

Report BIRS Workshop First Nations Math Education

Mathematicians and math educators from Western together with First Nations elders, teachers and bands representatives have met twice at the Banff International Research Station; the first time in June 2006 and the second time in December 2007. The purpose of these meeting was set in motion a variety of initiatives to move forward in promoting mathematical opportunities for Aboriginal and First nation students.

The workshop was based on the impression that First Nations/Aboriginal student participation and success in school math programs is limited. This impression was readily confirmed by data presented.

The performance of Aboriginal students in BC for the last five years has been significantly lower than the performance of non-Aboriginal students¹:

As early as grade 4, Aboriginal students lag behind their non-Aboriginal classmates by about 20% in their performance on the Foundation Skills Assessment in numeracy.

By grade 10, the gap widens and only 47% of Aboriginal students fulfill the expectations in numeracy, compared to 77% of non-Aboriginal students.

¹ “*Demographics and Performance of Aboriginal Students in BC Public School*, (2004), and *Report Card on Aboriginal Education in British Columbia* (2004), *Working Group 1a Report: Mathematics Education in the Aboriginal Community*. Kanwal Neel (Simon Fraser University): Louise Poirier (Université de Montréal) July, 2005

Over the last seven years, only 5-7% of Aboriginal students have written and passed the Principles of Mathematics 12 provincial exam, compared to 25-27% of non-Aboriginal students.

In the same period, 38% of Aboriginal students completed their grade 12, and graduated from secondary school, while 77% of non-Aboriginal students graduated.

We find the same pattern on Aboriginal students performance all over Canada, however there are not exact figures since the test data from different provinces are not available.

It was agreed by participants that successful achievement in math programs is critical for Aboriginal students if the outcome of cultural, political and economic equity for Aboriginal peoples is ever to be realized. Several participants in the workshop described barriers to success for Aboriginal students and identified the shortcomings of current approaches. Most prominent among these were: the cultural and social dissonance between school and one's Aboriginal society; the inhospitable nature of public education systems for Aboriginal students in that their history is ignored and their potential unrecognized; the absence of math programs that lead to success, for all students; and the lack of teachers trained to successfully teach math. These factors, when considered together, constitute insurmountable barriers to success in math for Aboriginal students.

The workshop presenters provided examples of inspiring initiatives that are overcoming one or more of the above barriers. Other experts shared

information about the powerful and effective traditional mathematical knowledge of First Nations peoples, which should become part of every teacher's lexicon when presenting mathematics.

In our discussion we found that one of the main factors that prevent aboriginal students to have access to a good math education is teacher's preparation. All teachers of aboriginal peoples in Canada need themselves to be properly prepared to teach mathematics, and to teach it effectively within the culture of their students. Teachers must have the necessary knowledge of mathematics in order to be able to teach effectively, and to increase their expectations about aboriginal students. First Nations students can do mathematics, and they must be given the confidence to become successful in this area.

It was very useful to have a collection of the people who have actually worked on these problems, and experienced those challenges first-hand, share those experiences with all of us and engage in a dialog about solutions. Mathematicians, Elders, Math Educators and teachers were involved in this workshop.

Although much work remains to be done in this arena, there are models for addressing the challenges that have achieved some success, both in Canada and the U.S., and having some models that have worked available for presentation, analysis, and development.

What are the outcomes you would like to see with respect to math education for First Nations?

The ultimate goal would be to have all First Nations people have access to quality mathematics education, and be well-prepared to take advantage of it. There are a number of pieces to this puzzle that need to be addressed. Here is a partial list, certainly quite incomplete.

1. All teachers of aboriginal peoples in Canada need themselves to be properly prepared to teach mathematics, and to teach it effectively within the cultures of their students.
2. The mathematics curricula in First Nations schools must be up to the standards of curricula in other schools, and provide students with a realistic chance of being prepared to continue on to college if they so choose (and they should be strongly encouraged to so choose). This does not necessarily mean having, say, calculus available by the end of the twelfth grade, but students going on to college should be within one precalculus course of being ready to engage calculus.
3. It is important for students to understand that mathematics is an important element of their own living cultures, and not something that is solely “white people’s knowledge,” to put it bluntly.
4. It is also important for students to see mathematics as something that can be interesting and rewarding, rather than as a dry subject whose only value is in its utility. The latter is an approach that has too often been taken elsewhere, for example in the mathematical education of American Indians in the U.S., and has not created very many enthusiastic students of mathematics.

How do you think we can get there?

That, of course, is the tough question. Though volumes could be written about different pieces of this puzzle and possible solutions, here are at least some items that could be addressed by PIMS, colleges and universities throughout Canada, and other institutions in the nation.

1. Changing the attitudes of both teachers and students, was agreed by the participants, was a good way to start. Teachers could be the harbingers of academic and cultural change, and we as a community should support them. One way to do it is by empowering teachers in providing them with the necessary knowledge of mathematics in order to be able to teach effectively. Teachers should also have high expectations for their aboriginal students, and a good way for this to happen is by learning more about First Nations culture and traditional

ways of knowing. First Nations students can do mathematics, and they must be given the confidence to become successful in this area, a good teacher can give them the confidence and the skills.

2. Teachers, mathematicians and elders should come together to create a workshop program for improvement in math education among aboriginals, where the standards of mathematics learning will be high, and the cultural context will be acknowledge. The powerful and effective traditional mathematical knowledge of First Nations peoples, should become part of every teacher's lexicon when presenting math. It is important for students to understand that mathematics is an important element of their own living cultures, and not something that is solely “white people’s knowledge,” to put it bluntly. Teachers need to teach math in the cultural context of the students; recognize the historical and practical role of math in the traditional and current lives of First Nations/Aboriginal people and introduce the rich history and its current significance in the field of math. Elders should be invited to talk to teachers and mathematicians about traditional ways of knowing, and how mathematics is and was part of their traditional culture. The goal is that teachers will have a greater appreciation of the aboriginal cultures and this will be reflected in their teaching. Mathematicians on the other hand, can learn from elders different approaches to mathematical thought. In addition, mathematicians could help Elders by making them aware of the mathematics in their traditional knowledge.
3. Teachers of aboriginal peoples in Canada need themselves to be properly prepared to teach mathematics, and to teach it effectively within the cultures of their students. We should provide opportunities for teachers of aboriginal schools to develop their math knowledge and math teaching skills. Mathematicians and math educators should find ways to provide math workshops for teachers, in areas where we find that many teachers have difficulties understanding a concept and delivering it in class.
4. In-service teacher education programs should be designed that can deliver training to teachers in remote areas, and not require them to travel great distances to central locations. Creative distance learning models could be examined for their potential in this area.

5. Where culturally relevant mathematics materials exist (e.g., those designed by Jerry Lipka and his group at the University of Alaska), they should be made widely available to teachers of First Nations students, and workshops in their use should be conducted. These could be designed to be delivered using distance education models; see the point immediately preceding this one.

6. A course could be designed for teachers on the history of First Nations education, particularly its mathematical components. A similar course, on the history of American Indian education in the U.S., has proved to be a popular and interesting portion of the education of American Indian teacher aides in the ENACT program at Southwestern Indian Polytechnic Institute in Albuquerque, New Mexico.

7. More “Math Circles” types of activities could be designed for First Nations students, with the goal of introducing the students to truly challenging but interesting mathematics. College and university faculty should be instrumental in the design and delivery of these activities, and they should be available to students throughout the regular academic year, ideally on a weekly basis.

The ultimate goal would be to provide all First Nations people with access to quality mathematics education, and be well-prepared to take advantage of it. Knowing the math is key! First Nations people must be given the opportunity to obtain a solid foundation in mathematics and science. They must be given the opportunity to participate fully and equitably in a world now increasingly dependent on technology.

By working together, success is attainable. It is critical that those involved in the circle of education; primary, elementary, secondary, post secondary... coordinate their efforts and create a smooth transition from one level to the next, and the only way this can happen is by communicating and

learning from each other.

The workshops at Banff set in motions some of the initiatives we described above. Meeting between elders, mathematicians, teachers and math educators have been happening resulting in the development of materials that bring together mathematical and traditional knowledge.