

Aboriginal Ways of Knowing and Learning, 21st Century Learners, and STEM Success

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Abstract

Aboriginal people are alarmingly under-represented in science, technology, engineering, and mathematics (STEM)-related careers. This under-representation is a direct result of the lack of academic success in science and mathematics, an issue that begins early in elementary and middle school and often escalates in secondary school with the majority consequently doing poorly, not completing these courses and often dropping out. This makes them ineligible to pursue STEM-related paths at the post-secondary level. The greatest challenges to success in these courses are the lack of relevancy for Aboriginal learners and, as importantly, how they are taught; impediments that are also paramount to the increasing lack of success for many non-Aboriginal students in STEM-related courses. This paper explores how Aboriginal ways of knowing and learning and those of the 21st century learners of today very closely parallel each other and illustrates how the creative multidisciplinary approach of a liberal education might be the way to enable early academic engagement, success and retention of Aboriginal learners in the sciences and mathematics.

Keywords: Aboriginal; Aboriginal ways of knowing and learning; Aboriginal culture; bridging cultures; 21st century learning; mathematics; science; STEM; Two-Eyed Seeing



in education

exploring our connective educational landscape

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Such a language would be...one that grows in the middle. (Ted Aoki, 1993)

There is an adage that “Natives can’t do science or mathematics” (Leroy Little Bear, personal communication, 2009), which parallels the same philosophy historically of women in science (Harding, 1987, 1991; Etzkowitz, Kemelgor, Neuschatz, Uzzi, & Alonzo, 1994), but at an even deeper level. I disagree. I believe the issue is how we teach science and mathematics. For many Aboriginal¹ learners whose ways of learning and coming to know are grounded in practical, hands-on, learning-by-doing first, the current Eurocentric model of theory before practice results in a paradigm clash (Aikenhead, 1997, 2002; Aikenhead & Michell, 2011; Cajete, 1999). As a result, the majority of Aboriginal students do poorly in science and mathematics-related courses as they progress through school, resulting in high attrition rates from such courses and often, consequently, from school (CCL, 2006a, 2006b, 2007; Statistics Canada, 2005, 2008, 2012). Without success in these courses, Aboriginal students are excluded from pursuing science, technology, engineering and mathematics (STEM)-related degrees at the post-secondary (PS) level. The consequence of this impediment is that Aboriginal people are critically under-represented in STEM-related professions at all levels within medicine, education, research, and policy to name a few. As well, without STEM-related degrees, Aboriginal people do not have the opportunity to work within their own community as professionals to build community capacity and self-efficacy, or to have an equitable voice and representation in policies, governmental or otherwise, that affect Aboriginal peoples and their communities. In order to participate and have voice in current and future opportunities in STEM professions, academic success in science and mathematics has to occur early and be sustained through all grade levels (K-12) so that Aboriginal students are not streamed away from such courses, as they most often are, and can continue on STEM-related academic paths at the PS level.

The Roadblocks

As an oral culture, Aboriginal knowledge is not written down, contained in textbooks, or stored on shelves for reference or posterity. All things are considered living and spiritual, related and interrelated, and critical to life and living (Cajete, 2000). Cultural experts such as elders hold knowledge in the traditional stories, in the ceremonies, and in the practices; teaching is by mentoring and learning is by doing and application. The laboratory for Aboriginal peoples is the *real* and *applied* world. Learning is not a linear process but rather continuous with multiple opportunities to cycle around; with each cycle one learns more at a deeper level. Failure is not built into the paradigm but rather learning is a life-long and continual process (Cajete, 1999, 2000). It is the clash or juxtaposition in ways of knowing and coming to learn between Aboriginal and Western paradigms that I believe presents the key challenges for Aboriginal learners in the Western system.

So here is my question: What if, as educators, we put away the crutch—the textbook—the traditional Western methodologies of teaching, think outside the cliché box, and begin in a different way, in a hands-on practical, learning-by-doing approach first, to build a foundation of context and bring in the theory later? Without context one does not have a frame of reference. Just as in learning to ride a bicycle, one first has to know what a bicycle is, how to obtain one and, then learn how to ride one by doing it. There is no amount of reading or having someone tell you how to do it, that will substitute for seeing a bike, actually getting on the bike, and trying to

ride it, and if you are as unfortunate as I was, going at break-neck speed downhill into the barn door. I doubt that cautions not to use that particular methodology would have been in any book of the instructions should I have had access to one anyway. And nowhere in the instructions, I am sure, would it have talked about scraped knees, a bloody nose, a black eye and the effect of unsuccessfully riding a male-framed bicycle on female anatomy. Certainly, there would be no cautionary phrases about downhill starts with no brakes, or barn doors as impediments to riding, albeit they are a highly effective, alternative means to braking. Context and practical experience made all those things very clear to me.

But importantly, in learning to ride a bicycle, I have been able to expand my experience and knowledge to road races in triathlons and bike trip holidays; activities that would not have been possible without that initial learning experience. So then, how can we expect students, particularly those who have no context for what we are teaching, to know, to learn such complicated subjects as chemistry, biology, physics, mathematics, or any of the other subjects that begin most often in the abstract and that are not taught in an interrelated fashion in the way they truly exist. More specifically, how can we expect students to learn a subject for which there is no “formal” context or vocabulary in their own culture? Talk about putting barn doors in their path to stop them...Ouch!!

In this Western system, we, as educators, expect Aboriginal students to jump over these large chasms between the two paradigms without any bridges and to learn in the Western way we have been taught without ever showing them how to do this, which has not and still is not, working. As someone of Métis heritage, I have lived between my urban life and my rural roots but have grown up essentially Western-educated. By this I mean I went to an urban school where the curriculum was standardized and taught using the colonial model (Cherubini, 2014; Friesen & Lyons Friesen, 2002; Tuhiwai Smith, 2012). Unlike my siblings and most of my family who did not complete high school, I did well, but I was lucky to have been mentored along the way by two key teachers who believed in me and patiently guided me in developing a bridging context that has enabled my learning and relative success at it. For many Aboriginal learners this is not the case and certainly not in the sciences and mathematics. Social and economic issues aside, the lack of Aboriginal ways of knowing and learning (AWKL), of relevant bridging context, and of mentorship, I believe, are the key roadblocks to Aboriginal success in PS education (PSE) and particularly in STEM education.

Removing Roadblocks

Western education has historically failed and continues to fail Aboriginal peoples. We hear so often the negative education statistics for Aboriginal people: the lack of attendance, high dropout rates, lack of success, and the statistical difference between on- and off-reserve graduation rates (CAP, 2010; CCL, 2006a, 2006b, 2007, 2009) to name just a few. While there are many social, economic, and political considerations at hand for Aboriginal peoples, I would venture to say that the Western education system in its entrenched methodology is increasingly failing non-Aboriginal students as well. In fact, the 2015 summer edition of *Education Canada*,² published by the Canadian Education Association, focused on exploring alternative retention methodologies to address the increasingly high secondary school dropout rate of youth in general. Something is not working for Aboriginal learners.

In wearing my many hats as educator, researcher, coordinator, and mother of three daughters, I increasingly hear from students in general: What does this all mean in the big picture? How does that fit with my life or me? Who cares? Will I ever use this? Why bother? And a myriad of other statements that attest to the lack of context and relevancy for students. Interestingly, these very closely mirror the statements of many of my Aboriginal students. In his address to the Building Reconciliation Conference at the University of Saskatchewan (November 20, 2015), Justice Murray Sinclair relayed that most Aboriginal students who leave school before completion have made the decision to leave by the age of 12 because it does not work for them and is frustrating, and they will leave at the first opportunity they see. If they leave, they rarely return and become yet another statistic. Therefore, the key is retention, which of course requires initial and continued engagement. However, if Aboriginal people do not see themselves in the curriculum, and as importantly, if teaching does not attend to their ways of knowing and learning, how can we expect them to even engage, let alone stay?

We hear much about indigenizing the curriculum; putting Aboriginal history and culture into the curriculum so Aboriginal people are correctly represented in the texts and materials we use for teaching. A prevailing philosophy is that if Aboriginal people see themselves in the texts, they will be able to associate with the concepts we are teaching and this will make learning easier (Battiste, 2013; Friesen & Lyons Friesen, 2002). I agree to a certain degree, but I believe indigenizing the curriculum has to be done by and with Aboriginal people to get it right this time, and this is going to take time. As well, there are more than six hundred Aboriginal groups in Canada alone and each has its own unique culture. So it is not equitable, nor ethical, in my opinion, to teach about one specific culture as if it were a pan-Aboriginal culture, and we do not want “tokenism,” misrepresentation or *mis-presentation* as has happened in the curriculum history (Truth and Reconciliation Commission of Canada, 2015). There are many educators now, especially new graduates, still largely non-Aboriginal, who do want to be inclusive and who do want to enable Aboriginal success in the best way. However, they are nervous to venture into the realm of Aboriginal education because they have very little knowledge of Aboriginal culture and are afraid of making mistakes or offending. Therefore, we need a different methodological approach, one that attends to AWKL and bridges cultures in a Two-Eyed Seeing way (Bartlett, Marshall, & Marshall, 2012).

Building Bridges

A new generation of Aboriginal learners is poised to enter the education system and, now that change is on the horizon, we have the opportunity to engage students in science and mathematics in a different way, one that attends to AWKL. The majority of 21st century learners, the students of today are hands-on, practical learners. They want to “do stuff,” are resourceful, and approach learning about nearly any topic through a myriad of resources made accessible through the Internet and social media. Gone are the days of textbooks, pen-and-paper, and all the “archaic” (as my daughters tell me) methodologies of my era. Students are not interested in learning a compartmentalized set of subjects that are not interrelated and connected for them. They see issues and want to know how to address them; they want to see how it “all” fits together and how it applies to them. Recently, I very reluctantly retired my iPhone 3 in favour of the iPhone 6 even though it was still working, not because my kids teased me incessantly that I was a Luddite, but for the reality that it could not keep pace with the new changes and I was being left behind. As educators and curriculum developers, if we do not engage differently with our young learners, Aboriginal or not, we too, and education as it is, will be left behind.

I argue that AWKL and the 21st century learners of today very closely parallel each other. While some might suggest AWKL is a subset of 21st century learning, I would disagree and suggest they are mutually exclusive because culture is a critically important component of AWKL and suggesting it is a subset of 21st century learning is assimilative and not a history we want to repeat. That being said, both are hands-on, practical learners who learn best by doing. They want to learn in environments that have context to their lives, that engage them, that allow them freedom to explore, to have their thoughts and voices heard and acknowledged. They also want it to be relevant, applicable, and have meaning for them. We could use the adages I often hear: “These kids of today...or, In my day...or, I had to do (such and such) so should they” or, alternatively as educators we could explore different methodological approaches to teaching, learning, and developing curriculum in ways that engage all students (and educators too) and enable their success.

In order to do this though, as educators and curriculum developers, we need to step outside our cliché box and explore different methodologies that attend to the learning styles and desires of students today, Aboriginal and non-Aboriginal alike. As Trilling & Fadel (2012) suggest, curriculum and teaching should be developed around domains of 21st century interest and need, such as health, the environment, the economy, and technology to name a few. Learning about the domain should be approached through multiple lenses (science, mathematics, art, narrative, literature, music, history, language, economics, et cetera) in an interrelated fashion so that there is a big-picture understanding and application. This philosophy not only mirrors the new movement towards Inquiry-based Learning³ in education, but also it parallels AWKL and the philosophy of PS Liberal Education institutions such as the University of Lethbridge (U of L).⁴

Possibly the gap is not so far apart between Aboriginal and 21st century learners as statistics and all governmental documents (CCL, 2006a, 2006b, 2007) tell us if we consider how both learn and what is relevant to them. Perhaps we need a different, updated measuring tool, one that accurately reflects ways of learning and coming to know of all 21st century learners inclusive of culture and new ways of learning.

Meeting in the Middle

So where do AWKL and the 21st century learner meet? I believe liberal education could be a weaving thread. AWKL are about coming to understand the whole in an interrelated and integrated cyclical way. Liberal education means exploring one’s area of interest using a myriad of lenses to provide students with a breadth of knowledge upon which to draw, such that they are enabled to make connections in an interrelated fashion and integrate the knowledge learned into a coherent whole. Such an approach also enables students to develop good critical-thinking and reasoning skills that allow for independence and self-efficacy in the future. Importantly, they develop tolerance and acceptance for differences of opinion, approaches to ways of coming to know and ways of being in a global society. It fosters good thinkers and citizens who can mobilize their thoughts and passions into action in their life and work (Jones, 2016; AACU, 2016). Interestingly, the principles of liberal education are the very foundational principles of the ways of learning, coming to know, and being in the Aboriginal paradigm. Outcomes of both prepare individuals to deal with complexity, diversity, and change, and create “global citizens” who are responsible and contribute to the good of their collective at all levels.

Mi'kmaq Elder Albert Marshall⁴ and Dr. Cheryl Bartlett,⁵ professor emeritus Cape Breton University, coined the phrase “Two-Eyed Seeing” as a guiding principle more than two decades ago, and it is now being picked up across Canada by organizations and individuals in transcultural collaboration, many of whom are asking to hear more. Two-Eyed Seeing refers to the traditional Mi'kmaq understanding about the gift of multiple perspectives—a gift treasured by many Indigenous peoples. How then, do we best understand and share the message of Two-Eyed Seeing to educators and 21st century learners in the dominant system (Hogue & Bartlett, 2014)?

For our current time, Elder Albert explains that Two-Eyed Seeing refers to the learning to see from one eye with the strengths of, or the best in, Indigenous knowledge and ways of knowing, and from the other eye with the strengths of, or best in, Western ways of knowing, but most importantly, learning to use both eyes together for the benefit of all. Two-Eyed Seeing implies responsibilities toward reciprocity, mutual accountability, and co-learning and is foundational to the First Nations' lifelong learning philosophy. Inclusivity and true relational understanding can only come from continual and cyclical commitment to Two-Eyed Seeing. The recent Truth and Reconciliation Commission Report (TRC, 2015) calls the governments, all educators, and Canadians to action to redefine success in terms of AWKL, encompassing the key attributes of Aboriginal learning including language and spirituality, and to develop tools and means of assessment that address the lifelong learning model of Aboriginal peoples. Such a redefinition is critical for the engagement, retention, and success of all 21st century learners, Aboriginal and non-Aboriginal alike. In Elder Albert's words, “Seeds germinate when the environment is right” (personal communication, 2015).

In the Aboriginal community, the philosophy that education is the way forward is relatively recent and still being accepted. You will often hear the phrase “Education is the new buffalo” (Stonechild, 2006), but the legacy of enforced education for Aboriginal people has left many scars that are only now beginning to heal. While many do believe this new philosophy, it is education in its current methodological approach that is still exclusionary to Aboriginal peoples, with the sciences and mathematics, as traditionally taught from the Western paradigm, being the greatest roadblocks for Aboriginal learners.

So...How do we Enable Aboriginal Academic Success?

Some time ago, the principal of Kainai High School on the Blood Reserve, a former U of L chemistry student of mine) and I began having conversations about the issues we saw as paramount to the struggles, lack of engagement and the high attrition rate for our Aboriginal youth in science and mathematics. We wondered: What if we moved away from the traditional Western way of teaching science and mathematics and invited the students into the science conversation using more culturally relevant methodologies such as performance, narrative, story, hands-on-first, learning-by-doing and learning as a community; could we engage them and keep them engaged? We put the textbook away, moved out of the classroom and began to explore teaching science and mathematics through theatre, cultural stories and relevant to them project-based learning to create bridges between Aboriginal and Western science and mathematics. A number of successfully funded projects, Chemistry Through Theatre and Bridging Paradigms: Teaching Aboriginal Science Through Performative Inquiry (Hogue, 2013; Hogue & BruisedHead, 2013, 2015) and a two-year Aboriginal after school club where we explored science and mathematics through hands-on projects such as robotics (Hogue & BruisedHead,

2015), confirmed our philosophy that if we can engage Aboriginal students in a *different* and *creative* way, make science and mathematics fun and relevant (culturally and at all levels) to their lives, then they are more likely to engage and stay engaged (Aikenhead, et al., 2014; Belczewski, 2009; Hogue & Bartlett, 2014; Hogue & BruisedHead, 2013, 2015). In the many conversations and evaluations we had with the students they all said the creative methods, the hands-on projects and community learning enabled them to relate their hands-on learning to understand science and mathematics in the classroom in a better way. My own work (Hogue, 2014) teaching introductory chemistry in the First Nations Transition Program (FNTP) at the U of L, from a hands-on-first culturally relevant methodological approach, for the past five years has proven to be very successful in enabling Aboriginal learners to succeed in chemistry. Where I before had high failure and attrition rates, I now see great engagement and success. Students constantly say in their evaluations of the course that learning science by doing it first and making it relevant to them, enabled them to bridge it to the theory and understand it easier. They wished they had been taught in this way much earlier because they might have pursued the sciences rather than avoiding them (Hogue, 2014).

Outcomes of the projects and their evaluations were foundational to the development of a pilot summer camp designed for younger Aboriginal youth who were academically or socially struggling. In early summer, the principal of Kainai High School and I, along with the support of members of the Faculty of Arts & Science and Destination Exploration, piloted a summer camp entitled, Bridging Cultures: Mapping your Destination with Science, Mathematics & Technology (SMT) at the U of L. The five-day camp brought middle school Blackfoot students in direct contact with university professors and instructors to experience hands-on-learning-by-doing in a variety of academic fields related to SMT. The goal was to create bridges to science and mathematics culturally through a liberal education, multidisciplinary approach. The theme of a circle was chosen as the circle is a foundational symbol in the Aboriginal paradigm and metaphorically illustrates continuity and possibility. In hosting the camp at the U of L, the goal was to create bridges and plant the seed of PSE in a non-intimidating way.

On Day 1, the students worked with a geography professor to build binomial distribution curves using the professor's homemade binomial simulator. By putting the balls into the simulator and watching how they rolled and settled, they came to understand statistical concepts such as average, mean, median, and distribution in ways that made more sense to them, they said, than trying to understand the formulas and graphs in the book first. Later in the afternoon, they mapped the landscape of the coulees using the Geographical Positioning System (GPS) and related this process to how their ancestors were able to navigate the land by the various positions of animals, plants, the skies, landscapes, and so forth in the natural environment. On the morning of Day 2, an academic instructor from the Department of Physics posed five puzzling phenomena to explore using hands-on activities to answer the question: Why is the tipi such an amazing design and structure? The students learned the brilliant science and mathematics of the tipis created by their ancestors and the instructor learned about tipi protocol from the students. In the afternoon, an instructor from the Department of Mathematics engaged the students in the mathematics of bubbles. Students created different mathematical bubble shapes such as circles, ovals, squares, and cubes and tried to create the largest bubbles without popping them. The most challenging bubbles were the cubes within the cubes. Day 3 saw the students taking the puzzle out of mathematical puzzles in fun and creative ways when they worked with a mathematics professor from Liberal Education to solve intriguing puzzles. They were soon hooked and did

not want to stop even when it was lunchtime. In the afternoon they learned that their arm-span could be used as a measurement to determine the circumference of a hoop that would fit their body. Using the hoops they made, they were able to relate the physics of motion learned earlier when they tried hoop dancing, and were able to see how the circular hoops could be interconnected to make beautiful images. Creating secret codes and computer programming was the theme of the morning of Day 4. They learned how the repeating loop in coding was critical to the movement of the video characters they created. The students thought coding was similar to the smoke signals and signs many Aboriginal peoples historically used to send messages and, importantly, that the repeating loop was like the repeating philosophy of the medicine wheel: many chances allowed for moving forward (female student participant, personal communication). In the afternoon, they expanded their computer skills to create noisy and illuminating electric circuits, and related these to the “natural” land circuits Aboriginal peoples used as a means of communication and connection and to travel on the land. One student suggested circuits, too, were like the medicine wheel, and that you could “change things” at different points, as long as you “completed” the circuit [circle] (male student, personal communication). On Day 5 the students learned “chemistry is the glue of all things” when they explored chemical reactions and the effects of changing concentrations on the bounce, stretchiness and texture of the colorful rainbow slime balls they made. They learned chemistry reactions could be viewed as metaphors for all reactions and interactions of life

A final collective student project was an art reflection puzzle where each student decorated a puzzle piece illustrating what he or she learned and liked and what SMT meant to her or him now. The group created a collage of the interlocking puzzle pieces to illustrate the interrelatedness of their experience. A video of the week was produced (See <https://vimeo.com/137716472> for video) as a visual journal. In the final evaluations, the students thought SMT were not scary but fun and exciting. “Now I get it,” said one young female participant; “I wish we could have this in all our classes,” said another participant, “because I could really get into this.”

Final Reflections

Through my research outcomes and teaching experiences, I have come to believe we need to target younger Aboriginal students in elementary and middle school and engage them in SMT in ways that attend to AWKL to enable success early. Importantly, we have to continue to work with them through to high school completion so that they graduate having succeeded in science and mathematics courses, and so they are then eligible to pursue STEM-related paths should they wish to. The expected surge in jobs in the STEM field in the next decade as the baby boomers retire and world changes with globalization has been foundational to the push for science and mathematics success through the integrated, hands-on approach of STEM, which is designed to develop the variety of skills essential to success in such a changing climate: critical thinking and problem solving, creativity and innovation, and communication and collaboration (Bybee, 2013; Weaver Burgess, Childress, & Slakey, 2015) to name just a few—skills that are the very foundation of AWKL. The difference and the part missing in STEM for Aboriginal learners is the cultural lens through which they view their world and approach learning. As a historically oral culture, this cultural lens includes learning through narrative, story, music, ceremony, mentorship, traditional practice, and learning from the land—ways that have historically been given significantly lesser merit as “the arts” in the Western system than science and mathematics, yet are critical for a holistic understanding of nearly any topic (Trilling & Fadel,

2009). Culture and the arts, in my opinion, are crucial missing pieces and the bridge to Aboriginal engagement and success in the current education system. In my research it is this piece that is the natural linker for explaining and sense-making, that actually bridges cultures and enables understanding. Interestingly, recent studies on the effectiveness of STEM have shown that many non-Aboriginal students who initially engage in STEM leave after some time (Cox, 2016; Maeda, 2012). Thus, something must still be missing. In light of the recent Truth and Reconciliation Commission's Calls to Action (TRC-CTA), which call for culturally relevant education for Aboriginal learners (TRC, 2015), I believe the "newly" emerging field of STEAM (science, technology, engineering, arts, and mathematics) (Cox, 2016; Maeda, 2012; STEM to STEAM, 2016) is a more culturally and holistically relevant way to invite, engage, and enable learners, Aboriginal and non-Aboriginal, in the sciences and mathematics. My own work engaging Aboriginal youth in science through narrative and theatre as well as my teaching practice (hands-on-learning-by doing) unknowingly has naturally been that of the "newly emerging" field of STEAM. Liberal education could be, I believe, the forum for moving STEAM forward.

We, as a society, are in a current global environmental and economic crisis, and we have arrived here through the explosion in the advances of science and technology without due care and attention to what we are doing, and now we have to fix this situation. The retiring baby boomer population, who themselves had fewer children, will be off enjoying the fruits of their successes. This projected deficit provides a critical opening for the fastest growing population, the Aboriginal population. In fact, in the next five to 10 years we are going to see a very significant increase in Aboriginal students in the education system at all levels (Statistics Canada, 2012). As educators and curriculum developers we need to prepare for this. It is a critical time of building bridges and creating paths to enable equitable Aboriginal academic success at all levels, and as Justice Murray Sinclair and National Chief Perry Bellegarde say, "This is a national issue and we need to be in this together" (Address, U of S, November 20, 2015).

In closing, most non-Aboriginal educators support Bellegarde's statement and do want to be involved but are nervous and do not know where or how to begin. This valid concern is echoed by many of my own colleagues and is the foundation of many of the discussions at all levels among educators and policy makers across the nation. Coming to understand a different culture and a different way of knowing, especially in light of the negative history, is not easy and can be a deterrent for many who are already nervous about where to begin. It requires a willingness to engage, to listen and to learn on the part of both. "We can't just talk about it any longer," as my elder-friend said, "we have to help each other and show each other how to do it" (Marshall, personal communication, 2015). Indigenizing the curriculum is going to take time if we are to get it right this time, but having a willingness to engage and participate, to think creatively and outside one's comfort zone of academic expertise, is a step in engaging in the conversation and changing our teaching practice in ways that attend to AWKL. It is this type of openness to change that will open doors of access and, as importantly, create bridges for Aboriginal and non-Aboriginal peoples to learn from each other. The educators invited into this project were not familiar with the Aboriginal paradigm but had a willingness to take up the challenge and engage in the conversation.... such willingness allows the conversation to "grow in the middle" (Aoki, 1993) as we, as educators, move forward together in this time of globalization.

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Endnotes

¹Much political conflict exists around the correct terminology in reference to First Nations, Métis and Inuit peoples. For the purposes of this paper, Aboriginal and Indigenous will be used interchangeably to be inclusive of all.

² Canadian Education Association. (2015). Towards fewer dropouts. *Education Canada*, Summer Edition.

³ Alberta Education. <https://education.alberta.ca/teachers/aisi/themes/inquiry.aspx>

⁴ University of Lethbridge. Faculty of Arts & Science: Liberal Education. <http://www.uleth.ca/artsci/liberal-education>

⁵ Eskasoni First Nation in Unama'ki (Cape Breton, NS).

⁶ www.integrativescience.ca