The Australian Journal of Indigenous Education
Volume 51 | Number 2 | © The Author/s 2022 doi 10.55146/ajie.v51i2.40

Failures Indigenising school mathematics: A narrative inquiry

Stavros Georgios Stavrou and M. Shaun Murphy

Department of Educational Foundations, College of Education, University of Saskatchewan, 28 Campus Drive, Saskatoon, S7N 0X1, SK, Canada, email: stavros.stavrou@usask.ca

We use a narrative inquiry methodology to consider tensions surrounding Indigenising school mathematics. This research takes place in a Cree bilingual school in a Western Canadian prairie province conducted with three Cree elementary school teachers. We contemplate ways that: Indigenisation and notions of success in education can be Eurocentric; what is sometimes taken-up under the label of Indigenising school mathematics can be a colonial practice that is not actually Indigenising school mathematics in ways that support or coincide with teachers' cultural identities; Indigenous worldviews are still at risk of Eurocentric colonisation; and Indigenous worldviews are complete and should not be scrutinised by the Eurocentric gaze.

Keywords: narrative inquiry, school mathematics, Indigenisation, Cree

Introduction

We acknowledge that we live and work on Treaty Six Territory, traditional lands of First Nations and homeland of the Métis peoples.

My name is Stavros, and I have white-settler identity with Greek heritage on my father's side, and French and Ukrainian heritage on my mother's. I was born and raised in Saskatchewan, Canada. I currently work for the Department of Mathematics and Statistics, and in teacher education. Excerpts in this study are presented in my first-person voice.

My name is Shaun. I have white-settler identity and was born on Treaty Six Territory in Alberta. I currently work on Treaty Six Territory in Saskatchewan, in teacher education. I was Stavros's doctoral supervisor and came alongside to think with him about the experiences that shaped this article. This article is based on research that Stavros conducted during his now completed doctoral studies with three Cree elementary school teachers in a Western Canadian prairie province. His doctoral research wonder asked, "How do the experiences of Cree school teachers and a white Eurocentric mathematician shape the learning of school mathematics as we co-teach predominantly Cree children?".

His research wonder was motivated by government mandates of Indigenising Eurocentric school curriculum. We use the term "Eurocentric" and are aware that this term is a generalisation due to the vastness of Europe, but given that Canada was colonised by settlers from various European countries, this has influenced curriculum documents across Canada. Heleta (2016), in her work on higher education in South Africa, posited that curriculum at that level is "rooted in colonial, apartheid and Western worldviews and epistemological traditions … [and therefore] the curriculum remains largely Eurocentric

and continues to reinforce white and Western dominance and privilege" (p. 1). This idea of curriculum located in ideas of Western (Eurocentric) dominance is a shaping influence on Canadian provincial curriculum guides. Continuing in this direction, this article includes discussions between Stavros and the teachers surrounding Indigenising school mathematics, and the meaning around Indigenous and Eurocentric worldviews of knowledge.

The following concepts emerged from discussions in this study:

- Indigenisation and notions of success in education can be Eurocentric.
- What is sometimes taken-up under the label of Indigenising school mathematics can be a colonial practice that is not actually Indigenising school mathematics in ways that support or coincide with teachers' cultural identities.
- Indigenous worldviews of knowledge are still at risk of Eurocentric colonisation when Eurocentric worldviews seek to identify, separate, extract and categorise Indigenous knowledge into subject areas under the guise of Indigenisation.
- Indigenous worldviews of knowledge are complete and should not be scrutinised by the Eurocentric gaze. One way this can be accomplished is simply by teaching through Indigenous worldviews of storytelling as knowledge without acknowledging mathematics or viewing stories as being mathematical (or not).

Narrative inquiry and Indigenous research

We are using narrative inquiry (a Western methodology) to research alongside Indigenous participants. Plains Cree and Saulteaux scholar Maggie Kovach (2018) explained that "Indigenous research" is a broad term in which Indigenous matters are studied across many disciplinary contexts. She explained it is open to study by both Indigenous methodologies, founded on Indigenous knowledge systems, as well as Western methodologies, such as narrative inquiry. We all lead storied lives and interpret our past and imagine our futures through these stories. Connelly and Clandinin (2006) explained that narrative inquiry is a way to think of experience as story, where story is "a portal through which a person enters the world and by which their experience of the world is interpreted and made personally meaningful" (p. 477). Narrative inquiry is a framework for understanding experiences (Clandinin & Caine, 2013).

Narrative inquiry is distinct from other forms of inquiry because stories are interpreted through the commonplaces of temporality, sociality and place. Temporality means being attentive to people and events evolving through the past, present, and future. Sociality refers to the inquirer and participants' personal conditions of "feelings, hopes, desires, aesthetic reactions, and moral dispositions" (Connelly & Clandinin, 2006, p. 480), as well as the social conditions of the environment and people that shape contexts. Place means the sequence of locations where the inquiry and events under inquiry take place. A narrative inquiry includes the "simultaneous exploration of all three commonplaces" (Connelly & Clandinin, 2006, p. 479). The inquiry site of this study is a Cree bilingual school in a Western Canadian prairie province. The research participants are three nêhiyawak (Plains Cree) elementary school teachers, Miss Moore, Miss Scribe and Miss Mitchel[1], and their predominantly Cree grade 6 students. Stavros

[1] All names of participants are pseudonyms.

negotiated entry into the research site through previous work with the teachers that he was doing as a researcher and educator with the University of Saskatchewan.

Stavros met with the teachers once a week during their maths class. They co-taught mathematics to the students, and Stavros wrote field notes from his observations. After the class, he often had interview conversations with the teachers and recorded these discussions. The salient points were transcribed and then presented to the teachers at subsequent meetings to ensure their agreement with the accuracy of their voices. Stavros and the teachers negotiated how these conversations would be woven into this article.

What is Indigenisation?

The provincial Ministries of Education within the Canadian education system have initiatives of Indigenising school subjects and educational spaces, such as classrooms. Conceptions of Indigenisation are broad and varied in the K-12 and post-secondary education systems. Gaudry and Lorenz (2018) described Indigenisation to consist of three main components: Indigenous inclusion, reconciliation Indigenisation and decolonial Indigenisation.

Within these three components is a spectrum of overlapping ideas and notions provided by a number of Indigenous and non-Indigenous scholars. Indigenisation is a process of supporting pedagogies that centre Indigenous ways of knowing and being, acknowledging treaty rights that recognise Indigenous sovereignty and land stewardship, promoting and funding Indigenous language and cultural programs, understanding that Indigenous languages are essential to Indigenous worldviews and ontologies, expanding narrow conceptions of knowledge, identifying and rectifying historical and current colonial practices that have repressed Indigenous knowledges, working towards decolonising education, cultural inclusion, and reconciliation (Battiste, 2013; Battiste & Henderson, 2009; Brake, 2019; Gaudry & Lorenz, 2018; Korteweg & Russell, 2012; Kovach 2010a; Kovach, 2010b; Kuokkanen, 2008; Truth and Reconciliation Commission, 2015; Wildcat, 2001).

In the research, Stavros and the Cree elementary school teachers he worked alongside considered the meaning and practice of Indigenisation in the context of their mathematics class. The teachers shared tensions they face amidst these mandates in regards to how Indigenisation is positioned in their mathematics classroom, including the ways they negotiate their identities.

Assumptions regarding mathematics

Mathematics has been shaped by Eurocentric notions of rigour that date back to ancient Greece. For example, Plato considered mathematical objects and processes to be either sophisticated or unsophisticated by perpetuating an idea that abstract theory based on philosophical arithmetic (*arithmetica*) should be privileged over the practice of calculations (*logistica*), which he called "a vulgar and childish art" (Cajori, 1909, p. 72). Bishop (1994) said mathematics "had in colonial times, and for most people it continues to have today, the status of a culturally neutral phenomenon in the otherwise turbulent waters of education and imperialism" (p. 51). The emphasis on theory and abstractions as being scientific has embedded into Eurocentrism the expectation that mathematics ought to be universal, apolitical, disassociated from experiences and cultures, and decontextualised in order to maintain the generality that is deemed as superior (Ernest, 1994; Ferrari, 2003; Gerdes, 1996; Iseke-Barnes, 2000). However, the reality is that "mathematical ideas, like any other ideas, are humanly constructed. They have a cultural history" (Bishop, 1994, p. 52).

Furthermore, while it is mathematics practitioners who are the governing gatekeepers, the subject is framed as having impartial agency to exclude, regulating access to learning and employment, prompting anxiety, and being an inherently challenging subject to learn (Macmillan et al., 2005; Popkewitz, 2004; Stinson, 2004). Since mathematics is depicted as a universal language accessible to all, ideologies such as meritocracy ensure students are blamed for their failure due to not working hard enough. These issues are exacerbated in the context of Indigenous mathematics education since ideologies of cultural-deficits and discourses around inherent lack of engagement are often further used to justify Indigenous students' achievement levels (Stavrou & Miller, 2017).

While it is not in the scope of this paper to describe the diversity of mathematics (in terms of theory, practice, education and application), we will briefly draw attention to the ways some literature identifies the broad research and practice of cultural mathematics via the term "ethnomathematics". Bishop (1990) wrote:

> To decontextualise, in order to be able to generalise, is at the heart of Western mathematics and science; but if your culture encourages you to believe, instead, that everything belongs and exists in its relationship with everything else, then removing it from its context makes it literally meaningless. (p. 57)

This historical focus on mathematics being without context and subjectivity has given rise to the field of ethnomathematics, which contends that mathematics is not a universal abstract phenomenon. Ethnomathematics includes perspectives in mathematics and education related to social groups through the various intersections of culture, ethnicity and class, and has a political and ethical emphasis on cultural revitalisation and student achievement (Bishop, 1994; Brandt & Chernoff, 2014; d'Ambrosio, 1985; d'Ambrosio, 2001; d'Ambrosio, 2006; Gerdes, 1996; Iseke-Barnes, 2000; Macmillan et al., 2005; Powell & Frankenstein, 1997; Vithal & Skovsmose, 1997). Ernest (2016) helped us consider that mathematics, like so many aspects of life, is about doing:

> Doing is action in the real world that we all inhabit, not in some fictional space of reified concepts and knowledge. It is learned socially by participation in relationships and human communities, even if only fleetingly. In these social contexts one learns to use a range of cultural tools including the full range of communicative modes and technologies. (p. 45)

Mathematics in schools has a particular context—a context shaped by many aspects of a learner's and a teacher's life. This paper examines how mathematics teaching and learning is shaped by the school culture and the society in which it resides.

In interviews between Stavros and the Cree elementary school teachers, there were discussions regarding assumptions they have regarding mathematics learning based on their experiences. The following field note is a transcribed interview between Stavros, Miss Moore and Miss Scribe.

> Miss Moore: Students either like math or hate it, and they are very vocal about it.
>
> Miss Scribe: It's a hoop to jump through. In high school, I just learned what I could, memorised the rest, wrote the tests, and hoped that I could scrounge enough marks to pass and get it over with.
>
> Miss Moore: It is definitely a game you have to play, and I didn't play it very well. Pass a written test to show them you're smart.

> Stavros: Who is "them"?
>
> Miss Moore: Our Eurocentric education system. Sit in your desk, face the board, disconnect from your classmates, no talking, watch the teacher solve problems, do worksheets, write a test. If you pass, you're smart; if you fail, you're trapped. That's a colonial system, and it's a cold way of learning math. That's why we teach about how we are all connected. We work together. We support each other. We let students show us their talents. *Miyō-pimōhtēwin* (walking in a good way).
>
> Miss Scribe: We want students connecting with each other. We let them show us what they know by sharing stories that have math, or drawing pictures, or building things. There are other ways to be smart in math besides tests and worksheets. That's a Eurocentric idea to measure knowledge in that one narrow way.
>
> Miss Moore: The way we have to test conflicts with Indigenisation. We're asked to provide alternative ways to teach and learn, and then the system tells us to assess in one way, and the assessment never includes FNMI [First Nations, Métis, Inuit – added for clarity] content! You can't Indigenise math and then expect us to stick to worksheets and tests.

The conversation illustrated assumptions that demonstrating mathematical knowledge is conventionally prioritised through written tests. There is also the assumption that the environment of mathematics learning is rigid: face the front, do exercises, and write a test. These are the tension-filled experiences of Miss Moore and Miss Scribe when it comes to learning and doing a Eurocentric school subject.

In an interview with Miss Mitchel, she explained her view that mathematics is a Eurocentric school subject disguised by the notion of universality. She also stated that Indigenising school mathematics does not make sense to her.

> Miss Mitchel: Mathematics is definitely a Eurocentric subject, but it seems weird to attach the word "Eurocentric" to it. People just think that math is math—but I guess that's the result of the whole universality idea around it. People assume it is one common subject everywhere.
>
> Stavros: So now that we are discussing mathematics in the context of Eurocentrism, how does that influence your perspectives of Indigenisation?
>
> Miss Mitchel: I still have the same perspective. Indigenising math seems so artificial. If I am teaching students to solve an equation, how would I Indigenise that? And for what purpose? How will that help solve for x? There are many ways Indigenous knowledge includes math, but there is no Indigenous algebra that we can include with the math curriculum.

Miss Moore, Miss Scribe and Miss Mitchel agreed that Eurocentric mathematics has assumptions of universality, and they contested the ways tests and worksheets narrowly assess capability. Miss Moore and Miss Scribe argued that assessments like tests and worksheets contradict Indigenisation. Miss Mitchel questioned the use of Indigenisation in a school subject when it comes to finding ways that Indigenous knowledge includes Eurocentric topics, such as algebra.

Colonial perspectives of success

Discourses around success have shifted in Canadian contexts. Historically, success in education was the assimilation, re-socialisation and cultural genocide of Indigenous peoples through residential schools (Gallop & Bastien, 2016; Lowman & Barker, 2015; Miller, 1996; Truth and Reconciliation Commission, 2015). Policies shifted over time as Indigenous students were kept from moving beyond grade 8, with an emphasis on boys learning trades and farming, and girls learning domestic service (Barman, 2012). Despite the shift in residential school policies and practices, the notion of educational success remained the same: assimilating Indigenous students into the lower socioeconomics of Canadian society and maintaining their inequality.

Following more recent changes in attitudes, discourses of reconciliation foreground the relationships between Indigenous peoples and the Canadian government and this has led to 94 Calls to Action aimed at repairing the destruction wrought by residential schools (Truth and Reconciliation Commission, 2015). This is the impetus for Indigenisation in the Canadian education system.

Pidgeon (2008a; 2008b) explained that, while Canadian institutions generally measure academic success of their students through things such as GPA, completing courses, graduating in a timely manner, and career advancement, success for Indigenous students has the additional expectations that they maintain their cultural identity, find and apply their gifts to reach their personal aspirations, and apply their gifts in ways that give back to their Indigenous communities.

We consider these additional expectations that some Indigenous peoples face as they negotiate their cultural identities alongside notions of success in Eurocentric mathematics learning (Doolittle & Glanfield, 2007). In the context of Stavros's work with the Cree teacher participants, there are complexities around the meaning of success. During conversations with Miss Moore, she shared her issue of being judged by colonial notions of success, and her desire to achieve success on her own terms as she defines it. She felt that, in the context of learning school mathematics, the goal of Indigenisation has the goal of helping Indigenous students be successful in Eurocentric mathematics, based on Eurocentric measures of success. Nonetheless, in past conversations, Miss Moore has said that she wants to be in control of her own success stories, and hates the idea that colonial Canada always stories Indigenous women as filled with trauma and in need of saving. She repeated this in the conversation with Stavros below.

> I am a Cree woman, a daughter, a granddaughter … My life goes down the path given by the Creator. My success is based on my journey on this path, not by a Eurocentric system that told me I am successful because I got a university degree. I only spoke Cree as a child. I didn't learn English until I went to school. Canada already had a story about me once I hit the school system—that they were going to save me. Canada loves to tell their white saviour stories of rescuing reserve students and educating them. We are still seen as needing to be fixed or helped because we are full of trauma. They colonised me in certain aspects, but I am not going to let that be how I am defined as successful. No. I am not theirs. I am successful because I said so. And as far as Indigenisation is concerned, I can talk about relationships, games, shapes, space, counting, sharing as I know and understand them, but it seems to only matter if it helps learn Eurocentric mathematics and do Eurocentric assessments. It isn't allowing us to define our own success.

Miss Mitchel shared her ideas of success in regards to her own life and the lives of her students. She sees success as a personal endeavour, and not something that should be representative of her or her students' cultures. She challenged ways Indigenisation is seemingly a method of assisting students' understanding of Eurocentric mathematics.

> If we teach another perspective, like an Indigenous perspective, we still need to teach the main way. Oops, I mean the Eurocentric way. Sorry. You know what I mean. It's not like math courses in university have special questions and topics in a calculus class. Of course, I want my students to have their culture. I am proud to have mine. I am lucky to have mine because I know many of my colleagues don't have theirs. But when it comes to learning math, I want my students to try their best. Whether they are successful in it or not, whether they excel at it or take longer than others to move forward, whether they love it or hate it … I want that to be on their own terms, not something that gets attributed to their cultural identity. Not all of them will go to university and unfortunately that means they will be defined in Canada's system as less successful, especially because Indigenous students are expected to push hard to represent all Indigenous people, which is ridiculous. What we can or can't do, who we are, what we become, should be based on our own identities and should be independent of having to represent all Indigenous people. As a mathematician, do you think you are representing all non-Indigenous people? All Greek people? I am good at math, and I loved math and science in school and university, and I was great at it. My parents wanted me to be a doctor or lawyer because my whole family went to university and became professionals so that's how I was raised. But I want my choices, successes and failures to be about me, not about my culture. I want that for my students, too, and I see how Indigenising math works against that in some ways.

Miss Moore and Miss Mitchel shared their desires to be in charge of their own stories of success. Miss Moore explained her anger at the ways her success is defined in colonial Canada in terms of being a trauma-filled Indigenous woman in need of saving. Miss Mitchel shared her tensions at having her success attributed to her culture, rather than her own achievements. She argued that her students' success in mathematics also should not have to be something that represents their cultures.

Indigenisation in Stavros's work

Stavros's research wonder considers the ways his experiences (as a white Euro-Western mathematician) and the experiences of Miss Moore, Miss Scribe and Miss Mitchel (as Cree elementary school teachers) shape the teaching of school mathematics. Their work of co-teaching grade 6 mathematics is partially influenced by institutional directives of Indigenisation. As we laid out above, there are many tensions surrounding how Indigenisation gets taken up education, including in Stavros's work alongside the teachers.

Stavros used the term "Cree mathematizing" as a framework to describe the ways the teachers' Cree language is woven into the learning of Eurocentric school mathematics (Stavrou & Murphy, 2020). The teachers translated certain mathematical terms from English to Cree, and taught Cree phrases that described motion, positions, counting and games. The teachers also spoke in Cree to foreground ways of being in relation. We argued that this gives a partial representation of Indigenisation as a way of discussing school mathematics through the use of the teachers' Cree language and experiences in the specific context of a classroom in a Cree bilingual school in a Western Canadian prairie province. In this

context, Indigenisation is supporting the learning of Eurocentric school mathematics by evoking the uniquely diverse experiences of the teachers and students. This supports the beliefs raised in this article by Miss Moore, Miss Scribe and Miss Mitchel that Indigenising school mathematics supports Eurocentric mathematics learning.

Stavros asked Miss Moore and Miss Scribe how they see their work together in relation to Indigenisation. Miss Moore and Miss Scribe explained their position that they are teaching naturally through their experiences and linguistic knowledge without regard to Indigenisation. They stated that they express themselves in the only way they know—through familial, cultural and linguistic experiences—and this one way has no regard to how it might or might not support Indigenising in their mathematics classroom. If it does not support the conceptions of Indigenisation, they cannot change how they teach because they cannot change their way of being.

Similarly, Stavros cannot change how he has come to know himself in relation to his mathematics learning. Stavros's position is that he attends their mathematics classes with the intention of sharing his content knowledge of the subject while being upfront about his limitations due to his singular, Eurocentric mindset. Miss Moore and Miss Scribe shared their appreciation for the learning born from this classroom dynamic—including times of tension when Stavros's Eurocentric ideologies of mathematics unwittingly stifles their experiences. However, such experiences become educative, since they lead to important discussions around the meaning of how we learn and share knowledge (Dewey, 1997).

Indigenous worldviews

There are complexities surrounding the positioning of Indigenous worldviews when it comes to considerations of Eurocentric ideas of success in learning Eurocentric mathematics. Conceptualisations of success in the learning of Eurocentric mathematics might be further elucidated through considerations of Indigenous worldviews.

Indigenous worldviews, or ways of knowing and being, are embedded in collective histories, experiences and cultural values (Deer, 2013). Worldviews are told through Indigenous oral traditions and elder-guided ceremonies that are located in geographical contexts, and situated within social and ecological relationships (Battiste, 2013; Michell, 2005). The oral and cultural traditions follow protocols of doing things in a good way through relationship-centred community practices that have particular orthodoxies to be upheld (Kovach, 2010a; Kovach, 2010b). An Indigenous worldview of knowledge includes a reciprocity in learning that carries responsibility since, like fire, knowledge can create and nurture, but can also destroy (Kimmerer, 2013). The notion that knowledge sharing is reciprocal is often absent in Eurocentric worldviews, which keeps Indigenous ways of knowing from thriving (Czuy & Hogarth, 2019). There is a moral imperative to acknowledge the tensions and force dialogue between these seemingly disparate worldviews (Ermine, 2007).

Michell and colleagues (2008) gave a comparison of Indigenous and Eurocentric knowledge systems, which included the idea that Indigenous knowledges are holistic, communal, contextual, focused on natural laws and land in sustainable ways, respectful of all life, reciprocal, and nourish the learning spirit.

Sweetgrass braid: An Indigenous and Eurocentric worldview of mathematics

Czuy and Hogarth (2019) shared their need to break down the sharp edges of the Eurocentric box and mould it into a circle as a way of protesting institutional spaces where Indigenous and non-Indigenous knowledges meet. In their dialogue, Czuy questioned the universality of mathematics "by closing the eye receptive only to Eurocentric, colonial math, and understanding mathematics through relationships between humans, land, animals, spirit, and cosmos" (Czuy & Hogarth, 2019, p. 7). She illustrated beginning with Indigenous worldviews through a story-based framework represented by a cross-section of the sweetgrass braid. Czuy explained (italicised in her work):

> [This framework] always begins in the East (rising sun), by understanding math through stories with/about land and community (the first strand); for example, stories about constellation positions foretelling seasons, hunting, or harvest. Weaving in the second strand engages a personal understanding and reflection to ground these knowings; for example, star stories from childhood memories, open to all histories, experiences, and cultures. The third strand of Eurocentric mathematics is then weaved in. Each strand has equal strength, but by critically engaging with the first two strands, like closing the Western eye, equity is better created. (Czuy & Hogarth, 2019, p. 7)

That is to say, Czuy and Hogarth explained that, in an Indigenous worldview, knowledge *is* story—created through the interactions of our relationships, situated in our landscapes and occurring across time—that makes space for the weaving of a thread representing a Eurocentric worldview of mathematics.

Our interpretation of this framework is that the Eurocentric thread serves an ideological purpose of theorising Indigenisation by identifying patterns and processes in lived stories (perhaps creating patterns and processes which are not there!) and categorising it as mathematical. We wonder, then, is the weaving of this thread an innocent accommodation of a worldview that has a colonial imperative to mathematise everything? Is Indigenisation sometimes a Trojan horse in the sense that it might present a means to colonialise Indigenous knowledges? Since the sweetgrass braid is a representation of Indigenous worldviews of knowledge through stories, we also wonder if Eurocentric worldviews attempt to unravel the braid in order to isolate portions of the threads that can be relegated to being mathematical in the Eurocentric sense.

Is accommodating a Eurocentric thread in the sweetgrass braid a more promising alternative than having Eurocentrism tugging at the harmonious strands of the braid, thus severing lived stories in a pursuit to find mathematical meaning to reinforce the ideologies that mathematics is ubiquitous and needs to be unearthed? This leads us to our final wonder posed in the next section.

Don't talk about an equation

We wonder if a promising next step is to refrain from using the term "mathematics" altogether when sharing the knowledge of our lived and told stories? To disrupt the colonialism of Indigenising school mathematics, can we remove the term mathematics from the equation and then stop referring to an equation altogether?

We argue that identifying mathematics in lived stories makes the Eurocentric assumption that Indigenous worldviews *can* and *ought* to be presented through Eurocentric categories of mathematical knowledge that are intended to serve an Indigenous audience of learners. We argue further that narratives of experience (told through relationships, in place and across time) are like a plate, and Eurocentrism often shatters the plate and extracts broken pieces and identifies it as mathematical. The fragments are then pieced together by Eurocentrism in an attempt to show the cohesion of life under the guise of Indigenising school mathematics.

Can knowledge be shared by starting and ending in relationship without segregating it into disjointed categories of school subject areas? Stavros and Miss Moore discussed this idea in the following field note.

> Miss Moore: I told you before, I think Indigenisation is sometimes just more colonisation at work. People want our stories, our teachings, our knowledge so that they could put it in a mass-produced science or math textbook. *Kimotamâkêwin*. It's just stealing from us and then trying to sell it back to us as something they made. *Cîsihiwêwin*.
>
> Stavros: I hadn't considered the aspect of financial gain. That is a concern.
>
> Miss Moore: I know the intention of Indigenisation isn't malicious but that doesn't mean it isn't still further colonising us.
>
> Stavros: How do you rationalise the work we do together?
>
> Miss Moore: I like teaching concepts through my language and I like that you are here to learn. We can all learn from each other. I don't think of what we are doing as Indigenisation in the negative way until I hear you asking me questions about phrases I don't experience—like when you wanted to know Cree words for teaching order of operations. Words like *mīna* (and) *katīna* (remove), *nīswāw* (double), *âpihtâ* (half), and so on, all make sense. But when you ask me to translate an expression like "five minus two, all squared, divided by three", then it doesn't make sense and I don't see any point. You are asking me to solve a school math problem, which is fine, but we can't pretend it's something that Cree people want to represent in their language. For what reason?

Miss Moore explained that there was a loss of practicality in many of the ways Indigenisation is taken up. She rhetorically asked what good is putting Cree words that no one actually says in a mathematics textbook. She stated the additional problem that it makes motionless a living story. She explained that she can teach school mathematics, which she knows has importance in society even though it often seems irrelevant to daily life. On the other hand, she argued that much of what she teaches comes from her personal stories and family histories. This could be taught at any time of the day—it does not have to wait for a 50-minute math or science class. The story is shared because it teaches us a lesson that moves us together as one, and keeps the spirits of our ancestral knowledge alive. This is an Indigenous worldview of knowledge. The Cree teacher participants in this inquiry highlighted that the Indigenisation of school mathematics in mandated government curriculum documents does not make an appropriate space for a worldview that can be more holistic, context-based and fluid. This paper is not meant to be prescriptive, nor do we know how educators will shift their practice from this work. Rather, we hoped to open a discussion on the scepticism of what educators take-up under the label of Indigenisation.

Acknowledgements

The first author's research and work are supported by SSHRC (Social Sciences and Humanities Research Council) and PIMS (Pacific Institute for the Mathematical Sciences).

References

Barman, J. (2012). Schooled for inequality: The education of British Columbia's Aboriginal children. In S. Z. Burke & P. Milewski (Eds.), *Schooling in transition: Readings in Canadian history of education* (pp. 255–276). University of Toronto Press, Scholarly Publishing Division.

Battiste, M. (2013). *Decolonizing education: Nourishing the learning spirit.* UBC Press.

Battiste, M., & Henderson, J. Y. (2009). Naturalizing Indigenous knowledge in Eurocentric education. *Canadian Journal of Native Education*, *32*(1), 5–18.

Bishop, A. J. (1990). Western mathematics: The secret weapon of cultural imperialism. *Race & Class*, *32*(2), 37–58. DOI: 10.1177/030639689003200204

Bishop, A. J. (1994). Cultural conflicts in mathematics education: Developing a research agenda. *For the Learning of Mathematics*, *14*(2), 15–18. https://www.jstor.org/stable/40248109

Brake, J. (2019, February 5). Canada unveils Indigenous languages bill to fanfare, criticism. *APTN News*. https://aptnnews.ca/2019/02/05/canada-unveils-indigenous-languages-bill-to-fanfare-criticism/

Brandt, A., & Chernoff, E. J. (2014). The importance of ethnomathematics in the math class. *The Ohio Journal of School Mathematics*, *71*, 31–36.

Cajori, F. (1909). *A history of mathematics*. The Macmillan Company.

Clandinin, D. J., & Caine, V. (2013). Narrative inquiry. In A. Trainor & E. Graue (Eds.), *Reviewing qualitative research in the social sciences* (pp. 166–179). Routledge.

Connelly, F. M., & Clandinin, D. J. (2006). Narrative inquiry. In J. L. Green, G. Camilli, & P. Elmore (Eds.), *Handbook of complementary methods in education research* (3rd ed., pp. 35–75). Lawrence Erlbaum.

Czuy, K., & Hogarth, M. (2019). Circling the square: Indigenizing the dissertation. *Emerging Perspectives*, *3*(1), 1–16.

d'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the learning of Mathematics*, *5*(1), 44–48. https://www.jstor.org/stable/40247876

d'Ambrosio, U. (2001). What is ethnomathematics, and how can it help children in schools? *Teaching Children Mathematics*, *7*(6), 308–310. https://www.jstor.org/stable/41199887

d'Ambrosio, U. (2006). *Ethnomathematics: Link between traditions and modernity*. Sense Publishers.

Deer, F. (2013). Integrating Aboriginal perspectives in education: Perceptions of pre-service teachers. *Canadian Journal of Education*, *36*(2), 175–211. https://www.jstor.org/stable/canajeducrevucan.36.2.175

Dewey, J. (1997). *Experience and education.* Touchstone. (Original work published 1938)

Doolittle, E., & Glanfield, F. (2007). Balancing equations and culture: Indigenous educators reflect on mathematics education. For the Learning of Mathematics, 27*(*3), 27–30.

Ermine, W. (2007). Ethical space of engagement. *Indigenous Law Journal*, *6*(1), 193–203.

Ernest, P. (1994). The philosophy of mathematics and the didactics of mathematics. In R. Biehler, R. W. Scholz, R. Strasser, & B. Winkelmann (Eds.), *Didactics of mathematics as a scientific discipline* (pp. 335–350). Kluwer Academic Publishers.

Ernest, P. (2016). The unit of analysis in mathematics education: Bridging the political-technical divide? *Educational Studies in Mathematics*, *92*, 37–58. DOI: 10.1007/s10649-016-9689-4

Ferrari, P. L. (2003). Abstraction in mathematics. *Philosophical Transactions: Biological Sciences*, *358*(1435), 1225–1230. https://www.jstor.org/stable/3558214

Gallop, C. J., & Bastien, N. (2016). Supporting success: Aboriginal students in higher education. *Canadian Journal of Higher Education*, *46*(2), 206–224. https://www.proquest.com/scholarly-journals/supporting-success-aboriginal-students-higher/docview/1824510902/se-2

Gaudry, A., & Lorenz, D. (2018). Indigenization as inclusion, reconciliation, and decolonization: Navigating the different visions for indigenizing the Canadian academy. *AlterNative: An International Journal of Indigenous Peoples*, *14*(3), 218–227. DOI: 10.1177/1177180118785382

Gerdes, P. (1996). Ethnomathematics and mathematics education. In A. J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 909–943). Kluwer Academic Publishers.

Heleta. (2016). Decolonisation of higher education: Dismantling epistemic violence and Eurocentrism in South Africa. *Transformation in Higher Education*, *1*(1), 1-8.

Iseke-Barnes, J. M. (2000). Ethnomathematics and language in decolonizing mathematics. *Race, Gender & Class in Education*, *7*(3), 133–149. https://www.jstor.org/stable/41674951

Kimmerer, R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge, and the teachings of plants*. Milkweed.

Korteweg, L., & Russell, C. (2012). Decolonizing + Indigenizing = Moving environmental education towards reconcilliation. *Canadian Journal of Environmental Education*, *17,* 5–14.

Kovach, M. (2010a). Conversational method in Indigenous research. *First Peoples Child & Family Review*, *5*(1), 40–48. DOI: 10.7202/1071291ar

Kovach, M. E. (2010b). *Indigenous methodologies: Characteristics, conversations, and contexts*. University of Toronto Press.

Kovach, M. (2018). Doing Indigenous methodologies: A letter to a research class. In N. K. Denzin & S. L. Yvonna (Eds.), *The SAGE handbook of qualitative research* (5th ed., pp. 214–234). SAGE.

Kuokkanen, R. (2007). *Reshaping the university: Responsibility, Indigenous epistemes, and the logic of the gift*. UBC Press.

Lowman, E. B., & Barker, A. J. (2015). *Settler identity and colonialism in 21st century Canada*. Fernwood Publishing.

Macmillan, P., McGregor, C., & Old, B. (2005). Ethnomathematics and Aboriginal student anxiety. *Academic Exchange Quarterly*, *9*(3), 126–131.

Michell, H. (2005). Nêhiyawak of Reindeer Lake, Canada: Worldview, epistemology and relationships with the natural world. *The Australian Journal of Indigenous Education, 34*, 33–43.

Michell, H., Vizina, Y., Augustus, C., & Sawyer, J. (2008). *Learning Indigenous science from place: Research study examining Indigenous-based science perspectives in Saskatchewan First Nations and Métis community contexts.* University of Saskatchewan Aboriginal Education Research Center.

Miller, J. R. (1996). *Shingwauk's vision: A history of native residential schools*. University of Toronto Press.

Pidgeon, M. (2008a). *It takes more than good intentions: Institutional accountability and responsibility to Indigenous higher education* [Unpublished doctoral dissertation]. University of British Columbia.

Pidgeon, M. (2008b). Pushing against the margins: Indigenous theorizing of "success" and retention in higher education. *Journal of College Student Retention: Research, Theory & Practice*, *10*(3), 339–360.

Popkewitz, T. (2004). The alchemy of the mathematics curriculum: Inscriptions and the fabrication of the child. *American Educational Research Journal*, *41*(1), 3–34.

Powell, A. B., & Frankenstein, M. (1997). *Ethnomathematics: Challenging Eurocentrism in mathematics education*. State University of New York Press.

Stavrou, S. G., & Miller, D. (2017). Miscalculations: Decolonizing and anti-oppressive discourses in Indigenous mathematics education. *Canadian Journal of Education*, *40*(3), 92–122.

Stavros, S. G., & Murphy, M. S. (2020). "What comes after nēwāw?": When generalization disrupts experience in mathematics. *The Canadian Journal of Native Studies*, *40*(1), 121–131. https://www.proquest.com/scholarly-journals/what-comes-after-newawl-when-generalization/docview/2528881540/se-2

Stinson, D. W. (2004). Mathematics as "gate-keeper"(?): Three theoretical perspectives that aim toward empowering all children with a key to the gate. *The Mathematics Educator*, *14*(1), 8–18.

Truth and Reconciliation Commission. (2015). *Honouring the truth, reconciling for the future: Summary of the final report of the Truth and Reconciliation Commission of Canada*. Retrieved from http://www.trc.ca/assets/pdf/Honouring_the_Truth_Reconciling_for_the_Future_July_23_2015.pdf

Vithal, R., & Skovsmose, O. (1997). The end of innocence: A critique of "ethnomathematics". *Educational Studies in Mathematics*, *34*(2), 131–157. DOI: 10.1023/A:1002971922833

Wildcat, D. R. (2001). Prelude to a dialogue. In V. Deloria & D. R. Wildcat (Eds.), *Power and place: Indian education in America* (p. vii). Fulcrum Resources.

About the authors

Stavros Georgios Stavrou has white-settler identity with Greek heritage on his father's side, and French and Ukrainian heritage on his mother's. He was born and raised in Saskatchewan, Canada. He currently works as a mathematician and in teacher education in the Department of Educational Foundations, College of Education, University of Saskatchewan.

M. Shaun Murphy has white-settler identity and was born on Treaty Six Territory in Alberta. He currently works on Treaty Six Territory in Saskatchewan, in teacher education in the Department of Educational Foundations, College of Education, University of Saskatchewan.

Please cite this article as:

Stavrou, S. G., & Murphy, M. S. (2022). Failures Indigenising school mathematics: A narrative inquiry. *The Australian Journal of Indigenous Education*, *51*(2). DOI 10.55146/ajie.v51i2.40