# Legitimizing the Obscured Experiences of One Another

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The high school completion rate and socioeconomic position of Indigenous Peoples indicate that we continue to be excluded from or choose to discontinue our involvement in academic programs, and that the forces of discrimination and meritocracy still heavily influence our academic choices within the available mathematics programs. This paper demonstrates the need for continued critical conversations regarding the current instructional practices and identifies exclusive forces at work in classrooms despite sincere efforts to develop programs that help more students succeed. I explore my own experiences as a student and educator of mathematics and suggest that we mathematics educators take responsibility for the evidential educational debt rather than laying the blame at the feet of our Indigenous students. The difficulties that Indigenous students encounter are not their own; they are ours. Though fraught with hardship, it is no longer unthinkable to challenge long-held assumptions about mathematics education and provide alternatives to the Platonist, Euro-American mathematical thinking that has usurped conversations for so long. In providing instruction of a wider breadth, we can journey toward a student population that is more interested in participating in our instructional programs. Thankfully, the work has already

begun by educators and researchers who act as beacons of light as we familiarize ourselves with the needs of our students and consider new directions for our practices.

Our students deserve
a real chance
        to discover the subject of mathematics.
Our history demands
that the legitimacy of mathematics
employed by Indigenous Peoples
        be recognized,
that the        activities,
        thinking, and
        practices
        of Indigenous Peoples
                be valued,
and that we participate in
        conversations about
        mathematics
        with Indigenous Peoples
                that are wholly dedicated to
                Indigenous Peoples
                without subjecting them to a colonial
                educator's transformative lens.

## A Call for Action

Tensions seem to have mounted here in Alberta; complexity defines the various arguments that I've heard that defend the perceived economic prosperity of Albertans and those of recent economic reports that submit that Albertans are being condemned to unskilled positions, low-wage jobs, poverty, struggle and the dredges of society. There is now evidentiary support for the claims that many Albertans have become dependent on social programs, government assistance, second jobs and payday loans (Cloutier 1997; Howe 2013). In particular, Indigenous Peoples experience reportedly lower rates of obtaining their high school diplomas when compared to non-Indigenous people at a cost to Alberta of over a quarter of a trillion dollars (Howe 2013). While the education provided to me has evidentially fallen short of successful for many students and others in the province of Alberta, I feel it is not necessary to lay the blame at the feet of those in need or to continue the cycles of meritocracy, poverty and structural violence (Cloutier 1997; Howe 2013). Howe's (2013) report implies that our educational institutions subject Indigenous Peoples to learning programs that fail to address their needs. It seems to me that students, parents, community members and, quite frankly, the economy, deserve better from all those interested in the welfare of Albertans.

Admittedly, many students, like myself, find success during their 12 years spent in traditionally structured classrooms that choose to adopt Euro-American programming and participate in the practices of decontextualization and meritocracy (Aikenhead 2017; Cloutier 1997). I'm afraid that my personal success and positive educational experiences have clouded my perception. Have I been so blinded to the wider mathematical experience? Have I been a poor witness to students having difficulties? Have the educational institutions I've participated in really failed to make room for Indigenous Peoples? Might I consider carving out the room needed to explore Indigenous mathematizing in my classroom given the amassing evidence demonstrating the failures of traditional Euro-American programming? Is programming that is restorative and regenerative of Indigenous cultural identity and cultural communities necessary, and, if so, is it accessible? Do I need to familiarize myself with Indigenous culture, history and current events in light of Howe's (2014) report and the Truth and Reconciliation Commission of Canada 2015 report? How can I participate in regenerative educational experiences with all my students? What might regenerative educational experiences look like? These questions now permeate my being and have sparked a personal search for identity. As someone of Métis descent, I feel responsible and can offer no concrete solutions, instead suggesting that we must take heed. For in my experience, there are no ultimate authorities nor are there any "legitimate" Indigenous resources that might finally satisfy the need for participation in the mathematizing of Indigenous cultures. Yet, all our students will benefit when we explore and participate in Indigenous communities of mathematics.

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## A Developing Practice

My own practice stems from years of studying formal mathematics. Beginning at home, my dad handed me a measuring tape and asked me to measure and cut boards to various lengths; together we built everything from pens and sheds to stairs and decks.

My first memorable academic success occurred in Grade 9 when my teacher claimed I would likely be unsuccessful in mathematics. My 12-year-old self disagreed, tackling difficult problems, suggesting various solutions and completing the course with a recommendation for the academic stream from the same teacher. I encountered classical mathematical streams while attending the University of Alberta such as geometry, calculus, statistics and algebra as well as less practised mathematical streams rarely found in high school mathematics such as combinatorics, ring theory and group theory. While largely successful, my interest in mathematics was brought to a swift close by the fields of complex variables and tensor analysis until I was able to explore these fields in a more visual manner. At the time, I was told that the complex field holds no similarities to the real numbers and that constructed proofs required memorization of procedure and analysis of code-like mathematical scripture. My later explorations of the complex field revealed many similarities to vector multiplication and rotation, but to this day I have been unable to imagine tensor analysis in everyday terms, a fact I attribute to the algorithmic pedagogy and rote procedural learning favoured by my instructors in the place of sense-making.

While some of my students find success in class through algorithm and memorization, many find success through alternative activities that more completely reflect the field of mathematics. For example, to find a set of multiples of two you can choose to multiply a set of individual numbers by two. This results in pieces of memorabilia highly valued in inclusive education and often the focus of individualized educational plans in my own practice despite my own efforts (personal communication, January 24, 2018). Alternatively, thinking about multiplication in the real numbers as a mapping or an elastic-like stretching of the entire line by various amounts allows one to apply the metaphor to the multiplication of complex numbers; what was once a linear elastic becomes a latex glove stretching and rotating around the origin. Using such an interpretation, the memorization of single-, two- and three-digit multiplication problems and algorithms become noncontributory pieces of trivia like those valued by game show contestants. The years I spent convinced of the inaccessibility of various mathematical streams were impactful. Today, my classes are filled with measurement and number sense, visual and mental descriptions of various dynamic ideas, and explorations of the unknown.

## The Complexity of Mathematics Education

The results from PISA, an internationally acclaimed standardized exam, have been used as fuel for campaigns in support of a mathematics curriculum filled with "literacy, numeracy, higher standards, [and] student testing" that "just a decade ago, was the envy of the world" (Wente 2014). Similar polling projects, such as TIMSS, have been employed to create political leverage and justify authoritative educational structures "mostly at the expense of mathematics and science teachers" (Aikenhead 2017). Misinterpreted rankings become ammunition for media who proliferate the message that the content taught and pedagogy used in our educational system does not meet international standards (Rodney, Rouleau and Sinclair 2016; Chorney, Ng and Pimm 2016). In addition, private interests use the results to suggest that their own pedagogy and content are more effective in meeting these standards (Stockard et al 2018). These unquestioned assessment devices create a barrier—a "mechanical, detached, emotionless, value-free, and morally neutral" gateway into high-paying careers and other STEM programs (Aikenhead 2017, 82). In Alberta, these barriers have induced such extreme anxiety that they have chased children away streaming in tears from STEM programs (Burdess 2019). In such a way, Platonist, Euro-American mathematics is assessed at the expense of other cultural content, worldviews and students to provide a smokescreen for socially privileged families to maintain their position in the societal hierarchy (Cloutier 1997).

A more complex picture is one of Albertans who have suffered, are suffering and may continue to suffer for a long time. Cloutier (1997, 3) recalls a particularly memorable instance in a classroom that anecdotally demonstrates the conditions we have been imposing on our Indigenous youth:

> The teacher of this Grade 5 class managed the arithmetic lesson in what I thought was an unusual but at the same time familiar way. She sat at her desk and when students had a question, they were directed to bring their work up to her. This routine was broken by the teacher's disciplinary comments shouted at the students.

Another instance, a young Métis man:

> Lorne:
> I walk in with a note telling them why I had missed three days of school. [The teacher said] "Oh it's the disappearing Mr. Lorne. Was there like, a Pow

Wow in town that no one knows about? Were you drunk or passed out somewhere?"

Joe:

Is that what the teacher said?

Lorne:

Yeah, the Math teacher in front of everybody, and you know how those classes are: twenty, thirty people in a class and they're all sitting there laughing. (Cloutier 1997, 164)

Dominating themes of low self-esteem, undermined self-confidence, marginalization and powerlessness in mathematics classrooms are reproduced in programming that flagrantly disregard psychological theories of motivation and the development of youth. No student should ever feel that they can't "do anything right. [That they are] a failure at everything and [can] do nothing at all" (Cloutier 1997, 1). Memories flood back to me. The increasingly smaller class size as my classmates and I progressed through school together, the note taking from a chalkboard or words copied off a projected image on a wall and the hours of assigned problems from outdated textbooks. By the time I reached the 30-level mathematics courses, all that was left of my class was my brother, my cousin and one additional student. The education system I grew up with was driven by meritocracy (Goodman and Kaplan 2018). It created "feelings of inadequacy and low self-esteem" that shaped the future of the young adults of today (Cloutier 1997, 2; Goodman and Kaplan 2018). I, by pure coincidence, survived and flourished for years in our educational system, and it is a privilege to be sharing my story with you now. But programs that attend to the needs of the few, that our children attend from the time they are old enough, fail many students. As someone who has won the educational lottery, I acknowledge my survivors' privilege.

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Conditions have not improved for many in Alberta since Hagey, McBride and Larocque (1989) published results demonstrating that 37 per cent of First Nations youth choose to end their academic careers in junior high (Cloutier 1997). In 2006, measures indicated that First Nations and Métis individuals ages 15–69 had obtained their high school diplomas at rates of only 48.5 per cent and 64.5 per cent, respectively, a statistic that contains "a great deal of heterogeneity" (Howe 2013, 20). Though experiencing education parallel to their non-Indigenous counterparts, young Indigenous people encounter racism, marginalization, structural violence and social destruction to such an extent that quantitatively significant differences have persisted despite decades of effort by educators to minimize differences in educational outcomes (Cloutier 1997). The experience of generations has convinced whole communities that their efforts will be unfruitful, that the time they spend in classrooms is worthless despite their struggle, and that any attempt to fight, kick and scratch from elementary to high school will be pronounced deficient.

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## Altering the Axioms

At the heart of this all, a nearly invisible "hidden agenda," a false dichotomy. It is an "elite aristocracy [fighting] for decontextualized content [sustained by] artisans and slaves" who have been convinced of the acontextual nature of mathematics that can be demonstrated through relative truths and imagined certainty (Aikenhead 2017, 89). The assumptions, limitations and restraints that cleverly disguise content as absolute and allocate authority have dictated what is and what is not valuable in our mathematics programs and disempowered those whose mathematics does not fall neatly among the subscribed axioms (Aikenhead 2017). Altering these axioms and exploring the resulting systems is reserved until late in the practice of mathematics when students of mathematics are convinced of absolutist ideologies and have spent years vigorously studying these ideologies (Aikenhead 2017). Concurrently, practitioners like myself easily mistake the popular Platonist, Euro-American ideologies as essential because of the demands that are placed on our programs through prescribed curriculums. Teachers administer "content, materials, descriptions, and representations" that favour Euro-American cultural content in the limited time available to them (Cloutier 1997, 39). The "voluminous" program of studies that teachers are responsible for delivering prevents us from engaging in cultural responsiveness; even my own mathematics classroom engages in a large

amount of decontextualization, linearity and stratification (Aikenhead 2017, 9).

The move from dominantly Euro-American mathematics programs to culturally restorative programs necessarily disrupts the notions believed by the dominant group. Among the barriers teachers face when disrupting traditional classroom pedagogies are the efforts to support students and provide scaffolding in traditional programs, which Rubel (2017, 90) asserts are "not equivalent to changing the game." Traditional mathematics programming does not provide a neutral ground but rather excuses participants from engaging in meaningful explorations because they feel uncomfortable legitimizing other ways of knowing. We rationalize our impetuous participation in traditional mathematics programming and present our own cultural knowledge as representative of mathematics because we are afraid of "[crossing boundaries and confronting fears]." In doing so, we absolve ourselves from our responsibility "to connect to [our] students' experiences" (Rubel 2017, 86). I too have fallen prey to these representations and have left, unexamined, the influence that my own activities lend while my students are building their understanding of the field of mathematics. Every time my students ask, Where's the measuring tape? or Do these correspond? or Is this right? these moments and the activities from which they have stemmed must be examined for purpose and intentionality. It may be easy to examine the impressions left by the odd questions on page 15, but it is much more difficult to do so when building a birdhouse, exploring the radioactive decay of various isotopes or sewing a ribbon dress. I must ask myself what ways of knowing I am helping students to explore.

Among their discussions, both Cloutier (1997) and Rubel (2017) share their concerns about meritocracy. Rubel argues that "teacher's views about students' mathematical capabilities play a central role in their task selection and in the mathematical opportunities they provide," and Cloutier adds that these views perpetuate "the [unequal] transfer of social and economic position from generation to generation" (Rubel 2017, 70; Cloutier 1997, 42). Meritocracy suggests that it is not the educator's responsibility to examine the barriers that exist within their current programming, it is merely a matter of effort on the students' part (Goodman and Kaplan 2018). The teacher can then "act as a missionary" saving the students from their struggles and transforming them into successful mathematicians (Rubel 2017).

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Teachers play superhero everyday and choose who needs their attention and who doesn't. I recall a scene from early in my career: I encountered a student struggling with the tasks assigned by the supervising teacher. The student's progress was much slower than the rest of the class, and the skills that the student had demonstrated during one-on-one coaching were an order of magnitude behind other students in the class. As a young professional, I was encouraged by more experienced teachers to supervise and entertain the students who had already completed the assigned tasks rather than concentrate my efforts on strengthening the mathematical processes of the student in need.

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It seemed as though it was important to these teachers that the students who were stronger mathematically be given every opportunity to become stronger, even at the expense of others in the classroom. I found myself needing to defend the choice I made to spend five minutes with this student despite the student's academic needs, which I felt were high priority. In my opinion, I should have never needed to act as a saviour, but in my experience as an educator, the gift of mathematical understanding is reserved for those students believed by educators to be capable; educators bestow mathematical understanding on those who are subjectively interpreted as having applied themselves.

According to Rubel (2017), educators must challenge the belief that effort will always result in reward, that students' experiences are largely similar to our own and that mathematics distributes power equally to all active participants. Facilitated by superficial efforts from educators, the lack of representation makes it difficult for students from marginalized populations to imagine themselves as participators in the field of mathematics. This "psychic disequilibrium" leads to crises of identity among students who begin to describe their world without consideration of their place in it and to clash with those who exercise authoritative control over those students (Rubel 2017). But this narrative is difficult to validate. Cloutier (1997) and AADAC (1991) reveal just how notoriously difficult it is to capture information from these students.

Exacerbating the problem, in Alberta, the diploma examinations and other summative assessments offer no solutions to the crisis nor do they offer any additional information. Diplomas are only written by the small percentage of students who have experienced a large degree of success within the field of mathematics. Through these examinations we gather information needed to strengthen existing curriculums, programs and lessons, but no data regarding those students whom the system has failed nor how we would address the difficulties they were experiencing prior to their exit. Our conversations here are therefore limited to the theoretical as we have not received feedback from the students we have failed. Thus, addressing the difficulties experienced within our mathematics programs could not only serve Indigenous Peoples but could improve the learning experiences of many other students as well. In the interest of servicing these missing voices, I offer a metaphor.

Ellenberg (2014) describes a wartime story of planes returning from enemy airspace. Fighter planes full of fuel, loaded with ammunition and flown by experienced pilots would return from the battlefield, or they wouldn't. Every single one of those planes was skillfully prepared for battle in anticipation of the difficult flight ahead. In much the same way, students are skillfully prepared to participate in mathematics. Yet, Indigenous students have found significantly less success as measured by the completion of their high school diplomas. Professor Wald suggested we might find additional pilots returning home if we bolster the armour of their planes in the areas observed to be most affected by the enemy fire. Like Professor Wald, I suggest that armour must be built that addresses the loss represented by the choices of young Indigenous Peoples to not continue in the field of mathematics. This armour must be neither too heavy, preventing them from successfully navigating in academic environments, nor too light, furthering the marginalization of these populations through tokenism (Ellenberg 2014).

## An Emerging Field of Study

Wiseman, Glanfield and Borden (2017) share their summary of this subfield of mathematics education. With only 195 academic and grey literature (news media and social media) sources of "Indigenous perspectives, knowledges, [and] worldviews" within the science and mathematics educational context, this subfield is in its infancy (2017, 16). The lack of longitudinal studies and in-depth policy analyses of mathematics curricula contributes to the crises faced by

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Indigenous youth. Much of the existing literature focuses "upon theoretical considerations or reflections related to program implementation" rather than demonstrating these programs in action (p 16). Their work demonstrates the difficulties encountered by teachers when implementing culturally responsive programs and pedagogy and the difficulties of access faced when teachers seek information about the original studies. In addition, Wiseman, Glanfield and Borden (2017) also illustrate that there has been little effort to include student voice as a part of these discussions. Of most interest to me was their concession that "there are very few studies which examine senior high school (Grades 10–12) levels of mathematics" (p 20).

It's not just academia that is lacking in resources. Classrooms are using the same textbooks now as I remember using in 2003. Teachers are teaching the same lessons they received from their instructors. Change is slow. As a teacher, I am tired of developing lessons at breakneck speed with no consideration for the cultural and economic impact of my lessons and delivering the same exercises as my predecessors simply because there are no other resources readily available for use in my high school mathematics courses. I often inherit my resources from other teachers, format a few small details and put them to use the very next day. The problem is heightened in semesters when I'm teaching courses I've not taught before and am scrambling to put together lessons with some semblance of organization. I imagine that beginning teachers feel similarly overwhelmed. And to pile on the problem, we've been using the same tools and technology since 1996 despite massive improvements simply because the technologies approved for the Alberta Government assessments are narrowly defined as calculators without including other technologies.

However, there is an unmistakable shift in mathematics education toward listening to the voices of First Nations, Métis and Inuit Peoples. In Canada, educators and researchers of both Indigenous and non-Indigenous descent have been busy building relationships with Indigenous populations to provide informal and formal research opportunities that prioritize the needs of Indigenous students within our education system. Wiseman, Glanfield and Borden (2017) consult a Circle of Advisors in performing a

systematic search of media outlets and academic journals. Their work highlights that current efforts to collaborate, connect and conversate have been moving away from deficit-based language, exposing foundational assumptions and forging open-ended inquiry projects. Of note are the works being produced in Indigenous communities; "Inuit, Mi'kmaq, Cree, Blackfoot, and Haida communities" have committed themselves to creating educational opportunities for their youth (2017, 15). Aikenhead (2017) examines a wide body of research across the Northern Hemisphere related to Indigenous mathematics. His publication summarizes the work occurring in British Columbia, Alaska, Hawaii, Ontario, Norway, Sweden, Atlantic Canada and Alberta.

Together, these researchers demonstrate that programs addressing the concerns of Indigenous communities are being implemented even though much of the published literature excludes detailed descriptions of these mathematics programs. Excellent exceptions stand out among the rest; a teacher of Blackfoot ancestry in Alberta invited her community to engage her Grade 9 students in explorations of the housing commitments made by the reserve's committee and discussed the tax structure and band policies in class. This same teacher collaborated with an "Elder, an archeologist, a reflective writing instructor, and a Blackfoot cultural teacher" to arrange a field trip to a sacred indigenous site" and to supervise the subsequent reflections on their visit (Aikenhead 2017, 107). The strength-based approaches demonstrated by these programs are consistent with that of Indigenous Elders and Knowledge Holders in my own educational community.

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## Engaging in Reconciliation

The pressure is enormous even for me, as one who identifies as Métis and specializes in mathematics education. I feel anxious thinking about the responsibility of seeking out Elders, facilitating culturally appropriate activities, participating in cultural exercises and advocating for alternative educational experiences. I wasn't taught that our family lifestyle was one of the Métis people of Canada; my siblings and I were simply growing up. To me, nothing was inherently special about the way of life of the people in our community. Even so, I am afraid of engaging in or being accused of cultural appropriation. There is little risk in paying for access to existing programs, adopting activities from colleagues and using tasks from my own educational experience. Using curriculum material that I am already comfortable with is much easier than building relationships with Knowledge Keepers, obtaining the required permissions and "engaging in [an] in-depth exchange of [...] people's worldviews, language-laden cognition, and values" (Aikenhead 2017). My concerns are only heightened by the risk associated with the marginalization of Indigenous students. For example, ethnomathematics suggests that "mathematics educators [should] draw upon their professional constructed forms or images [and] superimpose their mental forms or images on Indigenous group's mathematizing" thus enabling educators to claim they are "[blind] to the cultural nature of Platonist mathematics" (p 104). Aikenhead (2017) insists that these programs dilute Indigenous perspectives only to superimpose a Platonist process on Indigenous mathematizing and place these perspectives in a hierarchical relationship. Thus, ethnomathematics recognizes other culture's mathematizing as cultural, but not Euro-American mathematics.

Gutiérrez (2017) attempts to bring to consciousness the "the ways mathematics can dominate" (p 4). Her research blurs the lines between formal and informal mathematics. She encourages us to explore other knowledges and to recognize that these explorations will cause "tensions and contradictions" that require educators to act as politicians in the legitimization process. The intention, she states, is not to "make humans better or into fuller versions of themselves" but rather to "help us recognize our place in this world" (p 6). She embraces three Indigenous ways of being that resist the dominance asserted by western ideologies: In Lak'ech, Reciprocity and Nepantla. Lak'ech celebrates our unique identities while simultaneously acknowledging the similarities among us. Reciprocity enacts our need for each other; we become more than we could be individually when acting together. Nepantla carves the space reserved for exploring multiple consciences and existing "in tension long enough to birth new knowledge" (p 12).

In place of "mathematics," Gutiérrez (2017) uses "mathematx" to validate the multiplicity of the practice of mathematics and proposes that mathematics programs should be "intricately tied to what is pleasing and rewarding in a connected way" (p 12). She invites educators of mathematics to engage in political processes and intervene

meaningfully in reality. In doing so, the work of educators can imitate that of professionals who embrace such consequential undertakings as the reclamation of the historical range of bison, the investigation of the AIDS epidemic and the optimization of distance-based transit fares, among other projects (Parks Canada 2018; Parsons et al 2003; Hoshino and Beairsto 2017).

Thankfully, there are already those who have been searching for rich cultural activities that are filled with learning opportunities for students and who are sharing their methods of curriculum creation. Aikenhead (2017) suggests a process that can be used to select these activities for the classroom. First, develop a relationship with an Indigenous Knowledge Holder. Next, familiarize yourself with the alternative ways of "counting, locating, measuring, designing, playing and/or explaining" that might be encountered (Bishop 1988). Third, identify any peripheral concepts that you may have unnecessarily stripped away and in doing so acknowledge the cultural impact that your educational experience has on your own practice. And finally, teach your students in a wholistic manner and integrate cultural transparency into your lessons. In addition, familiarizing ourselves with the work of authors and researchers of Indigenous descent provides insight into the worldviews of and teaching methods advocated by Indigenous communities. Michell (2005), of Nēhîthâwâk descent, suggests teaching methods that the Woodlands Cree worldview encourages, including "sustained contact with natural environments […]; traditionally developed technologies […]; utilising Cree resource people and elders in curriculum planning, development, implementation and evaluation processes; experiential learning and hands-on activities […]; trial and error; experimentation […]; peer mentoring […]; sharing circles […]; making models; [… and] traditional games;" among others (p 38).

*Familiarize yourself with the alternative ways of "counting, locating, measuring, designing, playing and/or explaining" that might be encountered.*

## Future Direction of My Practice

Even my recent teaching assignments, paired with friends and educators of Indigenous descent, have provided little progress toward a classroom filled with diverse learning opportunities. My own efforts have thus far been limited to amending available resources, experimenting with fair assessment practices and providing spaces where my Indigenous students feel welcome. My classroom continues to lack mathematically rich cultural explorations despite my best intentions. Instead, I wade through textbooks of preconstructed material searching for instruction and assessment activities that will fulfill the requirements of the program of studies best in an effort to fill the 125 hours of study that all Grades 10–12 mathematics courses in Alberta consist of. In fact, for much of my career I have unknowingly aided in the propagation of Platonist, Euro-American mathematics by filling the hours using my lengthy experiences from the University of Alberta. I continue to provide programs disproportionately depleted of activities from Indigenous cultures without applying significant effort or recruiting aid from community members. I am likely to continue using resources that contribute to the struggle and stagnation of marginalized populations until a more complete mathematics program that accounts for Indigenous learners has been developed. As such, I find myself caught in a race against time. Valuable years pass by as educators develop contributions to the field of mathematics education, but in the meantime, the learning of my students is limited in cultural breadth to the exclusion of Indigenous populations. I feel as though my own engagement with the existing field of Indigenous mathematizing has thus far been noncontributory.

Groups that are knowledgeable in mathematics, both Euro-American and Indigenous, must work together to affect a long-term mass adoption of mathematics programming that is more reflective of the practice of mathematics. Those interested in impacting the historical narrative of Indigenous communities might begin by exploring Indigenous knowledge and mathematizing, focusing on the "counting, locating, measuring, designing, playing, and explaining" (Gutiérrez 2017, 11) of Indigenous people, the "images, artifacts, and symbols" of Indigenous communities, and the personal ways of knowing and being of Indigenous community members (Russell and Chernoff 2012, 114). I feel as though there are so many unanswered questions, so much so that educators may find it easier to adopt the mathematics programming of traditional mathematics curriculums. But for educators like me who want to do some heavy lifting, thankfully, we aren't alone. Indigenous Knowledge Holders and Elders are busy sharing their stories and history, educators are busy compiling resources, and researchers are

busy kick-starting conversations. I've found this community to be friendly and inviting. I sincerely hope that you find the same.

## References


AADAC. 1991. *How Do I Fit?* Calgary, Alta: Alberta Alcohol and Drug Abuse Commission.

Aikenhead, G S. 2017. "Enhancing School Mathematics Culturally: A Path of Reconciliation." *Canadian Journal of Science, Mathematics and Technology Education* 17, no 2: 73–140. https://doi.org/10.1080/14926156.2017.1308043 (accessed December 31, 2020).

Alberta Government. 2016. *Diploma Examination Multiyear Reports*. Alberta Government website. https://education.alberta.ca/media/3273032/diploma-multiyear-province-report-table.pdf (accessed December 31, 2020).

Bishop, A J. 1988. "The Interactions of Mathematics Education with Culture." *Cultural Dynamics* 1, no 2: 145–57, DOI:10.1177/092137408800100202.

Burdess, A. 2019. "C^3: Current Commentary by the Council." *Mathematics Council Newsletter* 37, no 2: 6. www.mathteachers.ab.ca/wp-content/uploads/2020/06/Mathematics-Council-Newsletter-Volume-37-Number-2-January-2019.pdf (accessed December 31, 2020).

Chorney, S, O Ng and D Pimm. 2016. "A Tale of Two More Metaphors: Storylines About Mathematics Education in Canadian National Media." *Canadian Journal of Science, Mathematics and Technology Education* 16, no 4: 402–18, DOI:10.1080/14926156.2016.1235746.

Cloutier, J. 1997. "Popular Theatre, Education, and Inner City Youth." Education and Research Archive website. www.dx.doi.org/10.7939/R3416T50W (accessed December 31, 2020).

Ellenberg, J. 2014. *How Not to Be Wrong: The Power of Mathematical Thinking*. New York: Penguin.

Goodman, R, and S Kaplan. 2018. "The Mantra of Meritocracy." *Stanford Social Innovation Review,* January 4. https://ssir.org/articles/entry/the_mantra_of_meritocracy (accessed December 31, 2020).

Gutiérrez, R. 2017. "Living Mathematx: Towards a Vision for the Future." Paper presented at the Synergy at the Crossroads: Future Directions for Theory, Research, and Practice," October 1, 2–26.

Hagey, N J, C McBride and G Y Larocque. 1989. *Highlights of Aboriginal Conditions, 1981–2001*. Ottawa: Finance and Professional Services, Indian and Northern Affairs Canada.

Hoshino, R, and J Beairsto. 2018. "Optimal Pricing for Distance-Based Transit Fares." Paper presented at the Innovative Applications of Artificial Intelligence Conference, February 8, 7765–770.

Howe, E. 2013. *Bridging the Aboriginal Education Gap in Alberta*. Edmonton, Alta: Rupertsland Centre for Metis Research. http://albertametis.com/wp-content/uploads/2013/08/RLI_Bridging_the_Aboriginal_Education_Gap_in_Alberta.pdf (accessed December 31, 2020).

Michell, H. 2005. "Nehithawak of Reindeer Lake, Canada: Worldview, Epistemology and Relationships with the Natural World." *The Australian Journal of Indigenous Education* 34, 33–43, DOI:10.1017/S132601110000394X.

Parks Canada. 2018. "Over a Century of Bison Conservation in Elk Island National Park." Government of Canada website. www.pc.gc.ca/en/pn-np/ab/elkisland/nature/eep-sar (accessed December 31, 2020).

Parsons, J T, P N Halkitis, R J Wolitski, C A Gómez and the Seropositive Urban Men's Study Team. 2003. "Correlates of Sexual Risk Behaviors Among HIV-Positive Men Who Have Sex with Men." *AIDS Education and Prevention* 15, no 5: 383–400.

Rodney, S, A Rouleau and N Sinclair. 2016. "A Tale of Two Metaphors: Storylines About Mathematics Education in Canadian National Media." *Canadian Journal of Science, Mathematics and Technology Education* 16, no 4: 389–401, DOI:10.1080/14926156.2016.1235747.

Rubel, L H. 2017. "Equity-Directed Instructional Practices: Beyond the Dominant Perspective." *Journal of Urban Mathematics Education* 10, no 2: 66–105.

Russell, G, and E Chernoff. 2012. "The Marginalisation of Indigenous Students Within School Mathematics and the Math Wars: Seeking Resolutions Within Ethical Spaces." *Mathematics Education Research Journal* 25, no 1: 109–27, DOI:10.1007/s13394-012-0064-1.

Stockard, J, T W Wood, C Coughlin and C Rasplica Khoury. 2018. "The Effectiveness of Direct Instruction Curricula: A Meta-Analysis of a Half Century of Research." *Review of Educational Research* 88, no 4: 479–507, DOI:10.3102/0034654317751919.

Wente, M. 2014. "Canada's Math Woes Are Adding Up." *The Globe and Mail*, March 4. www.theglobeandmail.com/opinion/canadas-math-woes-are-adding-up/article17226537/ (accessed December 31, 2020).

Wiseman, D, F Glanfield and L Lunney Borden. 2017. *How We Are Coming to Know: Ways in Which Indigenous and Non-Indigenous Ways of Knowing, Being, and Doing Might Circulate Together in Mathematics and Science Teaching and Learning.* Show Me Your Math website. http://showmeyourmath.ca/comingtoknow/report/ (accessed December 31, 2020).


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