good books too? A favorite among my kindergartners was Ellen Stoll Walsh's *Mouse Count*. After children became familiar with the story, we acted it out together. One child would play the hungry snake, 10 other children were cast as sleepy mice, and the remainder of the class acted as the audience, helping to keep track as the snake added mice to the jar. A piece of cloth in the center of our circle served as the jar, intentionally sized so that the little mice could feel the space getting tighter as the snake added more, then notice the change to less as the mice eventually escaped, a few at a time. I drew attention to mathematical ideas by modeling language such as "Look! Now there are more mice in the jar," and I asked questions such as, "What do you notice about the jar now?"

In the fall, we focused on *more* and *less*, then moved to *plus one* and *minus one*, then to different ways to compose and decompose 10. In the math center, we did a new take on the snake-and-mouse story. I added props I'd found at a dollar store: a sock for the child who was the snake to wear on one hand, 10 smooth gray rocks for mice, and a clear plastic jar just the right size to highlight the changes in number of mice. The children greatly enjoyed the continuing play of this math-rich story.

Stories are powerful because they put math in meaningful contexts. I have taught many students who can count to 100 or recite addition and subtraction facts but lack the necessary understanding behind the procedures. While manipulatives usually help if they encourage children to focus on math concepts (Willingham 2017), acting out a story can be even more powerful because it allows children to visualize and experience the way quantities relate and change. Plus, stories bring joy because they can be shared again and again.

Engage children in math games

My kindergartners loved to play Alligator—our version of the card game my grandfather called War, which as a child I happily played with him. Repeated opportunities to determine which number was larger helped me internalize the concepts of *more* and *less*, and the game context motivated me to play countless times. As the students played, they would delight as the hungry alligator snatched the card with the largest quantity. When one child, James, suggested that the alligator must have a tummy ache, the new goal became having the card with the *least* amount.

Alligator can be modified in many ways, which is important because children need to be exposed to multiple representations of numbers. Many of the teachers I work with now use cards with variations, including numeric symbols, dots, tally marks, ten frames, and fingers to represent the quantities (available at buildmathminds.com). With preschool children, we use only cards with quantities 1–5. With older students, the game can be played with multiple cards, so that children have to add up two or three cards to determine who has the most or the least. Alligator is just one example of the many common games that are mathematically powerful and can become even more so when enhanced by a teacher with strong math content knowledge.

In addition to being fun and motivating, games increase access, cooperation, practice, and learning for all children. Playing games together prompts discussions—and sometimes even passionate disagreements—where mathematical precision matters. At the same time, games are low risk. If you lose, you can just start again. Games allow for differentiation, with more advanced students guiding their peers. They also provide structure, making participation easier for dual language learners. And they can be sent home, so children can continue playing and learning with their families. Some schools even host game nights and invite parents to share math-related games from their childhoods as an opportunity to promote family learning and share cultural traditions.

Like stories, games provide math with meaningful contexts and can be enjoyed again and again. They also provide an opportunity for assessment. One year I taught a very shy student, Aaliyah. If I pulled her aside to administer an interview-based assessment, she was hesitant or would not answer at all. But if I quietly observed her playing a card game with her best friend, Naomi, I realized Aaliyah knew more than she demonstrated to me when we were alone.

Conclusion

When we think about educating children, we try to consider the whole child. When improving our professional practice, we must consider the whole teacher (Chen & McCray 2012). Like academics in kindergarten, growing our content knowledge about math is crucial. Like social and emotional skills in kindergarten, our own attitudes, beliefs, and confidence about math are equally important. So, here's a challenge I will leave with you: The next time you're out to brunch and someone jokes about being unable to calculate the tip, or the next time you're in the teachers' lounge with a colleague who is laughing off how bad she is at math,

take a step toward ending this negative cultural practice. Help others find the joy in math as you work to find it in yourself and cultivate it in your students. I hope that soon you will join me in proclaiming, “I love math!”

Browse the websites below and follow these organizations on social media for a daily dose of inspiration.

Erikson Early Math Collaborative

(earlymath.erikson.edu)—Lesson ideas, videos, summer institute, and more. Twitter: @eriksonmath

Mathematically Minded: Learn to Love Teaching Math (buildmathminds.com)—Free downloads of materials including number cards, online trainings, and more.

Twitter: @BuildMathMinds

YouCubed at Stanford University

(www.youcubed.org/open-creative-mathematics)—“Open, Creative Mathematics.” Twitter: @joboaler

Which One Doesn’t Belong? (wodb.ca)—Activities based on the book by Christopher Danielson. Twitter: @WODBMath

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