

“Start with where you are”: The View of Indigenizing STEM Curriculum from Educational  
Outreach

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## Abstract

As educational institutions in Canada respond to the Truth and Reconciliation Commission's 2015 "Calls-to-Action" by exploring what it means to "indigenize" curriculum, the process is complex and requires contributions from multiple angles of education, including informal education. This is particularly important for STEM education, where the exclusivity of western-centric notions of science and technology must be re-evaluated to provide a more culturally-aware offering. The unique position of informal education programs like educational outreach provides a unique outlook that offers lessons that formal education can benefit from. To explore this unique position in indigenizing, we use a qualitative study with *Geering Up*, a STEM educational outreach program at the University of British Columbia, and members of K'omoks First Nation on nearby Vancouver Island. We conducted semi-structured interviews with 10 members of Geering Up and 4 members of K'omoks First Nation, and identified themes that ought to inform how educators and scholars consider the foundations of indigenizing curriculum and education in general, particularly the value of sharing. We explore its potential as the foundation of a broad framework for indigenizing curriculum in a way that scales from one community's perspective to multiple in a way that is respectful, and accounts for the significant time, energy, and human resource commitment involved in these practices.

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### **Introduction**

Canada at the turn of the 21st century is in the process of coming to grips with its colonial practices that persist today in the form of numerous social and psychological wounds affecting its indigenous peoples (Chrisjohn, McKay, & Smith, 2017; Chrisjohn, Young, & Maraun, 2003; Milne, 2016). In 2015, Canada’s Truth and Reconciliation commission laid out its “Calls to Action”, which defined various goals for decolonizing Canada, including in education. At their core, these seek to move away from purely western-centric educational content and towards a more equitable balance between western and indigenous ways-of-knowing.

However, the process of *indigenization*, however aspirational, is deeply complicated and even organizations with good intentions risk perpetuating colonizing practices through sloppy execution or lack of investment in understanding. This is particularly important for science, technology, engineering, and mathematics (STEM) education, as interest in these lucrative careers crosses cultural boundaries. We examine here one such STEM educational institution from an understudied angle: that of informal education through outreach. Their story has lessons to offer both formal and informal education, and broader initiatives that operate across multiple communities and institutions.

### **Literature Review**

#### **Colonization and Education in Canada**

The long term effects of Canada’s residential school system are so severe (Chrisjohn et al., 2017; Milne, 2016) so as to be considered by many to be a genocide (MacDonald & Hudson, 2012). Attempts to avoid furthering cultural genocide through education have led to a re-

assessment of educational practices, notably as explicit “Calls to Action” by the Truth and Reconciliation Commission of Canada, e.g. “developing culturally appropriate curricula” (The Truth and Reconciliation Commission of Canada, 2015). The education priorities capture a push to “indigenize” education, which seeks transformation via inclusion of “indigenous knowledges, voices, critiques, scholars students and materials”, and support the plurality of Indigenous knowledges and practices (Pete, 2016). Institutions across Canada are in the process of figuring out what it means to “indigenize”, including STEM education.

### **Indigenizing STEM Education**

That being said, while Canadian institutions have focused on the inclusive aspects of indigenization, support for indigenous ways-of-knowing as part of the curriculum has been lacking, leaving us still exploring *what does indigenization look like* (Gaudry & Lorenz, 2018)? Indigenizing curriculum is a nuanced and negotiated process, and cannot be reduced to simply adding western and indigenous outlooks together (Hauser, Howlett, & Matthews, 2009; Nakata, 2007). There are complexities and power dynamics at play where cultures meet (Nakata, 2007), and indigenizing institutions must navigate these dynamics.

There have been initiatives globally to indigenize STEM curriculum, although much of the scholarship has focused on projects that work with a single community, with less focus on the possibility of many, such as Miller & Roehrig (2018) incorporating STEM curriculum into a traditional Ojibwe game called Snow Snakes (Gooneginebig in Ojibwe) with the White Earth Ojibwe community in the United States. STEM education has also worked with indigenous communities within city centers rather than within their own communities, e.g. (Bang, Marin, Faber, & Suzukovich, 2013).

Lessons from indigenizing STEM (and education in general) have given us various recommendations, including: the value of circles of sharing and social relationships between students and instructors (Ragoonaden & Mueller, 2017); the importance of indigenization being community-driven, building an inclusive curriculum, prioritizing ontological pluralism, and institutional reflexivity (Hauser et al., 2009); and the aforementioned move beyond mere inclusion towards reconciliation and decolonization (Gaudry & Lorenz, 2018). Additionally, the importance of proper mindset has been stressed (Hatcher, Bartlett, Marshall, & Marshall, 2009; Kapyrka & Dockstator, 2014). We are at the point in indigenizing education where scholars and education professionals are working to understand *what indigenization looks like*, and experiences must be drawn from all angles where educational services are offered.

### **Research Objectives**

Informal education has not had as much attention in indigenizing STEM education scholarship, e.g. educational outreach. Outreach has a unique relationship with indigenous communities, given broad geographic coverage and intermittent contact with communities. Although situated within a broader educational apparatus, they are nonetheless unique in their position, and have important lessons to share for educational practices more broadly. This is especially true when outreach organizations undertake indigenization: working with many communities consolidates many ideas on indigenization, supporting the development of frameworks informed by their cultural encounters.

Therefore, our first objective is to describe how both STEM education outreach employees and indigenous First Nations community members conceptualize the role of the organization in indigenizing STEM curriculum within outreach within the context of the relationship between indigenous communities and western academic institutions. This calls to

mind hopes and challenges of indigenizing curriculum. Then, drawing on this descriptive analysis, we explore what informal education like outreach can offer efforts to indigenize STEM.

## **Research Design**

### **Research Framework**

We use an evaluative case study design, which allows us to investigate multiple social units in order to understand the overall phenomenon (Merriam, 1998, p. 41). We focus on the educational outreach program: Geering Up Engineering Outreach at the University of British Columbia (UBC). Geering Up offers STEM educational outreach to schools and communities in Vancouver and broader British Columbia. Their outreach ranges from educational workshops at local and remote communities to week-long camps offered to indigenous and rural K-12 students throughout the province. Crucially, they are working more closely with their partner First Nations communities to indigenize their practices. This study focuses on the indigenous outreach team with Geering Up, specializing in outreach to participating indigenous and/or rural communities and schools.

We also work with K'omoks First Nation on Vancouver Island, located just outside of Comox BC. This small First Nations community of approximately 220 members (Government of Canada, 2016) has a standing relationship with Geering Up for STEM summer camps. We work with the education coordinator to oversee the research process and assist in recruiting participants.

### **Data Collection and Analysis**

We use a qualitative methodology consisting of semi-structured interviews with members of the STEM educational outreach program and community members from K'omoks First Nation. Each interview takes approximately 1.5 to 2 hours. We use a purposive sampling

procedure to select interview participants from Geering Up's indigenous outreach team. This resulted in the researcher conducting 10 semi-structured interviews. With K'omoks First Nation, we use a snowball sampling procedure based on building a relationship first and foremost with the nation's education coordinator, who serves as the primary point of contact between K'omoks First Nation and Geering Up. This resulted in 4 semi-structured interviews. Additionally, members of the community were given the opportunity to elect whether they were to be anonymized for the purpose of presentation and publication.

The researcher transcribed the audio of the interviews. Each interview transcript was analyzed using qualitative thematic analysis.

## **Findings**

### **Inclusion and Representation**

Awareness of underrepresentation of people of indigenous identity in STEM fields was perceived as a primary value of outreach's goal. Increasing indigenous representation in STEM was described by both Geering Up and members of K'omoks First Nation as a process of 'seeing oneself' as a scientist or engineer. Said Charlene Everson, education coordinator for K'omoks First Nation:

...that's the thing with indigenous kids, and that's the whole goal with indigenous education in general, is making indigenous kids see themselves in sciences, see themselves in healthcare, see themselves in these things, and by highlighting their strengths.

This however was connected to anxieties about race on the part of Geering Up staff, where staffers sometimes struggled with the fact that they themselves were not indigenous:

...we look different, we look different from everyone there, and that's not good. I want the kids to be able to see themselves in us, and I think that's easier if their ancestry is at least a little bit closer.

Lack of indigenous instructors in the Geering Up staff was perceived as an obstacle to the goal of helping children to 'seeing oneself' in STEM.

### **The Human and Cultural Capital Connection**

Meeting the demands of indigenizing curriculum is a time and energy intensive process, reliant upon significant effort from actors on both sides of the equation, community and educational institution. The contribution of elders and knowledge keepers was reinforced by community members:

Interviewing people, elders, knowledge keepers, and do some vetting. And bring in an elder or knowledge keeper who can start it up. Preferably the beginning of each group, I would have someone come in and ground the knowledge.

This, however, is difficult to implement in small communities, as elders and knowledge keepers are often both a) limited in number, and b) limited in availability:

I know for K'omoks, there's very limited amount of people... [Elder] really is one of the only people with a lot of that cultural knowledge in our town, in our community.

Furthermore, Geering Up employees regarded the prospect of a full-time community outreach staffer whose sole job is working with communities on relationships towards this end as an ideal, indicating the need for extensive effort to be contributed to indigenizing curriculum.

I would love it if we [could have] someone like [outreach assistant], which I guess we now have, but yeah, like someone whose job it is to be our cultural liaison, and that's like their sole job, of getting in touch with the community.

Although outreach organizations are exposed to many different communities, contexts, and ideas, working with many different communities simultaneously and sequentially makes it difficult to put in the time and energy required to indigenize curriculum. Therefore, traditional indigenizing frameworks that rely on lengthy time and energy investment are a challenge to implement and to sustain when they don't come in with structures to manage the time and energy commitment of staffers, elders, knowledge keepers, and community members.

### **The Prominence of Resource Sharing**

Building lessons that coordinate STEM and indigenous cultural outlooks was considered difficult, and this is where the emphasis on sharing was particularly felt. Sharing is seen as a seeding the beginning of this process, and 'starting where you're from', given UBC's place on unceded Musqueam territory:

“Even if you [...] came in and had [...] stuff that was all Salish, Musqueam, Squamish people, technology that you used in the program [...] it's those kinds of things and I think that once you get started [...] They start off with one project, and next thing you know they have all of these ideas for stuff. And I think it's the same with this. You just have to spark people's imagination, and just start. Start with where you are.”

The value of sharing was not just considered to be between First Nations communities through Geering Up, but also with the mainstream, formal school district as well:

“what if you [...] helped develop something and then we were able to bring it into the school and use it as a tool to teach the district about K'omoks people, by showing that technology, and having a whole science thing based around it that would benefit not just our students where they could see themselves in their education, which is the whole point of indigenous education, but where the rest of the community could use it too. Our community at large, not just K'omoks First Nation, but the district.”

Even though Geering Up employees were well aware of the follies of building pan-indigeneity into their practices, indigenous community members emphasized that indigenizing education is a process that is shared by multiple First Nations communities, and that there's significant benefit in sharing lessons and ideas about how their own outlooks and STEM education can be equitably represented.

## **Discussion**

### **The Unique Offerings of Educational Outreach**

What is evident in conceptualizing informal educational organizations like Geering Up is that their attempts to indigenize their STEM educational offerings are subject to many of the same challenges that would affect formal education, in particular the constraints of time and energy and its connection with human and cultural capital towards indigenizing curriculum. However, exposure to many different communities, which may be considered weakness towards indigenization, accords Geering Up with a unique position: that of being a nexus of resources between multiple First Nations' communities and educational institutions.

Given the challenges with developing indigenized STEM lessons, entities that serve as a nexus of resources are of great value, and can lessen required time commitment on members of

the community, as well as serve as the spark by which lessons and ideas can be created. This also speaks to the value of allowing educational organizations to “start with where [they] are”, and where human and cultural capital may be its most accessible: although indigenized STEM lessons themselves may not necessarily translate by virtue of their cultural source, their existence serves as a beacon for communities to explore, with the educational outreach program, its own actualization of indigenized STEM.

### **Towards a Sharing Framework of STEM Indigenization**

As a potential nexus of resources, the prominence of *sharing* comes to mind. Ideas for curriculum indigenization that are developed in one community, i.e. “start with where you are” can seed discussions with other nations, prompting opportunities to actualize how STEM curriculum indigenization can look for other nations. Indigenizing STEM lessons is not always immediately obvious (one participant from K’omoks First Nation expressed the oddity of “indigenizing math”), so it can be a time and energy intensive process. Outreach based sharing can spark these conversations and make them easier by virtue of example, but in doing so manage the required time and energy commitment asked of knowledge keepers and elders. The value of this idea was developed primarily by the education coordinator of K’omoks First Nation, based on her own experiences with education within her community, so exploration of this idea and its advantages ought to be credited there.

The ultimate goal is a critical mass of indigenized STEM lessons, borne from networking indigenized curriculum between First Nations communities. Avoiding pan-indigeneity becomes a priority, and this ought to be guarded against by a) emphasizing the source of a lesson, and b) acquiring advance permission from the community leaders or representatives to teach such a lesson in their community. Furthermore, lessons can be transmitted to mainstream formal

educational settings, especially since outreach organizations like Geering Up commonly interact with formal school boards and instructors (case in point: one of the participants from the community is a school teacher).

The place of Geering Up at the centre of many entities produces an opportunity to develop a framework for assisting educational organizations and communities in producing indigenized STEM curricula, and thereby meeting some of the most conceptually difficult Calls to Action in the TRC's 2015 report. While significant value has been had in projects that build relationships and lessons with singular nations and communities (e.g. Miller & Roehrig, 2018), broader-scale initiatives like what is suggested in the TRC's Calls to Action require broader scale approaches and frameworks, and these start from identifying the foundations that those approaches and frameworks will require.

### **Relationships as Foundational**

Finally, the basis of this indigenizing framework depends on the quality of the relationship built between institutions and nations, evident in the challenge of time and energy in indigenization efforts and resource sharing. The quality of the relationship will determine engagement in the education process that enhances the human capital availability, as well as the quality of resources that are shared across any framework. In this way, no framework can exist without development of a trustful relationship. Relationships must also be persistent: oral and collaborative knowledge built over the course of a relationship can be at risk due to staff turnover, an issue facing both informal and formal education alike. While scholars, indigenous and western alike, have stressed the importance of good and persistent relationships (e.g. Haig-Brown & Dannenmann, 2002), the importance of research and mindfulness must continue to be

stressed, and that simple practices like gift-giving be incorporated into western-indigenous engagement.

### **Conclusion**

Indigenizing education and curriculum within it is essential to Canada's push to decolonize. However, without proper implementation of indigenization, these Calls to Action are little more than aspirational. This requires buy-in and initiatives from all forms of education, formal and informal. This brief look-into the operations of a STEM educational outreach program working to indigenize carries lessons for formal education that can prove essential in connecting targeted, one-to-one relationships between institutions and nations, to many-to-many, broader scale relationships between multiple institutions and multiple nations. By emphasizing the foundational element of sharing through the resource nexus that is organizations like Geering Up Educational Outreach, we hope to help move the push to indigenize to a broad scale, national level, collective endeavor.

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