

Empowerment and Motivation of Young Aboriginal Mathematics and Science Students in Canada

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Abstract

This article addresses the issues faced by the young Aboriginal students in urban and rural settings, which hinder their achievement in mathematics and science. An effort is made to reveal the techniques and programs that address the under-representation of young Aboriginal students in these subjects at secondary and post-secondary levels. Successful programming is essential to bridge the gap between differing urban and rural cultures and also to make the content material recent and relevant, thus providing a supportive environment. The Aboriginal students can be empowered to learn and be motivated to succeed by improving the linkage between Western and Indigenous thinking, by creating relevant and up-to-date curricula, and by providing adequate support at the family and community level.

The population of young Aboriginal students is rapidly growing in Canada; however, the rates of achievement among these youth are grossly underrepresented in high schools and post-secondary education. These numbers are even more reduced in the subjects of mathematics and science. Though there are a growing number of young Aboriginals entering into urban areas and attending city high schools, there are still diminished numbers of students pursuing studies in mathematics and science (Morrissette & Gadbois, 2006). Empowerment and motivational skills are key tools that are taught to most students in hopes of their becoming successful members of society; these tools are even more crucial to those students from Aboriginal backgrounds. For the purposes of this paper, the term Aboriginal will be used to represent those students of Metis, Inuit, and First Nations heritage. This article provides a background of the key problems facing Aboriginal students in urban and rural settings; as well as outlining techniques for providing sound teachings in mathematics and science with the purpose of empowering and motivating young Aboriginal students.

Current Issues Facing Young Aboriginal Students

Though the Aboriginal population in Canada is growing rapidly, there is still a strong dissonance between the number of young Canadian Aboriginals and the number of young Canadian Aboriginals who are graduating. Statistics for the graduation rates of Aboriginal students in 2011 indicated that less than 50% of students were graduating from high school (Pirbhai-Ilich, 2011). This statistic was in stark contrast to their non-Aboriginal counterparts, where the graduation rates were as high as 88% (Pirbhai-Ilich, 2011). There are three main areas of concern regarding the education of young Aboriginal students specifically in the areas of math and science: contradictory ways of thinking between Aboriginals and non-Aboriginals, a lack of relevant course material, and the absence of proper support systems.

Drastic differences exist in the way that science is viewed by Aboriginal and non-Aboriginal peoples. In this article, the term *Western* describes non-Aboriginal perspective of science and the term *Indigenous* describes the Aboriginal perspective. The Western approach tends to view science as an amalgamation of distinct subject areas, whereby the researcher acts as a separate entity quite removed from the subject matter of study (Hatcher et al., 2009). The overall aim of Western science puts an immense emphasis on finding definitive answers in an attempt to gain a certain level of power over nature (Aikenhead & Ogawa, 2007). Once this

power is attained by the researcher, the so-called mysteries of the universe will be unlocked and a level of ultimate knowledge will be achieved.

Indigenous science tends to have a more holistic approach to learning, or coming to know. Coming to know is a term that is used to describe the way in which Indigenous science is understood by Indigenous peoples (Colorado, 1988). The Indigenous researcher is not seen as a removed specimen, but more as an active participant who is thoroughly connected to the environment and the subject area. Knowing is based more on the experiential journey taken by the learner rather than on empirical evidence (Hatcher et al., 2009). This journey focuses on the relationships and kinships found between living organisms; allowing the learners to engage their body, mind, and spirit (Cajete, 2000). Because there is such a great disparity between the Indigenous way of viewing science and the Western way of viewing science, many Aboriginal students feel a certain disconnect with the subject area because they cannot grasp the differences in the ways of learning. Western culture is not conducive to Indigenous teachings and some Aboriginal students have problems trying to change the way that they think (Hatcher et al., 2009). As a result of this disconnect between the two ways of viewing science, many Aboriginal students pull away from the sciences and choose not to pursue them in their later high school years or in university or college.

Another problem that plagues young Aboriginal students is the perceived lack of relevance of the subject matter. Because there have traditionally been low numbers of Aboriginal students enrolling in science and math courses (Tait, 1999), many youth have not had the exposure to the subject areas that their non-Aboriginal counterparts have had. The absence of contact between Aboriginal students and the science and math subjects may be due to their living in isolated communities or their having few to no family members involved in careers that utilize the subject areas. This lack of exposure has led to several generations of underachieving minorities in these subjects (Varghese, 2009).

A lack of culturally relevant classes can also be linked to the differences between Indigenous and Western peoples' personal circumstances. Generally speaking, the home life of Aboriginal students is not the same as non-Aboriginal students in such factors as family structure, family occupation, community location and structure (Sutherland & Henning, 2009). The result of these differences between home environments and school environments is the offering of a science and math curricula that has the impression of an entirely foreign culture (Aikenhead, 1996), a culture to which Aboriginals have no real connections (Pirbhai-Ilich, 2011). Because Aboriginal youth do not have a significant connection to the sciences and math, they have low registration numbers in these areas in both high school and post-secondary education, leading to an overall disengagement from the subject areas.

The final issue that hinders the success of Aboriginal youth in the areas of science and mathematics is the lack of proper supports at the family and community level, which would include people in leadership roles. For those students living in relatively isolated communities, such as those in northern Manitoba, there is a scarcity of qualified support staff. Often, the only person qualified to help a student is the teacher, and quite frequently this teacher does not have adequate training in the areas of science or math (Professor Lindsay, personal communication, July 5, 2011). If in addition the student has a poor relationship with the teacher, he/she can be left feeling discouraged with the subject area and not want to resolve his or her negative experiences. As a result, the student could abstain from taking science and math courses in the future.

Traditionally, Aboriginal people have utilized techniques such as sharing circles, ceremonies, mediation, and storytelling as their chief means of interacting and communicating (Sutherland & Henning, 2009). These techniques of communication are usually facilitated by Elders in the community (Spence et al., 2007). It is a rare occurrence to see any of these methods of learning being used in today's Western classrooms. A lack of leadership, due to the ineffective use of Elders in teaching and learning, can lead to students' not having proper guidance in school, which can lead to floundering in their studies and a total disengagement

from science and math. The shortage of adults with post-secondary education in predominantly Aboriginal communities significantly affects the graduation rates of Aboriginal youth (Spence et al., 2007). Educational attainment declines when there are limited numbers of adults in proper educational leadership roles in the family or community; educational success further suffers when support from these people is lacking.

Practices Required to Build Motivational Skills and Empower Young Aboriginal Students

On a whole, it can be said that the levels of high school completion amongst Aboriginal youth are lagging behind their non-Aboriginal counterparts (Belczewski, 2009); however, certain practices can be implemented to thwart these issues and promote success. Throughout the country, several studies have been carried out that provide valuable information regarding the success of Aboriginal youth (for example, see Baydala et al., 2009; Houser & Bainbridge Frymier, 2009; Spence et al., 2007). There are also hidden pockets throughout the country where young Aboriginal students are thriving in their studies. These successful programs provide valuable information about what is required to empower and motivate Aboriginal youth. Three main areas need to be addressed in order to provide successful programming that empowers and motivates Aboriginal students: (1) creating border crossings between Western thinking and Indigenous thinking, (2) creating relevant and modern curricula, and (3) providing adequate support at the family and community level.

There are blatant differences in the way science and math are viewed by Indigenous and non-Indigenous peoples; however, these two different ways of thinking can be merged together to create a unified approach to “coming to know.” The Mi’kmaq people of Atlantic Canada have a tenet known as Two-Eyed Seeing. Two-Eyed Seeing allows a learner to view with one eye the strengths of the Indigenous ways of knowing and with the other eye the strengths of the Western way of knowing (Hatcher et al., 2009). By using Two-Eyed Seeing, the formation of an integrated curriculum can occur. This integrative curriculum can draw on aspects of both Indigenous learning and Western learning without either taking precedence over the other. Students who formerly struggled trying to adapt to a more Western mode of thought would have an easier time following a curriculum that more closely mirrors an integrated way of life between the two cultures.

One of the main reasons that Aboriginal students disengage from learning is due to the perceived irrelevance of the classroom curricula (Belczewski, 2009). This deficiency in relevance can be linked to the dissonance between school culture and home culture or a disinterest in the delivery method of curricula. Western type schools emphasize discussion and explanation (Varghese, 2009), which are not commonly used in Aboriginal culture.

One way to combat the stress caused by this discord, and at the same time demonstrate the relevancy of the curriculum, is to deliver the course materials by means of a more holistic approach – more specifically by using the Aboriginal model of the Medicine Wheel. The Medicine Wheel is a powerful and common symbol used in traditional Indigenous culture. Modelling and delivering courses via this framework will enable students to feel a certain kinship toward the material to be learned. A holistic approach can also tap into several of the multiple intelligences at one time (Hatcher et al., 2009). In Varghese’s (2009) broad frame for each of the four quadrants of the Medicine Wheel, lessons can be divided into seeing, feeling, knowing, and doing. Creating this harmony will empower students to excel and gain self-confidence.

Another way to make material relevant is by using teaching strategies that students are familiar with. This includes methods such as Elders’ stories, sharing-circles, reflection, and the use of technology (Sutherland & Henning, 2009). Knowledge that is passed down through Elders can motivate students to connect with their past, present, and future (Hatcher et al., 2009). Even if the specific material is more Western in nature, using traditional techniques can draw a link between the old and the new, and make the information more relevant. Schools that

offer culturally relevant teaching strategies are more likely to provide Aboriginal students with the tools that they need to succeed (Baydala et al., 2009). Like other youth, Aboriginal students thrive on the use of technology. Teachers must tap into the students' interests by using modern forms of technology in their teaching (Pirbhai-Ilich, 2011). The use of holistic teaching strategies and the implementation of technology is a surefire way to engage students and make the material relevant.

The final strategy that can be used to motivate and empower Aboriginal youth can be considered the most important technique: educators and community members must provide a respectful environment that is supportive and conducive to learning. The foremost way to provide a supportive learning environment is by having teachers who are passionate and motivated themselves. Teacher characteristics have a significant effect on student motivation and achievement (Houser & Bainbridge Frymier, 2009). Teacher clarity is ranked amongst the highest criteria for influencing student empowerment. Their empowered students are more likely to be motivated to complete assigned tasks and have greater self-esteem. Effective teachers must also navigate the bridge between Western and Indigenous science (Sutherland & Henning, 2009). This compassion for both ways of learning can provide the support that students need to be successful.

Another way to provide support is by developing a community of caring. Results from studies carried out by the British Columbia Ministry of Education and the Saskatchewan Department of Education show that communities that participate in activities that support schools are a key factor in promoting education attainment in youngsters (Spence et al., 2007). In several programs throughout Canada and the world, having community involvement has greatly inspired and motivated students (for example, see Aldous et al., 2008; Belczewski, 2009; Hatcher et al, 2009). One such summer-school program was offered to Aboriginal science students in Australia and the results were groundbreaking. Students significantly improved in their studies and in their behaviour and attitudes. In another program offered to the students of the University of New Brunswick First Nations Science Outreach Program, university students hosted a science camp within the Aboriginal community. The purpose of this program was to build relationships between educators and youth, and within the community itself. Positive relationships help to motivate and empower students by providing a supportive community (Baydala et al., 2009; Belczewski, 2009).

A final way to motivate and empower students is to surround them with inspiring and educated adults. Adults who value education can offer leadership and guidance to young students, with resultant positive effects on their motivation and future success (Spence et al., 2007). Encircling students with educated, supportive adults provides an environment that nurtures education and empowers students to succeed.

Conclusion

The growing populations of Aboriginal youth have not accompanied commensurate increases in high school completion rates. Strides have been made to address the low levels of high school graduates; however, many of these developments have not had much success. Problems such as the differences between student culture and school culture, a perceived lack of relevance of course material, and the absence of support from community and family members, trouble today's Aboriginal youth. These issues can be addressed by bridging the gap between the two differing cultures, making material modern and relevant, and providing a supportive environment filled with educated adults. Once these issues are addressed, students will feel empowered to learn and motivated to succeed. Education will be theirs for the taking.

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