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Education Notes bring mathematical and educational ideas forth to the CMS readership in a manner that promotes discussion of relevant topics including research, activities, issues, and noteworthy news items. Comments, suggestions, and submissions are welcome.

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I moved to Canada when I was 18, so I am acutely aware of the learning experiences and adjustments one has to make in the education system that does not reflect your own cultural and linguistic backgrounds. To this day, my processes of learning do not always align with what is so familiar to my students. For example, the learning via “memorization by abbreviation” (FOIL, CAST, SOHCAHTOA) is a completely foreign approach to me, yet the one that many of my students will be most comfortable with. Furthermore, in my current role as a mother to a bilingual multicultural child, I am faced with various challenges when it comes to teaching my daughter. As such, cultural relevance is important to me as a person and as a teacher.

In the past four years, I have been very lucky to live and work in the community with close ties to its local First Nations people. The various resources and opportunities available have allowed me to explore the meaning behind reconciliation and indigenization and to incorporate Indigenous knowledge into my teaching. In most practical terms, indigenizing the curriculum can be through as approached in two ways: through content and through delivery. Introducing Indigenous content involves familiarizing yourself with and promoting local context and history. Indigenizing your delivery means exploring [First Peoples principles of learning](#), knowing and being.

It is encouraging to see the interest universities have been showing in Indigenizing their curriculum and the serious steps [K-12 curriculums](#) have been taking in that direction. However, practitioners often struggle to find existing resources, don't know how to establish connections (internal and external) and hence are reluctant to explore. Reconciliation is a process, it takes time and deliberate practice, so there are no easy and fast ways, no checkboxes to fill it and hence “pass” the indigenization of curriculum test. One needs to find their own approach and their own identity within this process.



But let's talk about content, it's the visible way to engage and likely an easier entry point to the process. On the surface, the introduction of genuine Indigenous content is easier done in historical and exploratory courses. But while content is easy to find, one has to be purposeful in pursuing meaningful application of it. For example, in my History of Math class, exploring development of mathematics across different civilizations, we kept coming back to oral traditions of First Nations and the use of rhetoric for mathematical problems in other cultures. A major topic in the course is different cultural approaches to learning and the functions that knowledge served within those communities. While indigenous number systems can be a vessel for introducing content, you need to find the wind and the current to carry this vessel forward.

What about service courses, where the mathematical curriculum seems to dictate the content of every class? Here is one example of a calculus problem based on local (to me) context involving the construction of [Coast Salish bentwood boxes](#): boxes that are made out of a flat cedar plank that is steamed and bent to form a box. A natural question to ask is how do we need to bend the plank to create a box of largest volume. Mathematically, it is a standard question. Contextually, students engage in this problem by exploring local traditions (what were the boxes used for?), materials (would any wood or plank do?) and crafts (how do we physically bend the wood?). The latter part emphasizes the simplifying assumptions we make to create a mathematical model: we assume that the thickness of the wood is negligible, while the craftsman carves a groove at the corners. As students generally struggle with 3-dimensional objects, this problem serves as a good opportunity for experiential learning as I ask students to construct and submit their “bentpaper” boxes together with their solution.

Students who identify with this particular application find inspiration and a sense of belonging in this project, which results in inspiring submissions.

Even in this small example it is clear that content cannot be considered without context and the indigenous approach to knowledge that requires a more thorough reevaluation of one's teaching practices to align them with First Peoples principles of learning. In any course, I emphasize the human and personal nature of mathematics as well as learning itself as a historical and cultural endeavour. I very intentionally situate all content in time and place as well as tie it to particular people and their stories. Sometimes these stories find me!

Last June, I started preparing my Calculus I for Life Sciences materials. In this class, one of the first applications I talk about is [Michaelis-Menten kinetics](#), which is a rational function model describing enzyme reactions. I like this model for a number of reasons: it has wide applications in chemistry, physiology and beyond, most of the first year students will encounter it in their chemistry classes but don't get a chance to analyze it rigorously, while fairly straightforward mathematical analysis reveals some intu-

itive chemical properties. Now, whenever I can, I always talk about people behind discoveries, and in this case it's particularly pertinent (one of the other reasons I like this model) because [Maud Menten](#) was a Canadian physician and one of the first women in Canada to obtain a medical degree. She has quite an interesting biography, had to travel outside of Canada to US and Germany because in early 1900 women couldn't do research in Canada, but she came back in the 50s and her final academic post was in BC. As I was re-reading her biography, I found a new (to me) [source with her biography](#) that includes the following info:

By the end of her life Menten was fluent in six languages, not only English, French, Italian, German and Russian, but also Halkomelem, which she learned this as a child growing up in British Columbia, Canada, as it was the language of some of her friends at school.

What a wonderful unexpected connection to the people whose land I was teaching my course on! These connections are waiting to be discovered. There's no royal road to geometry and there's no shortcuts to indigenization: it is a journey each individual has to build for themselves. But as teachers, we can offer our students a peek into other people's journeys.

In fall 2020, I taught Math for Elementary Teachers. I got very lucky: CMS organized Closing the Gap webinars and one of the presenters was [Lisa Lunney Borden](#) talking about "Math Elders Knew". The webinar was at the same time as my class, so I asked my students to join in, which they mostly all did. I could talk for a while about the wonderful insights and activities that Lisa shared, but instead I ask you to watch the video; I ensure you that you will learn a lot. What I will share is one of my student's reactions to the talk. My student, let's call her Amanda, has already graduated with Bachelor degree in Anthropology with minor in Indigenous Studies, and was taking Math for Elementary Teachers to enter the teacher education program. Amanda was both amazed and confused: in her entire Bachelor's degree no one has ever talked about mathematics as it arises in everyday lives, in art and in culture. How is it possible that cultural and social anthropology completely skipped over what Amanda now realised was an essential part of the study of humans? As educators, we need to address the gaps created by curriculum divides to create a truly universal experience for our students.

In my other role as Editor-in-Chief of *Crux Mathematicorum*, I am truly excited that this year we will be starting a new column "Explorations in Indigenous Mathematics". The column, led by Edward Doolittle, will explore cultural mathematics, allow the readers to experience the discipline through a broader humanizing approach, and engage in mathematics with societal context and history. The first column in [Crux Volume 47](#), issue 1 focuses on starblanket design, rich in culture and mathematics. *Crux* now features a new cover, designed by Indigenous artist Rebekah Brackett. Rebekah is one of the people that provided inspiration and guidance in my own journey to understand and embrace First People's principles of knowing and learning. As we were organizing Fraser Valley Math Education Sq'ep (Sq'ep meaning a meeting, gathering in Halq'eméylem), we explored the connections between math, language, art, land. With the help of Tasheena Boulter and her family, consisting of the few last fluent speakers of Halq'eméylem, we created a [counting booklet](#) featuring number words in Halq'eméylem and images of the lands of the Sto:lo people. Take a look at the booklet, explore the numbers and enjoy the views of the beautiful Fraser Valley. Let us begin to explore each other's mathematics together.

