Ability to Learn Mathematics for Aboriginal Students Increases if the Context, Personal and Cultural Relevance are Meaningful

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Introduction

For many years, the achievement and participation rate of Aboriginal students in mathematics in British Columbia (BC), Canada has been significantly lower than those of the general student population. The 2006 Canadian Census enumerated 3.8% of the country's total population to be of Aboriginal ancestry. This paper looks at the situated nature of numeracy and concludes that one’s ability to learn mathematics can increase if the context, personal and cultural relevance are meaningful. Members of the Haida Role Model Program in Haida Gwaii, BC, Canada were interviewed. The results of situated understanding may assist teachers to find ways of using this work to make mathematics school curriculum and pedagogy more meaningful for Aboriginal students.

Numeracy is a socially based activity that requires the ability to integrate math and communication skills (Withnall, 1995). Mathematics should be embedded in cultural activities that involve everyday tasks and solve everyday problems (Nunes, 1992). People of different cultures and different eras have engaged in mathematical activities to solve the problems they encountered in their daily lives. Numeracy has multiple layers and should be linked and contextualized.

Theoretical framework

Ethnomathematics has been identified as the study of mathematics that takes into consideration the culture in which mathematics arises (Ascher, 1991; Bishop, 1988; D’Ambrosio, 1985; Zaslavsky, 1991). D’Ambrosio (1990) also defines ethnomathematics in the following way: “Resorting to etymology, the term ethnomathematics is introduced as the art or technique (tics) of explaining, understanding, coping with (mathema) the socio-culture and natural (ethno) environment” (p. 22). Ethnomathematics seeks to identify the diverse ways in which cultural groups quantify, compare, classify, measure, and explain day-to-day phenomena in their own environment. D’Ambrosio (1990) acknowledges the need to consider a holistic view of mathematics that includes one’s culture, the culture of others, language, and the algorithms we use and combine to construct individual abilities or even disabilities in mathematics.

Lave and Wenger (1991) argue that many activities are learned through mutual engagement in a joint participation, called a community of practice, where the participants are involved in a set of relationships over time in a context of lived experience (p. 98). And that participation “refers not just to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities” (Wenger, 1999, p. 4). Hence, school mathematics is a form of situated learning, which needs to take place

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1 Aboriginal peoples in Canada comprise of the First Nations, Inuit, and Métis.

2 Numeracy means different things to different people. In this paper I consider numeracy to be multiple layered that requires the ability to integrate mathematics, situated and contextual problem solving, and communication skills.
within a context. The context needs to be mathematically meaningful to the learner, and the curriculum should make sense of the local social and cultural situations.

**Methodology**

In this study members of the Haida Role Model Program on the islands of Haida Gwaii were interviewed to determine how they “Do the Math” in the daily lives through the frameworks of community of practice and ethnomathematics. Haida Gwaii is a collection of islands situated off the northern coast of British Columbia, Canada and south of Alaska. Half the population on the islands belongs to the Haida nation, and the students of Haida heritage have lower performance and participation rates in mathematics. Though the Haida are a small nation and it is not necessarily representative of all the First Nations or Aboriginal people in the country, some of the numeracy practices of this nation are similar to those practiced by other nations.

The Haida Role Model Program consists of elders, professionals, and community members that go to schools and assist teachers in integrating Haida knowledge and perspective with the school curriculum. The Role Models provide a vital connection between the school district community and the Haida community. Since the Role Models had been screened and identified by the school district this group was representative of the community. Some of the Role Models interviewed were non-Haida, but were related to the Haida nation through marriage.

The primary data for this study consists of interview excerpts from thirty-three participants over the period of six months. All interviews were digitally recorded, and verbatim transcripts were produced. According to Patton (1990), full transcriptions of interviews are the most desirable data to obtain. An "open coding" system was developed and then the interviews were analyzed and documented to determine how the participants “Do the Math” in the daily lives. The mathematical practices in the community life of Haida Gwaii are unique to its people, land and context. One should be careful in generalizing such an experience for Aboriginal students in other regions or countries. Through the interview process a number of themes emerged concerning the effect of different ways of knowing on the success rates of Aboriginal students in school mathematics and mathematics-related disciplines. Those interviewed focused on different aspects of the issue and offered their point of view from their personal experiences in the community. Many connections were shown between the types of problems that people solve in their daily lives and the concepts taught in school mathematics.

Ability to learn mathematics increases when the students are taught skills that are useful for their daily functioning in the home, the workplace, and the community (Bishop 1988). The disposition that mathematics is useful and meaningful for Aboriginal students could also be mediated by showing them how traditional and contemporary cultural activities have many mathematical concepts embedded in them.

**Situated Learning**

When participants were asked to share a story about how they learned best, their answers invariably pointed to two factors. One, that learning was easier if it was situated in a context familiar to them. Secondly, the need to interact with those who have more experience and knowledge, such as a mentor, teacher or a guide to mediate their learning (Vygotsky 1986) was important to learning. Many Aboriginal students have difficulty relating to certain teachers because of cultural conflicts. They need a teacher who is a "culture broker" (Stairs 1995). A culture-broker teacher helps students move back and forth between an Aboriginal culture and the culture of Western mathematics (conventional school mathematics), and helps students deal with cultural conflicts as they arise. For the vast majority of students whose home worldview differs from the worldview of school, cultural border crossing is not smooth (Aikenhead 1997).
Irvine and Armento (2001) identify the significance and urgency of implementing culturally responsive pedagogy. This term implies that teachers should be responsive to the students’ culture in their teaching. Teachers should have high expectations and be aware of the prior knowledge, language, and experiences of the students in their classes.

Danny Robertson, director of the Rediscovery Program in Skidegate, is not Haida but his wife Nika Collison is of Haida heritage. He points out that he was successful when the learning mattered to him and it was practical:

Math was one of the subjects I found most challenging throughout elementary school and high school. … When I started working in the outdoor recreation business and started working as a sea kayak guide or rock climbing instructor—I really felt the pain of the lack of knowledge because simple calculations that are absolutely fundamental for safety were challenging for me. I got my unrestricted captain’s ticket and I got 95% on the exam. It is because it was really practical and something that I could wrap my head around. It was daunting but I was fully capable. Again, because it was relevant, there were other guides to help me, and I was interested. (Danny Robertson)

Figure 1. Eco-tourism promotes Haida Gwaii’s Natural and Cultural Environment

Cecil Brown, a young entrepreneur, relates his experience of also having difficulty in learning mathematics, but was able to learn the concepts once they were mediated in smaller components, and made contextual.

I was never good at math but I always started thinking with dollars. How could I put this money in my pocket and take it away. Fractions were the toughest thing for me but one of my teachers just explained with fishing and measurements of a pole and it eventually all clicked in. Basically you have to break it down, break it down, break down and then after a while you start finding all these shortcuts for yourself. I had to do an upgrade in math and this teacher really helped me because he broke it down for me. Breaking down all the concepts was—like basically just teaching you how to add again—everything made sense. (Cecil Brown)

Elder James Young started to learn mathematics when he was only three years old. His learning took place neither in a traditional way, but in a situation that involved reasoning, logic, patterns, and mental calculations while he played the game of checkers:

When I was a little boy, maybe three or four years old, my uncle used to come, and everyday we would play checkers. We had the checker board, and lined all the checkers up—I had twelve on my side; he had four on his side. Even though he had four checkers, he used to beat me. I never gave up and everyday we played checkers. Finally I won a game. When I won a game he added another checker to his side and played with five pieces. As I grew up and got better at the game he had to add more checkers. Pretty soon we were playing twelve against twelve. Since the way my brain was developed, before I even started school, I was good at math. (Elder James Young)
Guujaaw, an experienced carver and president of the Haida Nation, explains that learning is life-long, and he learned how to carve not by going to school but from others: I learned to carve from all the peers, the old people, the old collections—that is how most of us learn, eh. We didn’t go to school for that, we learned one-to-one… working as an apprentice and then learning on the job or actual doing it. It is continuous learning. (Guujaaw)

In Haida Gwaii many people used to work in fishing, forestry or other resource-based industries and those jobs are becoming fewer. Since many of these people don’t have formal education they now need to upgrade their education in order to be qualified for jobs in other trades. Bobbi Parnell, who works at the Masset Learning Centre, assists clients to gain skills and education so that they become self-sufficient through employment or self-employment. She observes that many adults find it a challenge when the learning is not contextual.

I would say there’s been very little success in the Adult Basic Education that’s going on in the community. Actually working on computers doesn’t work for a large number of people--they just give up. I think connecting it to their lives is really important. I think a lot of people drop out of the programs because ‘What is the use of this?’ ‘What does this have to do with my life?’ and so I think if they could learn math within the context of their everyday life—they’re trying to train for careers they have never been in before so they can’t connect to it that way so at least if they could connect it to their lives. I think practical projects are where they know it is a link to something—building is not cultural but practical. I have seen people who have succeeded in upgrading when they had a very specific goal. (Bobbi Parnell)

There is a commonality among the various participants. Learning takes place in situations of co-participation mediated by others in that community. Individuals do not see learning as the acquisition of knowledge so much as a process of social participation. Situated Learning in a community of practice involves much more than the technical knowledge or skill associated with undertaking some task. Members are also involved in a set of relationships over time (Lave and Wenger 1991). Eventually “learning as internalization, learning as increasing participation in communities of practice concerns the whole person acting in the world” (Lave and Wenger 1991, 49).

Early Intervention and the Role of Parents

Palmantier (2005) reported that Eurocentric approaches often do not fit the needs, interests, or development and learning styles of Aboriginal students. Early intervention to address student-learning difficulties in mathematics is more successful than responding to accumulated deficits at a later date (MOE 1999). The NCTM Position: Early Childhood Mathematics Education (2002) also affirms “high-quality, challenging, and accessible mathematics education for 3 to 6-year-old children is a vital foundation for future mathematics learning.”

Young children are naturally inquisitive about mathematics, and teachers can build on this inquisitiveness to help students develop the positive attitudes that often occurs when one understands and makes sense of a topic (Expert Panel on Early Math in Ontario 2003).
The most important connection for early mathematics development is between the intuitive, informal mathematics that students have learned through their own experiences and the mathematics they are learning in school. All other connections – between one mathematical concept and another, between different mathematics topics, between mathematics and other fields of knowledge, and between mathematics and everyday life – are supported by the link between the students’ informal experiences and more formal mathematics. (NCTM 2000, 132)

Beginning early, perhaps even before they are conscious of it, children form attitudes about mathematics. In many cases, a parent’s frustration or discomfort with mathematics influences a child’s perspective. The parent's attitude may well result from her or his own early mathematical experiences, forming a vicious cycle of negativity.

Elizabeth Moore, chief councilor for the Masset Village Council, believes in the importance of all children being numerate, and that there should be mentoring opportunities for the weaker students. The children need to be challenged with learning opportunities inside and outside the classroom.

I want our children to have the needed math skills. My daughter is in grade 4 and I challenge her. The other day I asked her what is 16 times 60. I knew she didn’t know the answer, but I just wanted to challenge her. She just said that the answer is big. … We also need the kids to have way more opportunities on the land rather than sitting in the classroom. The kids need to be out there picking berries, gathering spruce roots, looking at the tidal pools. (Elizabeth Moore)

Reg Davidson, a carver feels that if as a parent he did his job, then teachers would be able to do their jobs as teachers. He also believes that people become accustomed to doing things a certain way and it is difficult for them to change. He also said that “You need to work with yourself first and then you work with your family. So you start with yourself first instead of trying to fix the world. The world will change”.

Figure 3. Reg Davidson starting with a Scale Drawing of 18:1 and using a Variety of Tools to Carve the Actual Totem Pole

While teachers and educators are still the purveyors of formal knowledge and the curriculum of mathematics education, parents and other members of society play a key role in a child’s success. Attitude about mathematics start to form even in the early years of a child. Sometimes, difficulties experienced in school stay with members of society for the rest of their lives, not just through the formal years of learning. Parents need to be more involved in what is going on and understand the importance of their role in their children’s education.

Changing Personal and Community Attitudes towards Mathematics

For Aboriginal students to succeed in mathematics, they and their families need to have a positive attitude toward mathematics, and they need to view it as valuable component of their education. As reported in the Royal Commission on Aboriginal Peoples, “Education programs carefully designed and implemented with parental involvement, can prepare Aboriginal children to participate in two worlds with a choice of futures.” (p. 442). Community attitudes towards mathematics can have a dramatic effect on the learning of mathematics by students. Unfortunately it seems acceptable in many social settings to say “Oh, I was never that good at mathematics” and yet there is almost
universal agreement that mathematics is an important school subject (NCTM 2000). It seems like one of the solutions to halting the downward spiral of negative attitudes is to improve experiences in mathematics classrooms. Parents care a great deal about how their children feel about their classroom experiences, and do not value a classroom that bores their children, or, makes their children feel incompetent and worthless. If student success can improve, and they begin to enjoy learning mathematics, we can initiate a cycle of positive attitudes. Students will find greater success when they find greater motivation to learn mathematics. Motivation and change of attitude can improve when students do tasks that are personally relevant, explains Danny Robertson:

- It is also a lot easier if kids can identify personally with what they learn. —there is motivation to want to learn more about it. Like in my case, learning mathematics was brutal for me until I was a captain and it really mattered and I really found it interesting and then I learned what I had to do. My attitude changed. (Danny Robertson)

- Students often mistakenly believe they do not need mathematics because they are “only going to be” some occupation, but that they find in fact it is quite dependent on mathematics. When mathematics becomes clearly important to students’ futures and their daily living then they will learn better, and enjoy it more at the same time. In fact, success itself breeds enjoyment. Changing societal attitudes discussed above are in themselves a challenge, but implementing these changes would require sustained efforts from the various stakeholders.

**Culturally Inclusive Pedagogy**

A key concept shared by many Aboriginal people is that of *relationality*, which is the belief and understanding of the interconnectedness of our world and all within it. In addition, relationality encompasses other realities that we cannot see, but of which we are aware (Wilson 2003). Aboriginal students participate in two cultures – the culture of the home and the culture of the school. Many of these students see little connection between these two cultures; and consequently many potentially rich situations from the native culture are nowhere to be found in the school (Davison 2002). James Sawyer, a carver and jewelry maker, suggests that student should get a chance to watch artists in action to learn concepts in mathematics:

- I think the kids would probably get a lot more interested if they were watching guys carving up poles or sculptures or even showing them the breakdown of bracelets or whatever on paintings because everything sort of starts in a square. From the square you go out to a three-dimensional piece—because most of the carvers will start with blocks and do everything in blocks and then after the blocks are done and they make sure the blocks are even, then they round them into their geometric forms or ovoid forms. Everything on the poles is symmetrical—they’ve got a lot of mathematics and measuring they do. (James Sawyer)

**Figure 4. Designs are Created on Tracing Paper before being made into Silver Bracelets by James Sawyer**

Davison (2002) asserts that the use of cultural situations can improve the learning of mathematics by Aboriginal students in several ways. When the teaching of mathematics uses ideas from the culture, students value their cultural heritage more. The integration of the students' experiential mathematics with their school mathematics can help them make new
connections. Guujaaw suggest that we should not just focus on the curriculum but also find way to integrate the learning with the land:

I think that the problem with our schools here is that the real-life opportunities apparent and in the lands and culture around us are ignored. A student might learn about things all around the world, but there is little attention to seabirds, or any of the many aspects of biology or about care of the oceans, and management about the resources, which people can build careers around. The flexibility has got to be built into the curriculum to allow our kids to learn about those things that are relevant to the life in the place that we live. (Gujaaw)

**Figure 5. Is the Tide Coming In or Going Out at North Beach?**

Many researchers suggest that when culturally inclusive curricula and pedagogy are delivered in a way that accounts for learner diversity, then Aboriginal students’ achievement improves significantly (Aikenhead 2002; Davison 2002; Hankes and Fast 2002; Irvine and Armento 2001; Jeffrey 1999; Nichol and Robinson 2000). Bishop (1988) indicates that the cultural background of students is rich in terms of the resources from which mathematics concepts can be developed. It is easy to talk about having culturally inclusive pedagogy, but the reality is, if a teacher is just going to be using a handout or a worksheet to make it culturally relevant, then it defeats the purpose. The teaching needs to be done in imaginative, creative ways where the students are motivated to learn in ways that are interactive and engaging. Stigler and Hiebert (1999) in *The Teaching Gap* argue that most efforts to improve education fail because they don’t have any impact on the quality of teaching inside the classroom. They also claim that there is no system in place to make things better, and it is teaching, not teachers, that must be changed. Learning activities should build upon a student’s prior knowledge and present mathematics in an exciting and inclusive way.

**Learning on the Land**

As mentioned earlier, contextualizing and making connections are powerful processes in the development of mathematical understanding. “When mathematical ideas are connected to each other or to real-world phenomena, students can begin to view mathematics as useful, relevant, and integrated” (WNCP 2006, 7). About thirty years ago, the Rediscovery Program (Henley 1996) started as a single camp near Masset in the north, and then it grew from its successes into an international organization. The purpose of this program was to reintroduce the youth of a particular culture or nation to their culture on the lands they own. For example, every summer Swan Bay Rediscovery Program is run in the south part of the island, for the purposes of giving the youth life skills, job skills, and cultural knowledge through a variety of activities. These activities include experiences in hunting and food gathering, cedar bark weaving, and learning about historical and archeological sites. The students learn how to read tide books, charts and mapping, compass work, chart work. They also have to plan meal where they need to calculate how much food they need to bring, and take the responsibility of finding resources in the wilderness. Danny Robertson, director of the Swan Bay Rediscovery Program, mentions they “teach concepts that can be tied to their culture-- anything from just simple food gathering to safe hunting protocol to reading the tides. All the activities require a lot of problem solving and focus on mathematical skills”.
Schools and Community

Many Aboriginal communities are still in the process of healing. It is critical to understand the current realities of their communities for the problems and challenges they face are complex (Kavanagh 2006). Many students find it difficult to make a connection between the mathematics concepts they learn in school and what they are using in their daily lives in their communities. Mediating meaning for Aboriginal students by showing them how traditional and contemporary cultural activities have many mathematical concepts embedded in them could motivate them to learn. Schools need to build the confidence and trust of the community by reaching out to them, and being respectful of their cultural traditions. Kim Davidson, a carpenter in Masset, wonders how the cycle of oppression can be broken:

In Aboriginal community across the country there is a system of institutionalized racism at work. What I see is that Aboriginal people that have gone through the school system have not had a very good experience. So they return to their communities with their bad experiences, their kids continue to struggle through it and they probably have bad experiences. Now, you have a whole population of people who don’t understand what is going on in the world. Especially with the oppression that is happening within the Aboriginal communities. (Kim Davidson)

An outreach program like “Homework Helper,” could be developed to help parents or grandparents to understand what their children are supposed to do, so that they may be able to help them. Like reading stories, the parents could do interactive math activities such as counting, measuring, designing, estimating, locating, or even game-playing (Bishop 1988). There needs to be a viable support system in place which could offer more one-on-one help for students in the form of tutorial sessions, these could be held at a venue other than the school.

Bernard Kerrigan, who formally studied education and law at university and now resides in Old Masset as a carver and jewelry maker, thinks that smaller classes would help. This way the teacher would be able to monitor each student and make sure that they know the skills. Another factor that he thinks impedes learning is that some students miss a number of classes due to a variety of reasons. In such a case the parents or guardians need to be contacted right away, with the assistance of a liaison worker or the support of a home-school coordinator. This should also be part of the outreach program. He also thinks that math anxiety and a teacher’s disposition towards mathematics is also a factor in students’ learning:

I had one instructor in college who loved figuring stuff out and he just had a joy of mathematics and sees the fun—like the way he looks at it I couldn’t imagine someone not enjoying mathematics being taught by him because he is just so enthusiastic of it. I see a lot of teachers that expect the children that have trouble with mathematics to live up to whatever expectations you have, you live up to that—so if you expect them to enjoy math and have fun with it and you teach that to them that it is fun and not something to be afraid of. (Bernard Kerrigan)

Jason Alsop, a recent graduate, talks about the realities of a mathematics classroom. He wondered how difficult it is for a teacher to support all learners, provide differentiated instruction, and give individual attention:

What I realized in my time is that you need the support—like in some colleges they have activity centers where you can go get extra help at a time when you have questions. But in a high school class it seems like—there is one teacher for the whole class and there are about four different levels for that one class. So teachers get impatient with the lower level students at times. They don’t have time to re-explain things so they say ‘I’ve already explained this, I don’t have time to deal with you’ and ‘I have got someone over here that is doing really well and I would rather help them do really well than help you get to the mid-level.’
seems like they prioritize a little bit. They only have an hour to do their thing and teach all the students. (Jason Alsop)

Today’s mathematics curriculum from pre-kindergarten to Grade 12 is in most cases limited to valuing aspects of the Eurocentric world by sharing its successes but ignoring those of other cultures. Students of Indigenous and multicultural heritage frequently face the challenge of learning in an environment that may undervalue or ignore their cultural backgrounds. Principles and Standards for School Mathematics (NCTM 2000) advocates the need to learn and teach mathematics as a part of cultural heritage and for life. Achieving this goal requires a paradigm shift in the way mathematics is taught and the introduction of culturally inclusive curricula and pedagogy. Learning activities should build upon a student’s prior knowledge and present mathematics in an exciting and inclusive way. Context combined with content should direct teaching in the ongoing cultural quest for knowledge.

Straddling the Worldviews

Knowledge among Aboriginal people is acquired in multiple ways, but the coming-to-know process is nevertheless extremely systematic in both epistemologies. Vonnie Hutchingson, Director of Haida Education with School District No. 50 stresses that it is really important to know that in the traditional Aboriginal worldview everything came as a whole and there weren’t separate and discrete parts. Everything you know connected to different aspects of your life. “So, if you looked at mathematics specifically and you asked elders how it is that we use mathematics in our daily lives, they would have a really hard time trying to articulate that because it was in everything that we did and it wasn’t segmented out” (Vonnie Hutchingson).

Aikenhead (2002) provides a gentle warning to proceed cautiously as it is easy to misunderstand culturally embedded meanings when we do not fully share the other person’s culture. He indicates that we need to how respect for Aboriginal knowledge and learn from the Aboriginal people and remember that gaining Aboriginal knowledge is a process of coming to know. Students need to know about different worldviews; both worldviews are an expression of the creative process that connects all things. Cajete (1999) explains that Indigenous peoples have historically applied the thought process of creative science within cultural contexts, which are holistic. Every Indigenous culture has an orientation to learning that is metaphorically represented in its art forms, its way of community, its language, and its way of understanding itself in relationship to its natural environment.

Language is said to be the root of many cultures. Words in a language, the ideas and feelings they represent, and the ways they are spoken allow people to fully express their traditional beliefs (Reed 1999). It is no exception with the Haida culture. Diane Brown, a Haida language teacher expresses the difficulty students’ face in learning their heritage language:

It is hard for the kids to be good in both cultures. I think right now they are more in the white world than our world. I think there is an inner need and an inner will to be that and some of them will come here and think they could learn the language just like that and the reality is it’s difficult so they don’t come very often.

(Diane Brown)

Shared Learning (1998) states that Canada’s Aboriginal peoples value a legacy of oral tradition that provides an account of each group’s origins, history, and spirituality. Stories bind a community with its past and future, and oral traditions reach across generations, from elder to child, and bear witness to how women and men were created and populated the land. There is a need to recognize the existence of multiple worldviews and knowledge systems, and find ways to understand and relate to the world in its multiple dimensions and varied perspectives.
Conclusions

The definition of success is complex and unique to each individual and community. Should success be based on the scores of a large scale or should it “involve children being self-confident, understanding their own culture and traditional values, and have a positive self-identity” (Kavanagh 2006, 20)? According to the British Columbia, Ministry of Education (2002, 2005 and 2006), in the annual report titled *How are we doing? Demographics and performance of Aboriginal students in BC public schools*, data have consistently shown that many of the province’s Aboriginal students perform lower than non-Aboriginal students in their achievement in mathematics. This has become a cause for concern as success is solely measured on the basis of data from provincial assessment. Such results do not reveal the whole picture of the community. Many members of the community are adamant that their children should learn mathematics that is “authentic”. They also want to see that their culture is acknowledged and represented in the curriculum but do not want a “watered down” curriculum for their children. Success is a difficult concept that should not be solely based on academics or economics but should look at life in balance.

The complexities that come into play when two fundamentally different worldviews converge present a great challenge. Many participants suggest that Aboriginal students should seek knowledge from both worldviews and recognize their interconnectedness. The dialogue needs to be a two-way street, rather than a view that the problem is to get Aboriginal people to buy into the Modern system. Aboriginal people may need to understand mainstream mathematics, but not at the expense of what they already know. Non-Aboriginal people, too, must recognize the existence of multiple worldviews and knowledge systems, and find ways to understand and relate to the world in its multiple dimensions and varied perspectives. Interconnected ways of knowing can motivate students in learning mathematics, and also increase all students’ levels of mathematics.

A number of themes have emerged as to what can be useful in integrating students’ experiential mathematics with their school mathematics, for the purpose of helping them be motivated and make new connections to improve achievement. Learning needs to be situated and in context. Students need to interact with those who have more experience and knowledge, such as a mentor, teacher, elder or a guide to mediate their learning. Students need the ability to be able to straddle between different worldviews in imaginative and creative ways. Early intervention with increased parental involvement can make a difference to students who have difficulties in learning mathematics; this is far more effective than responding to accumulated deficits at a later date. Changing societal attitudes towards mathematics can be challenging, but they can have a dramatic effect on the learning of mathematics by students. Where possible, culturally inclusive pedagogy should be utilized that accounts for learner diversity. Schools need to change the structure inside and outside the classrooms so that there are more outreach programs that utilize the resources of the land and the expertise of role models. Implementing changes is not easy. It is easier to talk about these ideas and themes than implement them because of a variety of factors. Progress will be slow, but first steps need to be taken with the intention of ongoing, continual improvement. Eventually, ability to learn mathematics for Aboriginal students can increase if the context, personal and cultural relevance are meaningful.
References


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**Figure 1. Eco-tourism promotes Haida Gwaii’s Natural and Cultural Environment**
Figure 2. Elder, James Young, in Skidegate, BC

Figure 3. Starting with a Scale Drawing of 18:1 and using a Variety of Tools to Carve the Actual Totem Pole

Figure 4. Designs are Created on Tracing Paper before being made into Silver Bracelets by James Sawyer
Figure 5. Is the Tide Coming In or Going Out at North Beach?

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