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I Heard This Great Math Story the Other Day!

IF YOU ASK CHILDREN ABOUT A MOVIE THEY LIKE, THEY WILL EAGERLY SHARE WITH YOU THE EXCITING MOMENTS, THE PLOT TWISTS, AND HOW THEY FELT ABOUT THE EXPERIENCE. ASK THE SAME CHILD “WHAT DID YOU DO IN MATH TODAY?” AND THE TYPICAL RESPONSES WILL BE: “NOTHING,” “I DON’T KNOW,” OR “FRACTIONS.”

IT WAS THE START OF THE ACADEMIC YEAR at our Faculty of Education and I was standing on the stage of our auditorium, facing 440 new elementary school teacher candidates: “How many of you love mathematics,” I asked. I counted about 15 tentative hands. Then, a sea of hands filled the auditorium as I said, “How many of you hate mathematics?”

A fear and a hate of mathematics is not uncommon, and is actually quite acceptable in our society. It’s cool to say, “Math sucks,” or “I’m not a math type.” Sometimes I feel like making such statements myself, even though I love math, just to fit in. Maybe, just maybe, the majority, speaking from personal experience, is right. We live in a democracy after all, where we value the opinions of the majority, and in a consumer society, where businesses appreciate that the customer is always right. Maybe school math (*smath*, as Bill Higginson of Queen’s University calls it – see his interview at www.edu.uwo.ca/dmp/Higginson) lacks humanity and imagination, and is just not worthy of our attention.

So what do we do about this? I think the answer lies in an innocent comment made by one of my students. To help our elementary school teacher candidates improve their image of math, we offered a math-for-teachers course, so they could re-experience doing mathematics in new ways, as a form of *math therapy* you might say. One of the teacher candidates commented on her experience by saying, “I learned that math can be discussed with your family and friends just like you would a favourite book or new movie.”

If you ask children about a movie they like, they will eagerly share with you the exciting moments, the plot twists, and how they felt about the experience. Ask the same child “What did you do in math today?” and the typical responses will be: “Nothing,” “I don’t know,” or “Fractions.”

What if we disrupt the typical meaning of *performance assessment* (which is based more on a business model than a performing arts model) and define it as this: if a student is able to discuss school math with family and friends just like one would a new movie, then that student has experienced meaningful math learning and teaching. It seems a crazy idea, I admit, because at first glance it appears that we’re equating math education with *entertainment*. However, as McKee¹ notes, we do not engage with the “story arts” simply to be entertained. “We do not wish to escape life but to find life, to use our minds in fresh, experimental ways, to flex our emotions, to enjoy, to learn, to add depth to our days.”



EN BREF Lorsqu'un élève peut discuter des mathématiques scolaires avec sa famille et ses amis comme s'il parlait d'un nouveau film, on peut dire qu'il a connu un apprentissage et un enseignement significatifs en mathématiques, déclare George Gadanidis, membre de la Faculté d'éducation de l'Université de Western Ontario. Avec le soutien du Conseil de recherches en sciences humaines, il travaille dans des salles de classe (de la maternelle à la 8^e année), offrant aux élèves la possibilité d'exprimer leurs connaissances au moyen de mots, d'images, de matériel concret et de symboles, ainsi que par les arts de la scène, c'est-à-dire les arts dramatiques, la musique et la danse. Pour élargir l'auditoire, il a conçu un festival de mathématiques (www.mathfest.ca) où élèves et enseignants peuvent partager leurs prestations mathématiques sous forme numérique.

Using Boorstin's² analysis of what makes movies work, and paraphrasing his ideas to suit our mathematics education context, school math *works* when: (1) it helps us experience the new and the wonderful in mathematics (as big ideas); (2) it engages us with these ideas in a way that keeps surprising us (unlike a predictable plot, where we can easily guess what will happen next); (3) it provides opportunities for us to connect emotionally with our math experiences; and (4) it helps us sense mathematical beauty.³

What might these characteristics look like in a math classroom? You can see two second-grade examples, with teacher interviews and samples of student math performances, at www.edu.uwo.ca/mpc/bigideas/arrays and www.edu.uwo.ca/mpc/bigideas/bbw. Shown at right is one of the songs written and sung by the students about their experiences in finding odd numbers *hiding* in squares. The ideas in this song grew out of stories they scripted to be shared with family and friends. See also the image on the right of odd numbers hiding in a square.

With the support of the Social Sciences and Humanities Research Council, we are presently working in K-8 classrooms, researching the concept of *students as performance mathematicians*. The guiding principles of our research include the following: (1) we start with big math ideas that cut across grades; (2) where possible, we use a story context as a starting point for doing mathematics; (3) we offer students opportunities to express their knowledge in words, pictures, concrete materials and symbols, as well as through the performing arts, using drama, music and dance; (4) we help students develop skills for scripting their math stories, with a focus on incorporating Boorstin's characteristics of the new and the wonderful, surprise, emotional moments, and beauty; and. (5) we create opportunities for students to perform their ideas for a wider audience (for example, second grade students perform for older classes, who then explore the mathematics at their level of sophistication, and in turn perform their learning for the second graders).⁴

The cases shared at the two URLs listed above give a good sense of what happens in classrooms and will help you decide on the value of our approach. Principals report that teachers in the project are excited to share with their peers, and other teachers want to join the project. Teachers report that: they were initially "surprised math can be in a story or song or poem"; they get feedback from parents about kids being excited about math; "students work so well, they have ownership of their work, even those who usually struggle with math"; they were surprised that so many students get to the higher level thinking of the activities; students are "inspired by the poems, songs, skits, and say excitedly 'those are my words!'"

One day, a class of second graders were waiting in line to visit and share their math ideas with a class of eighth graders. The teacher asked for volunteers and children eagerly offered to share. One of the boys started crying.

"What's the matter?" asked the teacher.

"They made me jealous when they said they wanted to share," he sobbed.

"You weren't present when we did the activity."

"I want to share too."

"How about you and I do the activity during lunch? Then you can share in Ms. Smith's class in the afternoon."

"OK, but I'm still sad."

THE CHOCOLATE BAR SONG

Here's a square

Chocolate bar

Eat this piece

Said the Wolf

Eat some more

And some more

Here's a square

Chocolate bar

There are.....

Odd numbers hiding in squares.

Squares are cool

Cause they have

Odd numbers inside of them

1, 3, 5, 7, 9, 11

Hey Sis

Do you want to see,

Something cool.....

Odd numbers hiding in squares.



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This student had other opportunities to perform his learning: by scripting and performing personal math learning stories about other activities for his peers; by bringing materials and math stories home and sharing with parents; and by singing his class's songs about their math investigations in the school gym, in a Math Concert teachers organized for the whole school, with parents and family in the audience. A sense of audience adds excitement and energy to the teaching and learning of mathematics.

To create an even broader audience, in 2008 we started the Math Performance Festival (www.MathFest.ca), where students and teachers can share their math performances in digital form. The Festival is a celebration of mathematical imagination and it is sponsored by the Fields Institute, the Imperial Oil Foundation, the Faculty of Education at University of Western Ontario (UWO), and the Canadian Mathematical Society. The celebrity judges include Susan Aglukark, Tracy Bone, Douglas Coupland, Bob Hallett, and Jay Ingram.

To help increase our repertoire of *math worth talking about*, we have created the Windows into Elementary Mathematics project at www.fields.utoronto.ca/math/windows sponsored by the Fields Institute, where we invite prominent mathematicians to discuss topics from elementary mathematics. Each "Window" includes video clips of the mathematician, interactive content, a hand-out of activities, and a poster on the theme. The posters that accompany the Windows are available in digital form on the project website. We are considering ways of displaying the posters in public places, like libraries, subways,

and buses. The project also provides students, parents and teachers with insights into the thinking of mathematicians, and helps the public better appreciate the beauty of mathematics and mathematical ideas. Lindi Wahl (UWO), who is one of the featured mathematicians, notes that "One of the things that I really love about mathematics is that I'm creating something new all the time."

In 2004 we organized a symposium on mathematics education and we invited as one of our speakers Apostolos Doxiadis, a math prodigy who eventually gave up mathematics and became an author and a filmmaker. Doxiadis said to us that mathematics education will not change unless what counts as mathematics first changes. He said that what is missing from school mathematics is the study of the stories of doing mathematics (which he called *paramathematics*).

We believe that good math experiences and good math stories go hand-in-hand. Math worth talking about is math worth doing. As teachers, principals and curriculum writers, we need to look ahead and ask ourselves: is what we're planning for our math classrooms going to prepare students to share their math experiences with your family and friends just like they would a favourite book or new movie? If the answer is "No" then perhaps we need to rethink school math. **I**

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Notes

- 1 McKee, R. (1997). *Story – Substance, structure, style, and the principles of screenwriting*. N.Y.: Harper-Collins/Reagan Books, 4-5.
- 2 Boorstin, J. (1990). *The Hollywood Eye: What Makes Movies Work*. NY: Harper Collins Publishers.
- 3 Gadanidis, G. & Borba, M. (2008). Our lives as performance mathematicians. *For the Learning of Mathematics* 28(1), 44-51.
- 4 Gadanidis, G., Hughes, J. & Borba, M. (2008). Students as performance mathematicians. *Mathematics Teaching in the Middle School* 14(3), 168-176.

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