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# MORE THAN A QUICK FIX

## A Model for Aboriginal Mathematics Education



*“My administrator told me to bring back three good ideas,” she declared as she entered my workshop on Aboriginal Mathematics in High School. She was a secondary mathematics teacher and her need for three good ideas was sparked by a recent move within her province to include First Nation, Metis, and Inuit (FNMI) perspectives in all areas of curriculum, including mathematics. She was looking for three things she could do to enable her to check the “included the FNMI perspectives” box. But such a quick fix simply does not exist. The work of decolonizing mathematics education and learning to teach from a place of Indigenous knowledge is complex and challenging.*

### MY ROLE IN THIS WORK

I was a secondary mathematics teacher for 10 years at We'koqma'q First Nation Secondary School in Cape Breton, NS. During my time teaching in this community school, one of several Mi'kmaw Kina'matnewey<sup>1</sup> (MK) schools in Nova Scotia, I was committed to being a learner as well as a teacher. I took time to learn to speak and understand the Mi'kmaw<sup>2</sup> language and I immersed myself in the daily life of the community. I strived to make my classroom a space that honoured Mi'kmaw values, knowledge and culture. I worked relationally with my students and strived to listen and learn from them so that I could teach mathematics in ways that were more appropriate and engaging. After 10 years filled with learning from my students and the community, collaborating with teachers in other MK schools, and representing MK schools at the provincial math leaders table, I was ready to begin my doctoral studies to further pursue the questions of how to transform mathematics education to better meet the needs of Mi'kmaw students. Work I continue to do today.

### A JOURNEY TO A FRAMEWORK

When I began my doctoral program, it quickly became apparent that before I could begin working with participants to develop Mi'kmaw mathematics materials, I needed to have a greater understanding of where the conflicts were arising for Mi'kmaw students.

Using a process of *mawiknutimatimk* meaning coming together to learn together (Lunney Borden & Wagner, 2013), I worked with teachers and elders in two MK community schools over a period of one year. Through our conversations, four key areas for transformation emerged as themes:

1. The need to learn from Mi'kmaw language,
2. The importance of attending to value differences between Mi'kmaw concepts of mathematics and school-based mathematics,
3. The importance of attending to ways of learning and knowing,
4. The significance of making ethnomathematical connections for students.

These ideas created a model with meaningful personal connections for students at the centre (see Figure 1 on next page).

### LEARNING FROM LANGUAGE

Although interconnected, each of the themes can be linked to the idea of learning from language. Examining the Indigenous language of a given community context would provide a starting place for transforming mathematics teaching and learning. As one participant shared, even students who come to school speaking English are not necessarily thinking in English ways, rather they are using *Lnuitasi* (Our peoples ways of thinking). Given that the ways of thinking are embedded in Indigenous language, understanding how Indigenous languages are structured and used within the community can be highly beneficial to teachers of mathematics.

Figure 1: from Lunney Borden, 2010



It can be helpful to ask questions such as “What is the word for...?” or “Is there a word for...?” to better understand how mathematical concepts are described in the language (Lunney Borden, 2012). Gathering words that can be used to describe mathematical concepts provides insight into concepts that may be potential strengths for building a mathematics program. For example, one participant, explained “*pukwe*” is part of something but when you say *aqatiyik* that is half of it ... now if a child understood Mi’kmaq, it’d be a lot easier for them to understand.”

Similarly, awareness of mathematical concepts that have no translation in the Indigenous language exposes the taken-for-granted assumptions that are often present in existing curricula. For example, the word flat is not commonly used in the Mi’kmaq language and no simple translation can be made, yet is frequently used in math classrooms. In my doctoral work I describe a student who, when asked to say something about her cube explained that “It can sit still!” and firmly placed in on the floor rather than talking about it having a flat face. The action of sitting still is more consistent with Mi’kmaq language structures than the flatness of the face.

It is also important to understand the underlying grammar structures of the Indigenous language. My research has shown that the prevalence of nominalisation (turning processes into nouns) in mathematics stands in direct contrast to the verb-based ways of thinking inherent in the Mi’kmaq language. Indigenous languages in Canada are verb based and contain a sense of action and motion that is not inherent in the static and fixed presentations of school mathematics. For my students the simple shift from asking, “What is the slope of the line?” to asking “How is this graph changing?” enabled my students to discuss active and dynamic mathematics that honoured the sense of motion in their own language. Looking to “verbification” as an alternative may help to create a more engaging and rich curriculum for Indigenous learners (Lunney Borden, 2011).

### A QUESTION OF VALUES

Educators must also think about how mathematical ideas are used and valued in the community context. It is important to understand how



numerical and spatial reasoning emerge in the context of the community culture. This study has shown that spatial reasoning was highly valued in the community as it pertained to matters of survival. Numerical reasoning was seen as useful in play. If we consider mathematics to be about examining quantity, space and relationships (Barton, 2008) then it becomes important to build a curriculum that values these concepts in a way that is consistent with the way these concepts are valued within the culture. Too often, school mathematics values numerical or quantitative reasoning over spatial reasoning and treats number as essential for young children. This approach positions many children as incapable in mathematics even though they may have strong spatial skills.

### WAYS OF KNOWING

Language and values also influence the preferred ways of learning in any community context. A mathematics program should provide children with opportunities to be involved in learning focused on apprenticeship with time for mastery, and hands-on engagement with concrete representations of mathematical ideas. It was recommended that a mathematics program should place visual spatial learning approaches on equal footing with the already dominant linear-sequential approaches, providing more ways to learn so that more students can learn.

*visual-spatial*

### CULTURAL CONNECTIONS

In addition to community language, values, and ways of learning being included in a mathematics program, it is also essential to make meaningful and non-trivializing connections to the community cultural practices. This involves examining how the school-based mathematics can be pulled in (Doolittle, 2006) through identifying types of reasoning inherent

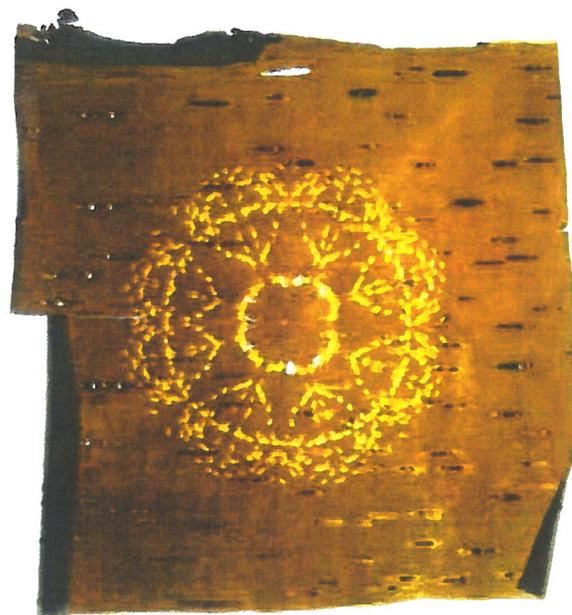


Grade 8 students making paddles at the We'koqma'q Mi'kmaw School. Photos by Kevin Redmond

in the community that can help students to make sense of the school-based mathematics. It also means creating learning experiences that help students see that mathematical reasoning is part of their everyday lives, and has been for generations. The success of Show Me Your Math<sup>3</sup>, a program that invites students to be mathematicians who investigate mathematics in their own community contexts, suggests that engaging students as researchers and authors of content is an important component of a culturally-based mathematics program. (Lunney Borden & Wagner, 2011; Wagner & Lunney Borden, 2012)

### CONCLUDING THOUGHTS

From the established framework in the model above, and from on-going work with students and their teachers and communities through the Show Me Your Math program, I have begun to develop culturally-based inquiry projects ([showmeyourmath.ca/inquiry](http://showmeyourmath.ca/inquiry)). By working collaboratively with elders and teachers, students have explored the mathematics of birch bark biting, making canoe paddles, making a hand drum, doing quill and bead work, and so on. These projects are not only helping students to see the mathematics that is inherent in their culture, they are also helping the teachers to see the value of beginning with Indigenous knowledge and pulling in the mathematics. Through such work, it is my hope, that we are moving closer to a decolonized approach to mathematics teaching.



Birch bark biting photos by Rob Smith

<sup>1</sup>Mi'kmaw Kina'matnewey is a collective of 12 Mi'kmaw communities in Nova Scotia who are part of a jurisdictional agreement for education with the federal government. MK communities boast an 88% graduation rate, nearly double the national average for Aboriginal children in Canada. For more on MK see [kinu.ca](http://kinu.ca).

<sup>2</sup>Mi'kmaw is used as an adjective, Mi'kmaq is used as a noun. The traditional territory of the Mi'kmaq, known as Mi'kma'ki, contains all of Nova Scotia, Prince Edward Island, parts of New Brunswick, Quebec in the Gaspé Region, and Maine. There are also many Mi'kmaw people living in Newfoundland and Labrador.

<sup>3</sup>See [showmeyourmath.ca](http://showmeyourmath.ca) for more on this program.

#### About the author:

Lisa Lunney Borden is an Associate Professor of Mathematics Education and Chair of the Department of Teacher Education at St. Francis Xavier University. Her research explores culturally relevant practices in mathematics. Having taught mathematics at We'koqma'q Mi'kmaw School for 10 years, she believes that learning about language, culture and ways of knowing from community members helped her to think differently about teaching mathematics. She welcomes correspondence about her work at [lborden@stfx.ca](mailto:lborden@stfx.ca).

