

Discussions on Science Curriculum: Stories told from Northern Places

By

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Abstract

This thesis outlines some of the issues raised in approaching a culturally-relevant science curriculum. This research was undertaken in conjunction with the Champagne and Aishihik First Nations and local high school students. The students and I engaged in conversations around science, culture, and education with the intent of informing curriculum planners and educators of the issues facing First Nations youth in the Yukon. Present approaches to education and the nature of school science are discussed as well as the possibility and appropriateness of merging First Nations Knowledge with school science. Comments by students revealed they would like to see a cultural approach taken through science education that bears a stronger connection to their lives outside of the school setting.

Table of Contents

Title page.....	i
Abstract.....	ii
Table of Contents.....	iii
List of Tables.....	v
List of Figures.....	vi
Acknowledgments.....	vii

Chapter 1: Stating the Facts

<i>Introduction</i>	p.1
<i>Rationale</i>	p.4
<i>Yukon Perspective</i>	p.4
<i>British Columbia Perspective</i>	p.13
<i>Canadian and United States Perspective</i>	p.17
<i>Science Perspective</i>	p.18

Chapter 2: Troubling School Science

<i>Literature Review</i>	p.23
<i>Including Student Voices</i>	p.23
<i>Present Approaches to Education</i>	p.25
<i>The Nature of School Science</i>	p.28
<i>Should School Science be More Inclusive of Cultures</i>	p.32
<i>Should School Science be More Inclusive of Local First Nations Cultures</i>	p.33
<i>Possibilities for Merging First Nations Knowledge and School Science</i>	p.36

Chapter 3: Walking the Walk

<i>Methodology</i>	p.45
<i>Social Critical Theory</i>	p.45
<i>Social Critical Theory and Postmodernism</i>	p.47
<i>Research/er</i>	p.48
<i>Validity/ Truth and Knowledge</i>	p.51
<i>Research/ Interviewee/ New Imaginaries</i>	p.52
<i>Ethics</i>	p.55
<i>Method</i>	p.57
<i>Rethinking the Method</i>	p.64

Chapter 4: Talking the Talk

<i>The Data</i>	p.68
<i>The Themes</i>	p.68
<i>The Vignettes</i>	p.72
<i>The Scripts</i>	p.76
<i>Script 1: What Is</i>	p.76
<i>Script 2: What Should Be</i>	p.80
<i>Script 3: When Culture Met Science. A Brainwave</i>	p.85
<i>Script 4: The Dark World of Stereotypes</i>	p.91
<i>Reflections on the Vignettes</i>	p.96

Chapter 5: Science is Science

<i>Limitations</i>	p.99
<i>Comments and Questions</i>	p.102
<i>What Students Want</i>	p.107
<i>Questions the Research Process Opened Up</i>	p.108
<i>Recommendations</i>	p.110
<i>Last Words</i>	p.112
<i>References</i>	p.115
<i>Appendices</i>	p.129
<i>Appendix A</i>	p.129
<i>Appendix B</i>	p.130
<i>Appendix C</i>	p.133

List of Tables

- Table 1. Total % Achievement in Math (2002-2003) First Nations vs. Non-First Nations**
p. 9
- Table 2. Total % Achievement in Language Arts (LA) (2002-2003) First Nations vs. Non-First Nations**
p. 9
- Table 3. % Participation Rates for 2001-2002 Provincial Exams comparing Aboriginal and All Students in British Columbia**
p.19

List of Figures

- Figure 1.* Achievement in Math Grades 3, 6, and 9 (2002-2003) First Nations vs. Non-First Nations. p. 7
- Figure 2.* Achievement in Language Arts (LA) Grades 3, 6, and 9 (2002-2003) First Nations vs. Non-First Nations. p. 8
- Figure 3.* First Nations students enrolled from K-12 by Grade Level from 2000/1 school year to the 2002/3 school year as a percentage of the total population of Yukon students. p. 11
- Figure 4.* Secondary School Progress: Student Cohort Entering Grade 8 in 1996. p. 16
- Figure 5.* Percentage of First-Time Grade 8 Students Progressing to a Higher Grade Level within B.C. p. 17
- Figure 6.* Science from a Native American perspective: A process oriented strategy. p. 43
- Figure 7.* Calvin and Hobbes comic strip p. 76
- Figure 8.* A Step by Step illustration to making dreamcatchers. p. 92

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I was fortunate to meet the acquaintance of five very cool high school students. Contributions made by Krystle Pelletier, Melissa Haywood, Brent Lamb, Chris Sterriah, and Doris Mervin provided the backbone of this research.¹ These students granted me the opportunity to hear about their experiences and thoughts about education in the Yukon. Their visions for education were inspiring and I hope this thesis in some way may help those visions become a reality.

I would like to thank my advisor and committee members who, despite overwhelming work loads, helped see this thesis to completion. The feedback provided by David Blades encouraged me to expand the depth and breadth of this work. As a student in the classrooms of Patricia O'Riley and Jennifer Thom I was challenged in ways I thought unimaginable. The foundations of 'truth' upon which I had always stood became shaky indeed. From them I have gained the courage to continue to question those foundations.

My friends Wendy Edwards and Mandeep Basran listened with smiles and enthusiasm and always offered the most sage of advice about school, work, and life in general. Thank you ladies. My family and friends in other parts of this country helped

¹ Students requested their real names be used.

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Changing the Space of Science Curriculum: Stories told from Northern Places

Chapter 1: Stating the Facts

As a young girl growing up in a northern community in Canada I spent time biking, swimming and fishing with my First Nations friends. Entering middle school we developed new friends and grew apart, something I thought at the time was a function of adolescence. However, when it came time to graduate, I noticed those First Nations friends from grade school had almost completely disappeared.

As I reflected on my experience, I realized that the science education I received in high school was a stepping stone that enabled me to become one of the scientists I had read about in magazines. I struggled through learning objectives and outcomes, memorized textbook facts and hoped that in university I might be able to study marine biology in an ocean ecosystem, instead of from a textbook in a classroom.

Unfortunately, the obstacles encountered in high school quadrupled when I entered university. It was the norm for me to scrape through courses by the skin of my teeth or perhaps fail them. I saw no connection between the processes and cycles I was memorizing in books to the world of biology I knew existed outside the lecture hall. Was it possible that other students were having the same experiences, or was my situation unique? How would the information I was learning in both high school and university prepare me for my role as a wildlife researcher?

Upon completing university and entering the world of research biology, I felt like I had moved beyond simply regurgitating facts and was free to become a creative biologist. In order to do my job properly it was necessary for me to listen, feel, watch and smell; senses I had not primarily used as part of my science studies since

elementary school were now essential in gaining a deeper understanding of the dynamics I was studying. The world of textbooks, classrooms, and fruitless memorization was behind me; that is, until I became a secondary school teacher.

As a teacher I felt it was my responsibility to impart my infinite wisdom in the areas of science and biology to my students. Further to this, it was necessary to follow the objectives and outcomes of the British Columbia Ministry of Education (2003a) science curriculum and to ensure the students had learned the information through appropriate means of assessment. This in itself does not seem problematic; that is until you peruse through the Science 10 curriculum and plan how you will teach, in detail, sections on Cells, Genetics, Chemicals and Reactions, Electricity and Magnetism, Radioactivity, and Earth Forces (British Columbia Ministry of Education, 2003a). I have found it difficult to teach this course without using a textbook-based, memorization/factual recollection approach. I realized in doing so that I was perpetuating the same experiences with my students by reinforcing a textbook-based, classroom centered, fact-laden curriculum. I found this problematic because I was teaching the curriculum in the same manner that was so discouraging and difficult for me to grasp as a student. There were inconsistencies between the skills I used as a research biologist and the skills I was having my science students develop. As a result of becoming more aware of my teaching practices within school science, I began to question the validity of secondary school science pedagogy. More significantly, I began to wonder how students were affected through the process of teaching secondary school science. Is it possible that students in my classroom could have experienced the same challenges I had throughout high school?

As a secondary teacher teaching science and biology in the Yukon, it was noticed that few of the First Nations students who started the year remained enrolled in my classes at the end of the school year. There was something unsettling about the decline in attendance rates of First Nations students as they moved up in grade levels. Because science is a core component of the curriculum until Grade 11, First Nations students who leave school earlier will not have had the opportunity to learn as much about science as their Non-First Nations counterparts. The prospects for these First Nations students entering the work force or post secondary education would be considerably minimized as a result of not completing secondary science. If this was the case, how was school science best preparing First Nations students for their future careers outside of school? Was it preparing them at all?

As a science teacher and member of the community, I felt it was my responsibility to address science education as it related to First Nations students and more significantly how First Nations students related to science education. First Nations students deserved representation in the conversation about school science and their thoughts were critical in understanding how they were affected by school science.

This thesis, *Discussions on Science Curriculum: Stories told from Northern Places*, provided an opportunity for students to speak about science education in Whitehorse, Yukon.

Chapter 1 provides the statistical rationale behind this research. The nature of education and school science is discussed in Chapter 2. This chapter makes an argument for including the cultural worldview of students to better facilitate their

learning within a science classroom and elaborates on the possibilities that exist for merging cultural knowledge and school science. A collaborative approach to this research was undertaken by the Champagne and Aishihik First Nations in the Yukon Territory, high school students in Whitehorse, Yukon, and I, and the methodology is explained further in Chapter 3. The results of this research are described in Chapters 4 . Chapter 5 is a discussion on the research, processes and further suggestions.

Rationale

Yukon Perspective

In 2003, First Nations students in Whitehorse represented approximately 21 % of the student population, 51 % of the rural Yukon school population and 28.5 % of the total Yukon student population (Government of Yukon, 2003a, p. 7, 8). There were 5,466 students enrolled in the Yukon public school system as of May 30, 2003, and approximately one fifth of the student population (or 1216 students) attended rural schools (Yukon Bureau of Statistics, 2003, p.1).

The *2002-2003 Annual Report* published through the Government of Yukon (2003a) released a number of statistics that illustrate the state of First Nations education. This report discussed the Individualized Education Plan (IEP), student achievement in Math and Language Arts (LA), and graduation potential.²

The Yukon Department of Education reported that “23% of all First Nations Yukon students were on IEP’s, whereas 7% of all non- First Nations Yukon students were on IEP’s” (Government of Yukon, 2003a, p. 13). Individualized Education Plans are put in place by the school to assist students in meeting the requirements of

² The Individualized Education Plan is a plan that describes the type of instruction, evaluation or assessment students with disabilities will receive.

the courses in which they are enrolled. The above statistics indicate that three times as many First Nations students compared to Non-First Nations students in the Yukon require specialized assistance in order to complete their coursework.

Student achievement in the Yukon is measured using Yukon Achievement Tests (YAT). These are “curriculum-referenced tests based on the Western and Northern Canadian Protocol common curriculum framework in Mathematics and Language Arts.³ This allows [the Department of Education] to... make comparisons to Alberta results” (Government of Yukon, 2003a, p. 16). The students write these tests at the end of the year in Grades 3 and 6 and at the end of their semester in Grade 9.

The *2002-2003 Annual Report* by the Government of Yukon (2003a) reported average scores for all Yukon students who wrote the YAT for Math and Language Arts Grades 3, 6, and 9 throughout the past three school years (2000-2001, 2001-2002, 2002-3). Average scores for First Nations students in both subjects and all three Grade levels were collected (with exception to Math and Language Arts 9 which were not recorded during the 2000-2001 school year for First Nations students). Thus, it is possible to compare the scores of all Yukon students to those of First Nations students. Although the two groups provide some level of comparison, it is not optimal because First Nations students' scores were included in the scores

³ “In December 1993, the ministers responsible for education in Manitoba, Saskatchewan, Alberta, British Columbia, Yukon Territory and Northwest Territories signed the Western Canadian Protocol for Collaboration in Basic Education (WCP), Kindergarten to Grade 12” (Western and Northern Canadian Protocol for Collaboration in Basic Education, 2003).

for all the Yukon students. The results do indicate, however, a trend that would only be amplified that much more if the two groups of comparison were separated on the basis of ethnicity.

These scores for First Nations students were compared to the scores for all Yukon students over the past 3 school years for Math and Language Arts Grades 3, 6, and 9 (with exception to Math and Language Arts 9 for First Nations students for the 2000-2001 school year). Comparison showed that for each grade and each year, First Nations student scores were below those of all Yukon students, ranging from 7-11.9 % lower (Government of Yukon, 2003a, p. 17, 19, 20, 21). If we were to compare only First Nations students with Non-First Nations students, the difference would be greater. Also, we do not know how many students are left by Grade 9; this would be a factor as well.

Another aspect examined in the *2002-2003 Annual Report* was achievement as a measure of “Success” or “Excellence.” “Success is defined as achieving a score of 50%-79% [and] Excellence is defined as achieving a score of 80%-100%” (Government of Yukon, 2003a, p. 22). These results were collected for the 2002-2003 school year and were divided so that *direct* comparisons between First Nations and Non-First Nations student scores could be made. Results of student scores in Math for Grades 3, 6, and 9 are shown in Figure 1.⁴

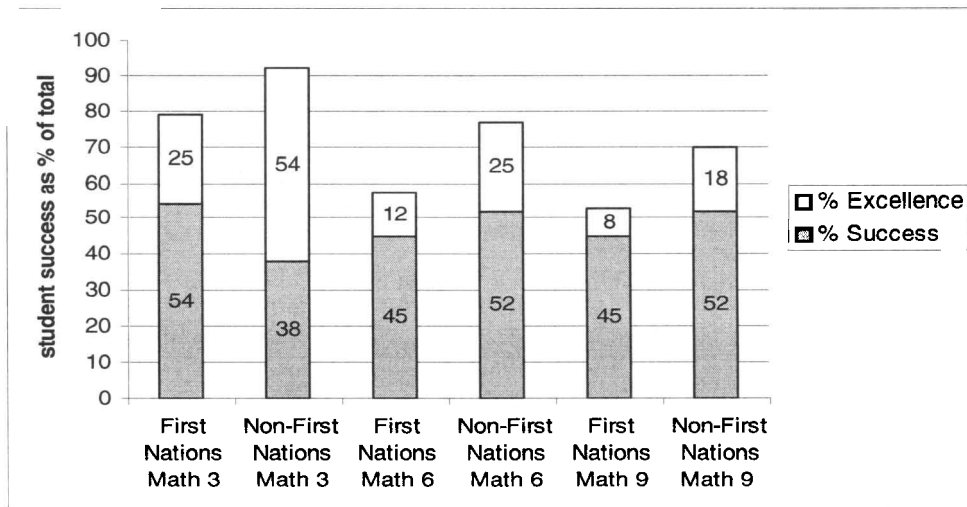
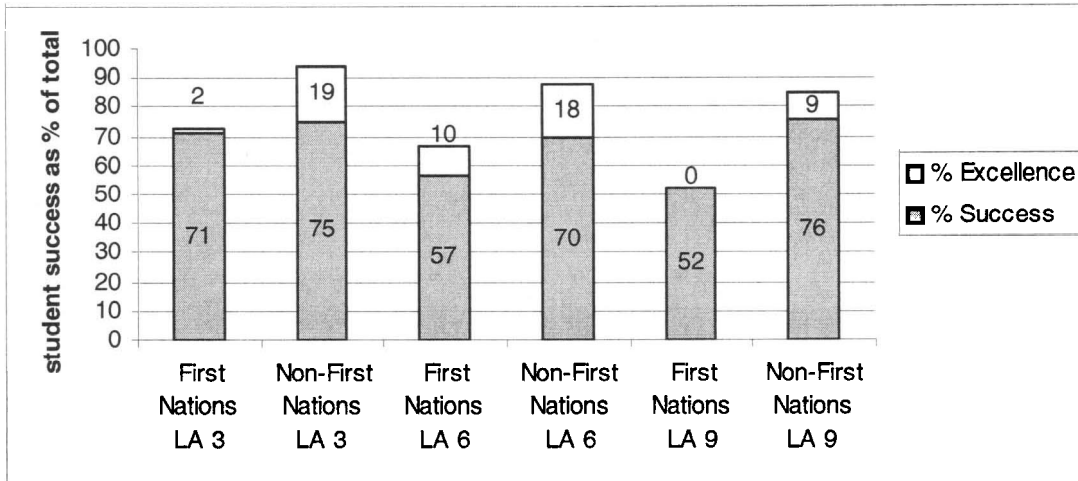


Figure 1. Achievement in Math Grades 3, 6, and 9 (2002-2003) First Nations vs. Non-First Nations. Success is defined as achieving a score of 50%-79%. Excellence is defined as achieving a score of 80%-100%. First Nations ancestry is based on self-identification.

⁴Adapted from "Annual Report 2002-2003" by Government of Yukon, Department of Education, p. 22-23. Copyright 2003a by the Government of Yukon. Adapted with permission.

Direct comparisons between First Nations and Non-First Nations students in Language Arts for Grades 3, 6, and 9 are shown in Figure 2.⁵



**Figure 2. Achievement in Language Arts (LA) Grades 3, 6, and 9 (2002-2003)
First Nations vs. Non-First Nations.**

⁵Adapted from *Annual Report 2002-2003* by Government of Yukon, Department of Education, p. 22-23. Copyright 2003a by the Government of Yukon. Adapted with permission.

Both Figure 1 and 2 illustrate that fewer First Nations students than Non-First Nations students are attaining over 50% on their YAT's at all grade levels in both Math and Language Arts. In Math 6 and 9 only slightly over half of all students who wrote the YAT received 50% or higher. Results for Language Arts were more favorable in that a higher percentage of First Nations students were successful for all grade levels; however their results were still lower than their Non-First Nations counterparts. Percent Achievement decreased in both groups for both subjects as students reached higher grade levels; this poses a larger problem to First Nations students whose results are already significantly lower than their Non-First Nations counterparts. If First Nations students are already at such a deficit in Math grades 6

and 9, how are they then prepared for the years of high school that lay ahead of them?

To acquire a better representation of the number of students achieving over 50% we can look to Tables 1 and 2.⁶ For these results I have added the percent “Success” and percent “Excellence” for each grade level in both Math and Language Arts. These numbers provide a better comparison between First Nations and Non-First Nations students in terms of how many students are reaching a level of “Success” and beyond.

Table 1.

Total % Achievement in Math (2002-2003) First Nations vs. Non-First Nations

<u>Grade</u>	<u>First Nations</u>	<u>Non-First Nations</u>
3	79	92
6	57	77
9	53	72

Table 2.

Total % Achievement in Language Arts (LA) (2002-2003) First Nations vs. Non-First Nations

<u>Grade</u>	<u>First Nations</u>	<u>Non-First Nations</u>
3	73	94
6	67	88
9	52	85

⁶ % Achievement is measured as a result of combining both Success and Excellence scores. (i.e. 54% + 25% = 79% - for First Nations students in Grade 3 Math). Success is defined as achieving a score of 50%-79%. Excellence is defined as achieving a score of 80%-100%. Adapted from *Annual Report 2002-2003* by Government of Yukon, Department of Education, p. 22-23. Copyright 2003a by the Government of Yukon. Adapted with permission.

Tables 1 and 2 illustrate the disparity in achievement scores between First Nations students and Non-First Nations students in both Math and Language Arts through all of grades 3, 6, and 9.

The Government of Yukon (2003a) in their *2002-2003 Annual Report* explains “that the number of Yukon First Nations students writing the various exams is too small to allow comparisons on the basis of ethnicity” (p. 24). The report does, however, indicate “82% of First Nations students with the potential to graduate were successful at meeting the requirements of graduation. This compares with 90% for non-First Nations students” (Government of Yukon, 2003a, p.28). The potential to graduate is defined as “any student enrolled in Grade 12 at the end of the year, provided they pass all of the courses in which they are enrolled” (Government of Yukon, 2003a, p. 24). Therefore, of the First Nations students who reach grade 12 and are enrolled at the end of the year, 82% of them succeed in graduating. Although these graduation statistics provide information about the number of students at the end of the year, they do not provide enrollment information at the beginning of the year, or reference the number of grade 12 students who receive leaving school certificates. The information for drop-out rates is not available for the schools in the Yukon Territory. Recording the graduation rates as a percent of potential to graduate is done only to compare results between Yukon and British Columbia. For the 2002-2003 school year 11% of Yukon graduates were of First Nations ancestry (Government of Yukon, 2003a, p. 24).

Time absent from school was compared and it was found that during the 2002-2003 school year in Whitehorse “First Nations students missed 17 days/year

on average whereas non-First Nations students missed 12 days/year on average” (Government of Yukon, 2003a, p. 25). It was noted that “[h]igh levels of absenteeism are typically associated with reduced performance and achievement” (p. 25).

The Government of Yukon (2003b) showed another significant indicator of First Nations success in education. Figure 3 illustrates the enrollment rates for First Nations students from Kindergarten to Grade 12 over the past three years in the Yukon Territory.⁷

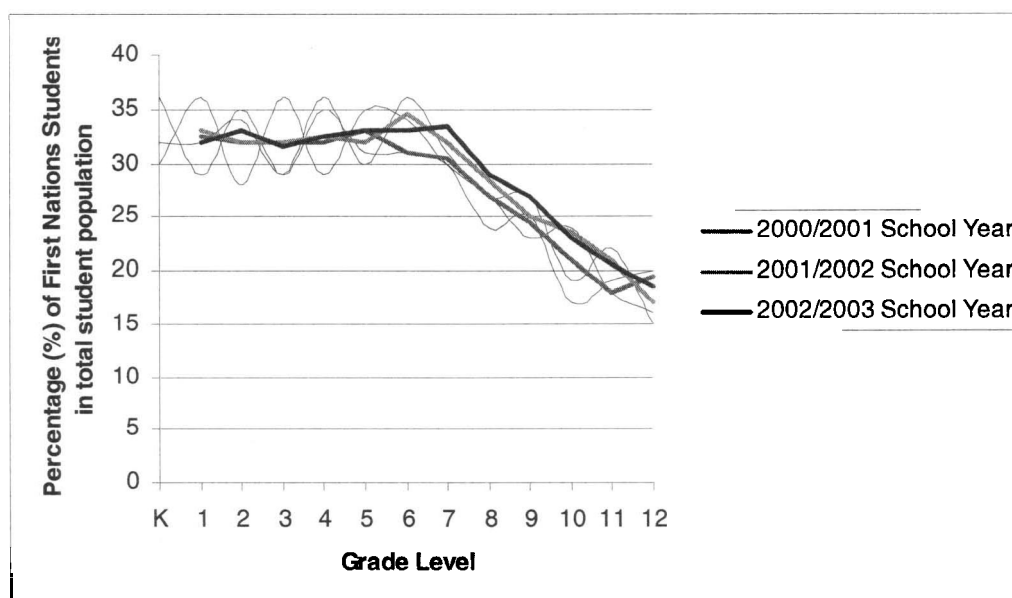


Figure 3. First Nations students enrolled from K-12 by Grade Level from 2000/1 school year to the 2002/3 school year as a percentage of the total population of Yukon students.

⁷Adapted from *unpublished data* from Government of Yukon, Department of Education.

Figure 3 illustrates the overall trend in enrollment of First Nations students in the Yukon over the past three years. Approximately 30 % of Yukon students who entered Kindergarten, for the years given, were of First Nations ancestry. The graph shows that around Grade 7, enrollment rates of First Nations students began to drop. By Grade 12, only about fifteen to twenty percent of the students in the school population in the Yukon were First Nations; about half the population that began in Kindergarten.

As there exists only 3 years of collected data on enrollment, it would be unwise to draw long term conclusions. Yet, the above statistics are unsettling and raise some important questions. If students are receiving the same curricular content, why the discrepancy in achievement? What causes student enrollment to decline around Grade 7? In a community effort to answer some of the questions raised by the aforementioned statistics, the Nacho N'Yak Dun First Nations in the village of Mayo, Yukon, initiated a study to inform the community and the Yukon Government about First Nations education in Mayo, Yukon.

After conducting more than 75 interviews with and distributing questionnaires to the members of the community, students, teachers and parents, McDonald (2003) made the following observations:

- Nacho N'Yak Dun (NND) students, parents, leadership, and education advocates have education goals that are either not consistent with, or are impossible to achieve, through the present program of study.

- The present system of education in Mayo continues to be destructive to the First Nation's cultural, spiritual, education goal, and general well-being, as articulated by NND society.
- Many NND students who have dropped out, found their school experience lacking in relevance to their lives, not associated with or reinforcing their cultural values and interests, and having too many problems within the system or at home to have the effort be worth the experience. (p.2)

It is important to emphasize that this study is particular to the community of Mayo, Yukon and caution should be taken if transferring these results to other communities or First Nations in the Yukon Territory. Although it would be inappropriate to assume similar findings in other places without a proper study, it is more than a coincidence that comparable statistics and observations have been found across Canada and North America (Barnhardt & Kawagley, 1998; Berkowitz, 2001; Bowers, 2003; Cajete, 1999; Coalition for the Advancement of Aboriginal Studies, 2002).

British Columbia Perspective

An annual report entitled *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools 2002-2003*, published through the British Columbia Ministry of Education (2003b) provides similar information on the performance and achievement of Aboriginal students in the province of British Columbia. This document reports on student achievement through the Foundation

Skills Assessment (FSA), results for provincial exams, and progress through grade levels. The FSA measures students' Reading, Writing, and Numeracy skills.

Much like the Yukon Achievement Tests, the FSA "is a set of written tests unique to B.C. that is administered to Grades 4, 7, and 10 each year in May in reading, writing, and numeracy" (British Columbia Ministry of Education, 2003c, p.4). The British Columbia Ministry of Education (2003d) paper on *Interpreting and Communicating British Columbia Foundation Skills Assessment Results* defines the percentage of students 'exceeding' or 'meeting' expectations.

The 'exceeds expectations' standard is defined as:

The level of a student's performance that is beyond that at which a teacher would say the student has fully met the expectations for the grade on this test. Student performance would be considered excellent for the grade on this test. The 'meets expectations' standard is defined as: The level of performance at which a student meets the widely held expectations for the grade on this test. (p. 3)

The report entitled *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools* showed data gathered for students who met or exceeded expectations in the areas of Reading, Writing and Numeracy from 2001-2003. The test results reported scores for students in Grades 4, 7, and 10 and were further divided into students who were Aboriginal and those who were Non-Aboriginal. The results showed that for each year and for each subject area, test results for Aboriginal students were an average of 21% lower than the scores for Non-Aboriginal students (British Columbia Ministry of Education, 2003b, p. 26).

In the same document, percentage of Grade 12 students who wrote and passed the English and Math 12 provincial exams were given. The exam results were recorded from the 1994/5 school year up to the 2001/2 school year. In comparison to Non-Aboriginal students, the exam results, on average, have been 31% lower for Aboriginal students who wrote the English 12 provincial exam and 20% lower for Aboriginal students who wrote the Math 12 provincial exam (British Columbia Ministry of Education, 2003b, p. 27).

In an effort to follow school enrolment by grade level, a cohort of Grade 8 students was tracked beginning in 1996. The report indicated that data include only public schools and that results were based on a minimum of 20 Aboriginal students and 20 Non-Aboriginal students (British Columbia Ministry of Education, 2003e, p. 1). Unfortunately, further information regarding the group size, number of Aboriginal and Non-Aboriginal students, and school districts involved was not provided with the report. Figure 4 illustrates those findings.⁸

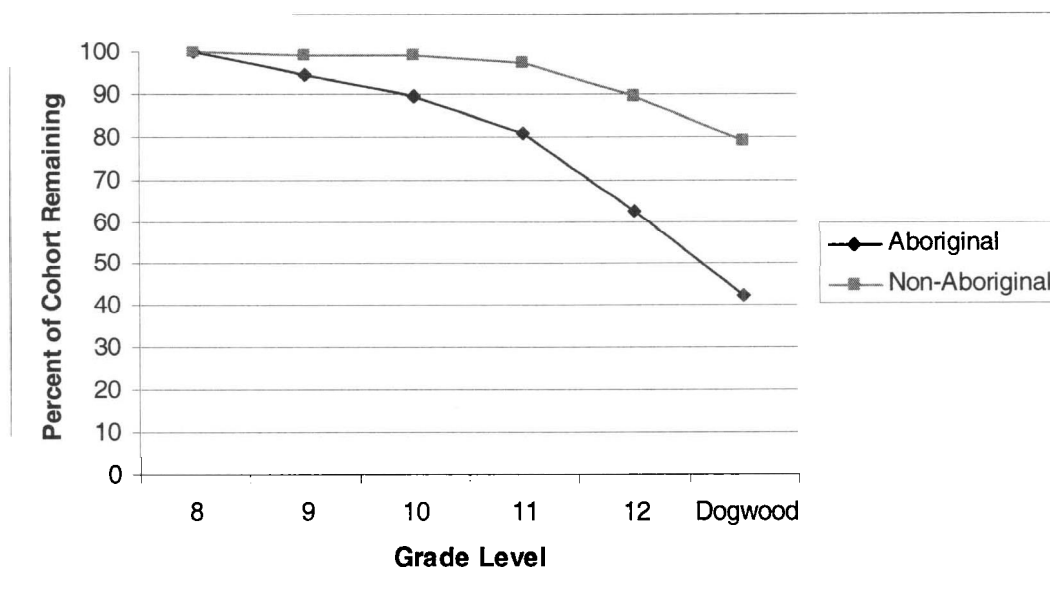


Figure 4. Secondary School Progress: Student Cohort Entering Grade 8 in 1996.

⁸ Adapted from *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools 2002-2003* from British Columbia Ministry of Education, p. 26. Copyright 2003b by the British Columbia Ministry of Education. Adapted with permission.

The report also collected data on the percentage of students who, after Grade 8, did not progress to a higher grade level within British Columbia. The results were fairly consistent from 1996 to 2002 and are significantly higher for Aboriginal students than Non-Aboriginal students. These results are illustrated in Figure 5.⁹

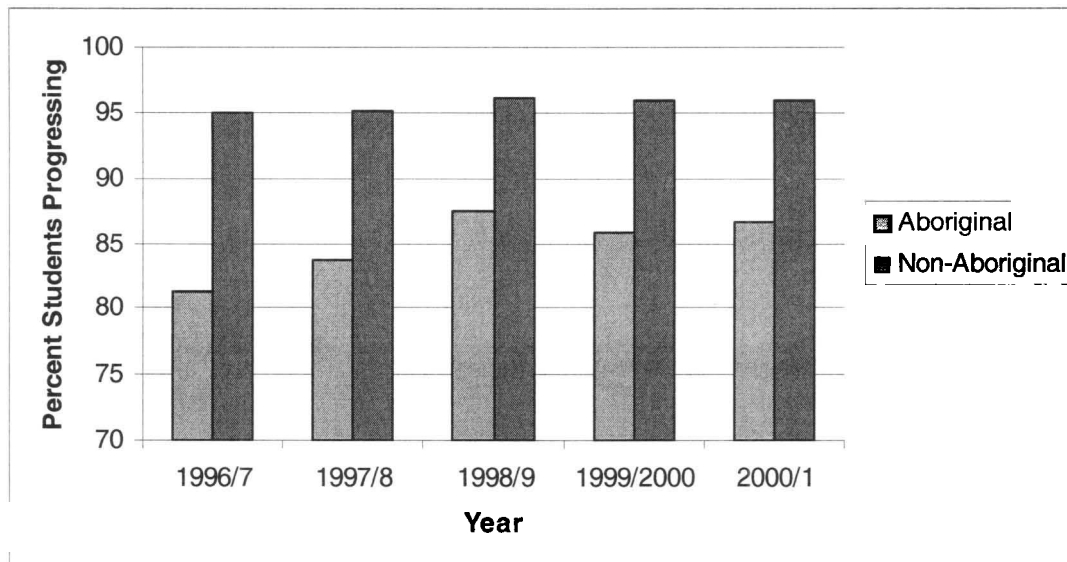


Figure 5. Percentage of First-Time Grade 8 Students Progressing to a Higher Grade Level within B.C.

⁹ Adapted from *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools 2002-2003* from British Columbia Ministry of Education, p. 26. Copyright 2003b by the British Columbia Ministry of Education. Adapted with permission.

The trends in Aboriginal education in British Columbia are similar to those reported in the Yukon Territory. The enrollment rates drop consistently after Grade 8 and continue to decline until Grade 12. Some of the similarities in achievement rate could in part be due to the similar curriculum that students in British Columbia and Yukon follow.

Canadian and United States Perspective

Findings from across Canada show that in 2001, “48% of Aboriginal youth aged 20-24 had incomplete secondary school as their highest level of schooling

(Ministry of Industry Statistics Canada, *Schooling*, ¶ 4). Although there are no statistics available to directly compare the same age group during the same time for all Canadian students, we can acquire a relative comparison among some other statistics. The *Youth in Transition Survey* (2002) stated the dropout rates of all 20-24 year-olds in Canada in 1999 was 11.9% (Statistics Canada, p. 26). The *Aboriginal Peoples Survey* (2003) showed “that for those aged 15 to 19, the most common reason for leaving school early was boredom” (Ministry of Industry Statistics Canada, *Schooling*, ¶ 6).

Our southern neighbors in the United States report much the same. Cajete, in his book *Igniting the Sparkle An Indigenous Science Education Model* (1999), notes that:

The U.S. Department of Education registers the high school dropout rate for Native American students at 50%, and on some reservations that figure reaches an astonishing 70%! A recent American Council on Education report states that Native Americans account for less than 1% of all college students, and more than 53% of all these students drop out after their first year in post secondary education. (p.8)

It is clear from the statistics available from the Yukon, Canada, and the United States that First Nations students are not performing as well as their Non-First Nations counterparts in mathematics and literacy. In relation to science education, I would infer that the same situation exists for First Nations students.

Science Perspective

Because the monitoring of First Nations student scores is relatively new, very little information with regards to student success in science education has been

produced. Published information on First Nations student success has only been collected over the last four years in the Yukon Territory in reference to Math and Language Arts achievement (Government of Yukon, 2003a). As a result, there is no data available to demonstrate how First Nations students are performing in science courses in the Yukon Territory.

During the 2000-2001 school year, British Columbia high school participation rates of Aboriginal and all British Columbia students were compared (British Columbia Ministry of Education, 2003f, 2003g). Table 3 illustrates those findings.¹⁰

Table 3.

% Participation Rates for 2001-2002 Provincial Exams comparing Aboriginal and All Students in British Columbia

<u>Subject</u>	<u>Aboriginal</u>	<u>All Students</u>
Biology 12	12	31
Chemistry 12	5	22
Physics 12	2	14

¹⁰ % Participation was defined as the number of students who either passed or failed divided by the total Grade 12 enrollment of selected participants. Aboriginal participation adapted with permission from *unpublished data* from British Columbia Ministry of Education. Copyright 2003f by the British Columbia Ministry of Education. All Students participation adapted from *2001/2001 Participation Rates for 20 Provincial Exams* from British Columbia Ministry of Education. Copyright 2003g by the Ministry of Education. Adapted with permission.

The participation rates for All Students include those of Aboriginal students.

Therefore, the differences illustrated in Table 3 would be that much greater if the student population were divided between Aboriginal and Non-Aboriginal students in British Columbia.

The British Columbia Ministry of Education (2003f) reported Participation and Success rates for Aboriginal students writing provincial exams over the last 7 years. The average Participation rates for Aboriginal students from 1996 to 2003 were 12% for Biology 12, 5% for Chemistry 12, and 2% for Physics 12. Within these three subjects, the average Success rates for Aboriginal students from 1996 to 2003 were, 68% for Biology12, 76% for Chemistry 12, and 82% for Physics 12. A student was considered successful if they achieved a grade of a C- or above. These statistics illustrate that once Aboriginal students are able to reach a grade 12 level in science, they are capable of succeeding within the science disciplines.

Although there is a lack of information on First Nations success in science courses at the secondary level across Canada, a degree of confidence can be gained by the following statistics. Statistics Canada (2001a) indicated less than 2% of the Total Aboriginal Identity Population were studying or employed in science related areas (including agriculture and biological science, engineering and applied science, mathematics and physical science, and health professions). Mullens (2001) reported “[s]cience and health educators estimate that fewer than 1% of aboriginal students are majoring in science-related courses [at the university level]” (p. 10). Data from Indian and Northern Affairs Canada (1996) compared university certificates and degrees issued to Registered Indians and all other Canadians. The results showed that for all four types of science related certificates and degrees (Agriculture/Biological Science, Engineering/Applied Science, Health Professions/Science and Technologies, and Math/Physical Sciences), Registered Indians were receiving fewer certificates and degrees than other Canadians ranging

from 2.6 -7.5 % less (p.58). Given the statistics on performance and dropout rates among First Nations students, it is not surprising that few First Nations students go on to study science at a post-secondary level.

Although no data exists on how First Nations students perform in science courses in the Yukon Territory, the data available from British Columbia high school students and post-secondary students in Canada indicate similar trends to those published through the Government of Yukon (2003a) and the British Columbia Ministry of Education (2003b).

How the education system and school science are falling short of these students has yet to be resolved. There are many educational issues that are raised in trying to answer the question of how the system is not enabling successful completion. As McDonald (2003) showed in her study of the current school system in Mayo, Yukon, it takes a community of parents, teachers and students to try and answer this question. A student-centered conversation may be one avenue for dialogue about how First Nations students understand school science.

The impetus in addressing the issue of First Nations students' success and retention arise as a result of my experiences growing up in a northern community, struggling through school science courses, and returning to teach in the same community as a science teacher. As a secondary science educator, I was concerned about the few First Nations students enrolled in school science and how my teaching practices may be affecting students in a way that might not facilitate success. I was also concerned with the science education I was promoting and its effect on the opportunities students had once they left high school. The opportunity to

understand better my teaching practice, the nature of school science, and to hear students speak about school science is undertaken through this thesis research.

Chapter 2: Troubling School Science

Literature Review

Concerns about the participation and success rates of First Nations students in science programs are shared by many people (Aikenhead & Huntley, 1999; Barnhardt & Kawagley, 1998; MacIvor, 1995; Mullens, 2001; Steele, 1999). First Nations students in the Yukon Territory are leaving school sooner and not achieving the same academic standing as their Non-First Nations counterparts (Government of Yukon, 2003a, 2003b). Because they are leaving school earlier and performing lower academically, their comments are critical to understanding why this phenomenon exists.

Including Student Voices

The discourse through which a high school student makes meaning of the school environment is very different from that of an educator. They are bound by the discourse of a high school student, a discourse many educators may have forgotten. This different perspective of understanding school allows students to be connoisseurs of the curriculum in a way that teachers may not be. Because of their different standpoint, students are in a position to inform educators about how they make meaning of school. Involving students in the curriculum development process can have many positive results.

A curriculum project in Italy with students ages 5 and 6, Rankin (1993) focused on “the questions, comments, and interests of the children involved” to shape the content and direction of the project (p. 210). This project was successful within the community which led Rankin to support the notion of “construct[ing] a

better world together, a world where the needs and rights of children are placed where they properly belong, center stage” (p. 211). The success of this project demonstrates that children as young as 5 and 6 years of age are capable of taking an active role in their learning.

A study by Blades (1992) found that high school students were also willing to participate in the direction of their learning. The results of the research “reveal[ed] that students are willing and able to bring critical voices to curriculum discourses, and that they have a direct vested interest in the change process” (p. 16). Not only are students interested in playing a role in the development of the curriculum, but they are in a position to discuss aspects of the curriculum that may not be apparent to teachers, or parents. Blades further suggested “[i]nvolving students in conversations about changes to their senior high school science program suggests an openness to the critical views of those usually not consulted in curriculum discourses” (p. 8). Students are privy to knowledge and social organization outside the realm of the adult world, and could thus provide valuable insight about their visions for curricular reform. A focus of this research, therefore, was to begin a conversation on school science with First Nations high school students in Whitehorse, Yukon.

In addition to considering students voices in the curriculum, this chapter discusses present approaches to education and the nature of the school science that is taught at the high school level. Literature suggests that the nature of school science is problematical and often in conflict with students of Non-European cultural backgrounds (Jegade & Aikenhead, 1999; Kawagley & Barnhardt, 1999; Mullens, 2001). Finally, I present literature on the processes and strategies other educators

and scholars have used to begin a curricular dialogue between First Nations Knowledge and school science. In order to gain a better understanding it was necessary for me to address a set of sub-questions:

- Present Approaches to Education
- The Nature of school science
- Should school science be more inclusive of cultures?
- Should school science be more inclusive of local First Nations cultures?
- How are First Nations Knowledge, school science, and the curriculum envisioned?

Present Approaches to Education

In his book, *The Curriculum*, Bobbitt (1918) advocated the use of the scientific method as a way “of analyzing results, of diagnosing specific situations, and of prescribing remedies” (p. 41). Using such metaphors in the latter statement, one would have to wonder if schools had developed a pathological approach to educating children.

As we enter the twenty-first century, it is evident many Canadian schools follow a curriculum development process similar to the one Bobbitt (1918) promoted through the use of the scientific method (Aoki, 1999; Blades, 2000; Reid, 1998; Saskatchewan Learning, 2002; Simons, 1998; Wein & Dudley-Marling, 1998). It is common for Kindergarten to Grade 12 teachers to follow a curriculum based on outcomes, objectives and assessment (British Columbia Ministry of Education, 2003a; Government of Newfoundland and Labrador, 2000; Province of Manitoba, 2004). Aoki (1993) was critical of curriculum as outcomes and objectives and

explained that because curriculum is often planned by a set group of people it “is imbued with the planners’ orientations to the world, which inevitably include their own interests and assumptions about ways of knowing and about how teachers and students are to be understood” (p. 258). Not only is the notion of having a few individuals plan a curriculum for all students an issue, but the structure in which these plans are implemented is also disconcerting. Aoki (1999) elaborated that “[w]hat deserves challenge today is the hegemony of such an image of curriculum, as it tends to reduce “teaching” to mere instruction-structuring pre-givens into learners’ heads - “learning” to mere acquisition, and “assessment” to mere measuring the acquired” (p. 180). Curriculum taught as a set of outcomes, objectives and assessments is troubling to many educators and academics (Aikenhead & Huntley, 1999; Apple, 1982; Blades, 1992; Sumara, 1999; Wein & Dudley-Marling, 1998).

Aoki (1993) describes the outcomes, objectives and assessment strategies as “curriculum-as-plan” (p. 257). Beyond the “curriculum-as-plan” exists the “lived curriculum” (p.258); the interactions between all people in a classroom that are not part of any written code of expectations. A teacher who is able to legitimate the lived curriculum has begun a dialogue which “allows deeper awareness of how the modernist vision of the world has dominated our curriculum landscape shaped in the manner of the curriculum-as-plan and instructional strategies – a landscape legitimated by metanarratives” (p. 263).

The “curriculum-as-plan” (p. 257), as Aoki (1993) described, tends to reduce knowledge to the ability to memorize and regurgitate facts. When 40% of the final grade students receive in all provincially examinable Grade 12 courses (British

Columbia Ministry of Education, 2003h) is based on their performance on the final exam, it is clear that the major role of the teacher is to prepare students for that exam. Even if a teacher attempts to legitimate the lived curriculum in her or his classroom, the students are aware that it is not the lived curriculum that counts as knowledge because it will not be asked on the final exam. This current approach to education, as described by Blades (2000), is “a system of education that substitutes exploration of the natural world for the contrived experience, understanding for memorization, and personal insight for external authority” (p. 70). Aikenhead and Huntley (1999) espouse that meaningful learning does not arise from memorizing facts and boldface words and phrases (p.161). As an example of what may constitute meaningful learning, Jardine (1998) explains that it “is not the epistemic excellence or their [students’] mastery of requisite skills or their grade point average that matters most fundamentally, but quite literally their ability to live, their ability to *be* on an Earth that will sustain their lives”(p. 75). Meaningful learning, then, arises from some other place than the outcomes, objectives, and assessments through which students are measured.

It is, therefore, necessary to move beyond “the classroom ...as a place where subject matter is “mastered,” where curriculum is “covered,” or where learning is “tested” (Sumara, 1999, p. 290). When this can happen, Sumara (1999) explains, “[t]he classroom becomes a myriad of ever-evolving relationships: between teacher and students, students and each other, teacher and texts, students and texts” (p. 290). Legitimizing the under-represented narratives of students within the curriculum may

allow for new discourses to arise and for these discourses to become engaged in the curriculum conversation.

Moving beyond objectives and outcomes would require drastic changes to not only the way school is taught, but in the way schooling is conceptualized by society as a whole. McLaren (1996) exclaims that what is “[n]eeded is a pedagogy of discontent and of outrage that is able to contest the hegemony of prevailing definitions of the everyday as the “way things are” (p. 277). If meaningful learning, as Aikenhead and Huntley (1999) explain, does not arise from the present way of approaching curriculum, how are schools preparing students for their roles as participants in society once they complete their time in the public education system?

As demonstrated above, the manner in which all school disciplines are being taught has come under challenge by academics and educators. McLaren (1996) urges educators to “contest the hegemony of prevailing definitions” (p. 277). The following section attempts to elaborate on the “prevailing definitions” of school science.

The Nature of School Science

School science education has been criticized for a number of reasons. The amount of information students are expected to memorize at the secondary school science level is too extensive to facilitate meaningful learning, the information students learn is often detached from the lives they lead outside of the school, the role models that exist within the curricular discipline are typically white males, and the way in which school science is transmitted by teachers to students is often problematical.

If meaningful learning does not arise out of the process of memorizing facts (Aikenhead & Huntley, 1999), then through school, students participate in what Blades (2000) describes as, “the accumulation of facts in the guise of science, an education that stresses, above all, the ability of students to recall the information they have been taught, usually through the imposition of external final exams” (p. 7). Students are not learning science in a meaningful manner and through the process of learning high school science, become further detached from the natural world. Kawagely and Barnhardt (1999) explain that “typical approaches to [science] teaching ... focus on compartmentalized knowledge with little regard for how academic disciplines relate to one another or to the surrounding universe” (p. 118). Students are not learning science in a meaningful way and through the teaching process are not being helped to understand the connections between the various science disciplines. If students are not learning about the connections between science subjects, how are they going to be able see connections between their science learning and their lives outside of the school setting?

Many curriculum scholars agree that the information students are learning is quickly forgotten and bears no relevance to their lives outside of school (Barnhardt & Kawagley, 1998; Blades, 1992; Coalition for the Advancement of Aboriginal Studies, 2002; Jegede & Aikenhead, 1999; Sumara, 1999). Educators hoping to impart to students the skills and knowledge needed to make a smooth transition between public school and public life should be aware of how the current science curriculum is disabling. Aikenhead (1996) states that “formal education normally found in school science does not usually translate into economic development or

environmental responsibility” (p. 227). He further explains that “the knowledge, skills, and values found in the typical secondary science curriculum have been widely criticized throughout the world for being isolated and irrelevant to everyday events that affect economic development, environmental responsibility, and cultural survival” (p. 227).

The extent to which high school science curriculum is irrelevant is also apparent in the lack of cultural role models available to students within the texts and curriculum. A study by Fort and Varney (1989) involving students from Grades 2-13 revealed that when asked to write and illustrate what came to their minds when they thought about scientists, most students described scientists as male and Caucasian. This is problematic if educators are hoping to see continued enrollment of females and ethnic minorities in science classes. As Mullens (2001) explains “the barriers blocking Aboriginal students [include] lack of role models, lack of mentoring, lack of validation for the pursuit of science” (p. 10). If high school science curriculum does not include the voices of other ethnic groups, it is that much more difficult for ethnic students to be successful within their courses. The lack of cultural presence within the curriculum is unacceptable to MacIvor (1995) who, in reference to Aboriginal students, states that “[b]ecause of the under-representation of our peoples in the sciences, and the great need for scientific and technological skills within our communities, efforts to encourage Aboriginal participation in school science are crucial” (p. 74). The absence of cultural presence in the curriculum and texts may be one of the aspects discouraging students from science. The absence of ethnic

worldviews within the curriculum and textbooks may also contribute to the minimal numbers of ethnic students in a science classrooms.

Because the narratives of non-European cultural backgrounds (e.g. First Nations, Hispanic, and African-American) are often not depicted in science textbooks, students can find it hard to reconcile the information provided in the text in relation to their own cultural heritage. Jegede and Aikenhead (1999) explain:

When the culture of science is generally at odds with a pupil's life-world, science instruction will tend to disrupt the pupil's worldview by trying to force that pupil to abandon or marginalize his or her life-world concepts and reconstruct in their place new (scientific) ways of conceptualizing. (p. 47)

A study by Allen and Crawley (1998) suggested "that the worldviews which students bring with them into the science classroom may affect not only how they make sense of scientific information, but the extent to which they are willing to participate in the educational experience" (p. 129). This tension between the worldview of the student and the information they are learning in the classroom can deter many students from studying school science or force the student to abandon their worldview in favor of school science (Aikenhead, 1996; Cobern & Loving, 2001; Kawagley & Barhhardt, 1999; MacIvor, 1995; Mullens, 2001).

The conflict between a student's cultural worldview and school science may be amplified by the way in which the teacher communicates school science. Research by Brickhouse (1990) revealed "[t]eachers' beliefs about science influenced not only explicit lessons about the nature of science, but also shaped an implicit curriculum concerning the nature of scientific knowledge" (p. 53). Further studies

have indicated that science teachers view science as culturally neutral and rarely think of teaching science from a cultural perspective (or teaching culture from a scientific perspective) (Aikenhead & Huntley, 1999; Allen & Crawley, 1998; Blades, Johnston & Simmit, 2000).

Creating opportunities and initiatives for students of non-European cultural heritage may encourage students to pursue science throughout high school and beyond. However, the ways in which science concepts are *communicated* and made relevant to students in the classroom needs to be examined. Furthermore, if students are to be successful within science classrooms, it is necessary to consider how culture plays a role in the teaching of school science.

Should School Science be More Inclusive of Other Cultures?

The opportunity to present school science from a variety of cultural perspectives exists and may provide students with a better way of relating to science so that they might be more successful in their studies.

An article by Selin (1993) gives extensive examples of various cultures who have contributed to science in terms of mathematics, surgery and astronomy. She explains “[t]he world of science is vast and limitless, and every culture has produced its own science, which is a unique reflection of its world view and philosophy” (p. 42).

Jegade and Aikenhead (1999) believe achievement in schoolwork is negatively effected as a result of the disconnection between a students’ culture and school science. Addressing school science and culture within the curriculum, therefore, is seen by some as an appropriate way to respond to lower success and

retention rates among First Nations students (Cajete, 1999; MacIvor, 1995; Snively & Corsiglia, 2001). Representation of scientific worldviews for other cultural groups including First Nations students can help students negotiate between their cultural background and school science. For example, as a way to alleviate the low numbers of African-American students in science, Murfin (1994) suggested reforming the curriculum in a way that combines contributions Africans and African-Americans have made to the body of scientific knowledge.

The potential to create a learning environment within a school science classroom that is responsive to the cultural needs of its students has been demonstrated. The extent to which a science curriculum is responsive is determined by the cultural identity within the classroom and within the community.

Should School Science be More Inclusive of Local First Nations Cultures?

Simons (1998) advocates curricular reform by granting schools, teachers, and students the autonomy to evaluate their own programs. Although her example is in the context of evaluation, she emphasizes a reciprocal relationship between teaching and curricular content:

By placing teachers and schools at the center of the evaluation process, evaluation can document and analyze particular curriculum effects in context, and provide relevant feedback to inform curriculum development at a point of need and in precise recognition of the needs and interests of the particular clientele in the school. (p. 359)

Simons' (1998) comment suggests that a certain amount of control over the curriculum be under local jurisdiction. Having schools invest, to some degree, in the

local development of curriculum as it relates to science education may be a practical way to deal with Canada's cultural diversity. As well, it may provide an appropriate avenue to address the lower success and retention rates among First Nations students (Science Council of Canada, 1991).

MacIvor (1995) claims that “[m]uch of what is learned in contemporary science classrooms is seen as divorced from community concerns” (p. 76). She states that making a science curriculum more relevant to a community “may help students see scientific and technical knowledge and skills as important to future community development, and as important to their future roles as community decisionmakers” (p. 77). Bowers (2003) also supports a community approach to curriculum and emphasized the importance of:

revitalizing the non-commodified forms of knowledge, skills and activities within the communities represented by the students in the classroom – thus enabling them to participate in mentoring relationships that will develop their talents and interest, and to experience other community-centered non-monetized relationships and activities that will develop a sense of responsibility for the well-being of the community...”. (p. 10)

Putting their skills into practice in the community as part of the curriculum could be a way for students to see the connections between classroom and community, and may allow them to become more successful in a school science setting.

A revisioning of school science and culture in such a way as described by MacIvor (1995) and Bowers (2003) would require a drastic alteration in how curriculum is understood and made meaningful within a community. In terms of

addressing First Nations knowledge and school science in the classroom, this type of shift would require more “than the addition of basket making, sled building [and] songs and dances” (Barnhardt & Kawagley, 1998, p.4) or “some Mickey Mouse courses in moccasin making” (Coalition for the Advancement of Aboriginal Studies, 2002, p. 10).

As Barnhardt & Kawagley (1998) explain, these changes have “been at a fairly superficial level with only token consideration given to the significance of those elements as integral parts of a larger complex adaptive cultural system that continues to imbue peoples lives with purpose and meaning outside the school setting” (p. 4).

For these reasons, I do not suggest that curriculum developers merely integrate First Nations perspectives within the science curriculum but that they move beyond the notion of integration. Culture is not something that is simply *added on* to an already well established discourse. As Grumet (1999) reminds us “[c]urriculum is the child of culture, and the relation is as complex and reciprocal as are any that bonds the generations. Curriculum transmits culture, and it is formed by it. Curriculum modifies culture even as it transmits it” (p. 24). Grumet’s idea conveys a fluid, dynamic, and interconnected approach to curriculum.

This approach is similar to the one envisioned by Thom (2002) who elucidates that “[s]chools, universities, children, teachers, teachers-to-be, and faculty exist as one dynamically and co-emergent living system” (p. 2). Educators must be aware of the knowledge they are transmitting and creating in their science classrooms and the impression that knowledge has on their students. A curriculum

designed to legitimate the cultural narratives within the lived curriculum may begin to meet the needs of the students it serves.

How are First Nations Knowledge, School Science, and the curriculum envisioned?

The purpose of this section is to highlight the ways in which various scholars, academics, and educators understand and negotiate the territory between Indigenous Knowledge and school science. Among those who agree that Indigenous Knowledge should be an integral component of school science, there is still debate as to how the two worldviews are merged. The point is not to espouse the one best way, but instead to engage in a thoughtful meditation to the possibilities that exist between Indigenous Knowledge and school science.

School science is taught very much from the same principles through which it emerged. Although there can be a sense of freedom and discovery within a classroom, the underlying discourse remains the same. It is important to remember that what we refer to as science in schools “was co-produced with industrial capitalism in 17th-century north-western Europe” (Gough, 2002, p.1223). As we enter into the 21st century, the foundation upon which science was built is being reified so as to continue along the same principles of history’s past (Bowers, 1997).

Exposing science’s inherent hegemonic discourse allows critique and opens up the possibility to explore the questions raised about its privileged position. In terms of discussing the relationship between Indigenous Knowledge and school science, it is necessary to critically reflect upon how new ideas emerge and through whose discourse they are validated. Those who would be inclined to a positivist mode of thought tend to uphold the notion of science as representative of a universal

truth, that the world can be explained through careful observation, experimentation and manipulation of variables. Others, such as Cobern and Loving (2001) believe “that truth is never under the sole proprietorship of any single domain of knowledge – not even science” (p. 65). Among educators and scholars who would agree that Indigenous knowledge be validated and represented within curriculum, ideas on how this knowledge becomes validated and represented are complex.

The possibilities for teaching Indigenous forms of knowledge in conjunction with school science exist and there are many individuals and organizations that are expanding the potential for these possibilities (Barnhardt & Kawagley, 1998; Nelson & Clark, 2000; Stephens, 2000; Western and Northern Canadian Protocol for Collaboration in Basic Education, 2000; Yukon Native Language Centre, 2002). It is important to exercise mindfulness in reference to the process through which the two are brought together, or if it is even appropriate to do so.

Barnhardt and Kawagley (1998) developed an initiative that is “characterized as two independent though previously separate systems being nudged together through a series of initiatives maintained by a larger system of which they are constituent parts...”(p. 8). Some may argue, however, that working within the already value laden umbrella of school science might serve to reduce the distinctiveness of Indigenous knowledge. This position is supported by Cobern and Loving (2001) who insist that “[i]ndigenous knowledge is better off as a different kind of knowledge that can be valued for its own merits, play a vital role in science education, and maintain a position of independence from which it can critique the practices of science and the Standard Account” (p. 51). These two examples serve to

demonstrate the difficulty in considering Indigenous Knowledge and school science. Consequently, when considering curriculum it is imperative that many voices play a role in how it is shaped.

A community of academics, parents, or teachers might agree that there are connections between Indigenous knowledge and science education and their visions for curricular reform. How they determine these connections and who is involved in the process is extremely important and difficult.

Christie (1991) is critical of a 'science for all' curriculum. Recognizing the two very different worldviews inherent in Aboriginal systems and school science (Aboriginal systems are not separate from the natural world, school science places humanity apart and above the natural world; Aboriginal systems understand events in terms of complex webs while school science seeks to isolate itself into various disciplines), he offers four principles important to explore in the discussion of science curriculum:

1. The context of scientific study – subject matter is to be examined and interpreted only as it is found embedded within its context.
2. The multiplicity of perspectives – [educators] are out to construct the fullest and the clearest picture of the situation we can, by integrating the best of our collective knowledge.
3. Ongoing negotiation of knowledge.
4. The focus on balance. (p. 110-111)

These principles provide a point at which to begin the discussion on the connectedness between Indigenous knowledge and school science as they challenge

the discourse of science education while at the same time working to change the direction of space school science occuppies.

A holistic approach to culture and education was taken by Hanohano (1999) who claimed:

[T]he Sacred Circle speaks to man's [*sic*] relationship to the great universe; Mother Earth speaks to man's [*sic*] connection to tribal territory and the earth; and Elders connect people to their past, their community, and their tribe. If education is truly to be transformed for Native people, then the challenge for our institutions, and for educators, is to find ways for these practices and beliefs to become a normal part of the educational experience. The quest now becomes one of finding how faculties and institutions can incorporate the wisdom and spirituality of our communities and Elders to increase and enhance the harmony and balance that is so essential to fulfillment of their educational missions. (p. 218)

His article discussed the interconnectedness between Native epistemologies and aspects of science and environmental education. Education grounded in the elements that are at the core of Native knowledge (the Sacred Circle, Mother Earth, and Elders) provide a stepping stone to culturally relevant education.

Based on her academic and instructional experience in science, Simpson (2002) provides a list of elements essential to successful school science programs.

Some elements she discusses suggest:

- Students must be able to personally identify with course content and the real-world applications of that content.

- Curriculum must be used that acknowledges science as one knowledge system, not the only system.
- Curriculum must also include a critical evaluation of Western science from Aboriginal perspectives including the negative impacts of science on Aboriginal communities in the past and in contemporary times.
- Content should be useful and applicable to the situations students will find themselves in the future.
- Space must be made for students' concerns, anger, confusion, and conflict between science and Aboriginal knowledge. (p. 22-23)

Although Simpson (2002) does not provide a specific framework for developing curriculum, she lists critical elements that can be used to guide the curriculum development process. These elements encourage the curriculum developers to address the issues of content relevancy to the lives of students, the conflict between school science and Aboriginal knowledge, and to provide students the space they need to reconcile the conflicts that may arise between school science and their own cultural worldview.

Using "A seasonal cycle as a curriculum framework" for Australian schools, Davis, Harris, and Traynor (1980) contend that "traditional Aboriginal knowledge of the environment should form the content from which is developed learning skills, scientific process skills, and those appropriate European concepts deemed essential for life in a wider community" (p. 2).

Recommendations from parents, Elders, professionals and teachers from the Ahkwesahsne community in Ontario were used in the design of a science and math

curriculum for students in Grades 6, 7 and 8. The four recommendations as written by Henderson (1996) were as follows:

1. Symbols – For example, students must understand the deep symbolism of the tree of peace, wampum, and metaphors used in treaty making.
2. Place – Units must involve tasks that support the web of life in this community.
3. Two Worlds – Students must be helped to make decisions about how they will make their path within both the dominant society and their aboriginal communities.
4. Living With Contradictions – We need to recognize that we can live with ambiguity, that students can choose a science or environmental career and still retain traditional teachings. (p. 16-17)

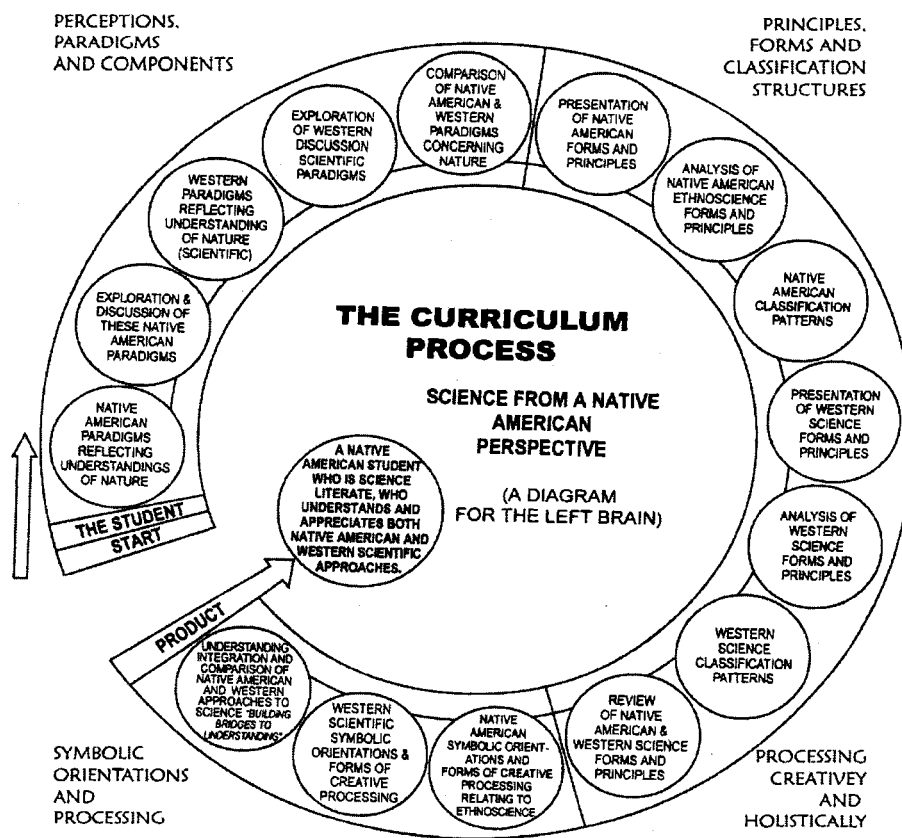
The author noted that “the discussions were heated” (p. 17) and emphasized that agreement on what was sacred and what was necessary to share with the community was not always black and white.

The Alaska Rural Systemic Initiative, as previously mentioned by Kawagley and Barnhardt (1999), is an example of how Native educators, Elders, and the Department of Education in Alaska envision school science and Indigenous Knowledge. Kawagley and Barnhardt (1999) explain that the Alaska Rural Systemic Initiative will allow Alaskans to “enter into joint ventures that are mutually respectful and recognize the validity of diverse sets of knowledge, as well as the benefits to be gained if they are pooled together in complimentary ways” (p. 125). Smaller organizations, including the Academy of Elders and Native Educator

Associations, are a part of the larger Initiative. These organizations share information and are involved in the dissemination of the information in order to inform the curriculum development process.

The Alaska Rural Systemic Initiative is designed to meet the needs of Alaskan students. This model may be useful in developing a curriculum for another region, for instance, taking a community oriented approach. However, different regions are responsible for providing relevant curriculum to their communities in a way that is appropriate and relevant to the people they serve.

Another model envisioned by Cajete (1999) is illustrated. Integrating his own history, experience, teaching and worldview, Cajete (1999) blends traditional knowledge and science to create what he calls a *curriculum mandala*. He describes this mandala as “a way to present a verbal and visual image, so the reader will have a sense of the dynamic process inherent in the experienced curriculum” (p. 103). This mandala exemplifies holistic integration of content and experience from both an Indigenous and Western perspective.



(p. 115).

Figure 6. Science from a Native American perspective: A process oriented strategy.

¹¹ From *Igniting the Sparkle An Indigenous Science Education Model*, by G.A. Cajete, 1999,

p. 115. Copyright 1999 by Kivaki Press. Reprinted with permission.

Cajete's (1999) diagram, although holistic in approach, uses a linear representation of educational development, very similar to the ones used in science classes today. He demonstrates, through the use of his model, how difficult it is to imagine science curriculum from a different perspective.

While being diverse in approach, these examples illustrate the importance of community involvement and ongoing dialogue between students and teachers, teachers and community, and the students and the community. The manner in which Indigenous Knowledge and school science are approached can range from linear and outcomes oriented to holistic and demonstrate that there is not *one size fits all* approach to curriculum in terms of how people envision Indigenous knowledge and science education. What they draw attention to is the importance of cooperative planning and community development. The examples of the processes involved in creating culturally relevant science education demonstrate that all community members, including students, teachers, parents and Elders should have the opportunity to contribute to the overall mandate of curriculum. The focus of this thesis research is to begin a student-centered dialogue *with* First Nations students about school science. Students' understanding and voices are an integral component of the conversation between Indigenous knowledge and school science. Forming mutually respectful relationships with people that serve to attain common goals within the community will be the approach taken through this thesis research.

Chapter 3: Walking the Walk

Methodology

The relationship between First Nations communities and the institutions conducting research can be tenuous. Concepts by the university community of research methodology may not always be appropriate within a community, given their ethics and protocols of conduct (Battiste & Henderson, 2000; Bishop, 1997; Blue Cloud, 1996; Marker, 2000; McDonald, 1992; O'Riley, in press). Determining a methodology that was recognized as valid at the academic level and respectful of the cultures and values of the people I worked with was challenging.

My experiences in education lead me to ask a number of questions regarding the process of education; why First Nations students are leaving school earlier and not performing as well as their Non-First Nations counterparts, and how the process through which science education was taught was impacting students. The information provided in Chapter One provided a sense of the participation and success rates of First Nations students. These statistics prompted further inquiry about the structures of education and how they interacted with First Nations students' success in school science. Social Critical Theory, therefore, is used as a starting point for a discussion on methodology. Included in the discussion on methodology are aspects of other forms of inquiry including post-modernism and 'post'-colonialism.

Social Critical Theory

Social Critical Theory is an attempt to "understand, analyze, criticize, and alter social, economic, cultural, technological, and psychological structures and

phenomena that have features of oppression, domination, exploitation, injustice, and misery” (Malhotra Bentz & Shapiro, 1998, p. 150). The statistics in Chapter One demonstrate that First Nations students in the Yukon are performing significantly lower than Non-First Nations students in all aspects of education. For example, First Nations students are absent from school more often, more First Nations students are in need of Individualized Education Plans so that they might complete the classes in which they are enrolled, through Grades 3, 6, and 9 First Nations students’ score are well below those of Non-First Nations students in Math and Language Arts, and fewer First Nations students complete high school (Government of Yukon, 2003a).

The difference in all the aspects listed above indicates inequity within the education process. As a cultural group, First Nations students are falling short of Non-First Nations students. First Nations students are following the same curriculum and participating in the same classes as Non-First Nations students, yet, it is almost as if they are not receiving the same education.

Through conversations with First Nations students, an attempt was made to become more informed about school science in a way that could properly address the issues of success and retention rates. Social Critical Theory “aims at a consciously transformed life and not merely at objectively measurable improvements” (Malhotra Bentz & Shapiro, 1998, p.153). This research, therefore, not only addressed how First Nations students might achieve higher rates of success; it also aimed to trouble the space occupied by school science so as to make it more inclusive of other cultures.

Social Critical Theory and Postmodernism

Munro (1999) states that “[a]lthough a critical perspective is attractive because it focuses on resistance and emancipation...the question of who determines what knowledge and action is necessary to eliminate oppression remains unresolved” (p. 433). Elaborating further on the previous comment she explains that “[c]entral to a critical perspective is the assumption that oppressed persons are not ‘empowered,’ or ‘conscious,’ and that only those championing a critical perspective have the inside track” (p. 433). A social critical theorist would view First Nations students as oppressed within the school system as a result of their academic performance in relation to Non-First Nations students and assert an understanding of how to facilitating change. The intent of this research was not to claim that First Nations students were oppressed and were in need of emancipation from the confines of the school. In fact, such a claim is itself oppressive. First Nations students have the ability to empower themselves and can decide when and for what purpose they choose to do so. For this reason the research deviates from the nature of Social Critical Theory and it was necessary to employ other forms of inquiry.

As a form of inquiry, postmodernism rejects fundamental truth claims and allows space for other ways of representing research, art, literature, and so forth (Dempster, 2001). Postmodernists posit that reality is the sum of our constructions of the world around us. How a student may construct a classroom can be different from the way a teacher may construct a classroom. O’Riley (1993) illustrated that it is possible to *deconstruct* the spaces occupied by research (or science education) using a postmodern methodology.

The freedom and challenge of a deconstructivist approach begin when “a researcher unthinks and rethinks her/his assumptions, beliefs, and values, working *with* the researched rather than *for* or *on*” (O’Riley, 1999, p. 51). This mode of thought includes spaces for respectful work, spaces that might not perpetuate the cultural biases and enactments of past ‘researchers’. Post-modernism, as envisioned by Blades (1997), might be a “[c]hange in science education curriculum-discourse...that moves beyond the entrapment of modernism; a movement to a postmodern science education curriculum-discourse” (p. 36). He insists “the move towards post-modernism begins...through constant questioning, the deconstruction of the discourses we participate in and form, so that new discourses can constantly appear: a type of repetition” (p.36). Including the voices of students in the conversation of science education disrupts the present discourse by validating and representing voices of those not usually heard. Conversing with students about their constructs of science education challenges a researcher to examine the discourses in which they are embedded. Deconstruction of the space occupied by school science can be accomplished, to some extent, by listening to and engaging with students who are usually silenced and underrepresented within the science curriculum conversation.

The Research/er

In terms of working with the Champagne and Aishihik First Nations, and First Nations students, ideas of oppression and emancipation are problematic. It is essential to this study to place into question different methodologies, use of ‘data’ and the relationship between the researcher and the researched.

First Nations people do not need another academic to work “on [their] behalf ...and for their benefit” (Bryson & de Castell, 1996, p. 7). As King (1998) pointed out, “[w]e want to escape from the zoo” (p. 118). Through a postmodern methodology this research was approached so that I “[did] not appropriate or romanticize the voices of the ‘oppressed,’ while claiming to see from their positions” (O’Riley, 1999, *Mesa Morphing Methodology*, ¶ 4). I was not employed to help the participants, however, I did feel compelled to be of help. This responsibility is echoed by Giroux (1992), who stated:

we have obligations at least to inaugurate a discourse around the unrepresentable, that which cannot be spoken within social relations, particularly within groups that know that generally to speak is to be punished. I want to help create those oppositional spaces without dominating them.
(p.158)

McLaren (1991) suggested “one of the most important tasks in which a field researcher can engage is understanding and transforming the various ways in which his or her own subjective formation privileges certain discourses that unwittingly construct subjects as the other” (p. 160). Through this process it was possible to understand better my position so that I did not appropriate other voices or dominate the research space. It was important as a researcher, then, to understand how my own position was shaping the research. It was necessary for me to consider how my age, profession, ethnic background, and relationship within the community affected the relationships established with those involved in this research.

Our society is one in which a power difference exists between myself, an individual of twenty nine years, and youth in their teens. People are told to *respect their elders* and to a high school student, someone of twenty nine years is an elder. The belief behind this statement is that older people deserve respect because they should, in theory, have more experience to share. I tried to minimize the effects of this power difference by emphasizing that what the students shared played an important role in this collaboration. Their thoughts and concerns were valid and deserved representation in the conversation about science education.

I was neither a teacher in the school the students attended nor someone they would have been familiar with in the school setting. As a consequence, establishing a level of trust and openness with the students was initially difficult.

I have been a part of the Whitehorse community since birth; however, I am not a part of the First Nations community. I am familiar with the values of people in the north but am not familiar with the values and knowledge of Indigenous people. Although “[n]o single individual can ever be aware of all the cultural concerns that may exist in the community” (Battiste & Henderson, 2000, p.141), it is important to allow enough time to discuss the issues and concerns that are raised, establish a relationship, and be open to suggestions. If a researcher can *let go* of being in charge and controlling the research, more possibilities exist for equal dialogue to emerge. The process of establishing common goals within the First Nations community and maintaining continuous dialogue and consultation formed the basis of ethical conduct around this research. As a result, Bishop (1998) explains:

the research itself is driven by the participants in terms of setting the research questions, the design of the work, the undertaking for the work that had to be done, the distribution of rewards, the access to research findings, accountability, and the control over the distribution of the knowledge.

(p.205)

One goal for this research, then, was for all the participants (the Champagne and Aishihik First Nations, students, and I) to be equally responsible for determining the path of the interpretive work. The number of students, group structure, dialogue structure and direction, and interpretation of the conversations was, thus, primarily the responsibility of the people involved. As a result, I was limited in how I could co-describe and co-explain the research process.

Validity/ Truth and Knowledge

“It is essential to critical theory that [as a form of inquiry it] be knowledge, that it be scientific. Otherwise, it would be just opinion and lack the power that comes from the objectivity and validity of knowledge” (Malhotra Bentz & Shapiro, 1998, p. 154). The authors explain, however, that “[i]t is philosophically critical by not accepting a pre-given definition of what knowledge and science are” (p. 150).

The concept of validity of knowledge can become an ethical dilemma in the context of research with First Nations peoples. For example, in the case of research with the Maori peoples in Aotearoa/New Zealand, Bishop (1997) elaborated on how past research “has misrepresented, that is simplified/conglomerated and commodified Maori knowledge for ‘consumption’ by the colonisers and denied the authenticity of Maori experiences and voice” (p. 37). Given the position on what

constitutes and limits or extricates data, the point of the research reported in this thesis is not to defend one stance as the valid and true way of understanding why First Nations students are not able to achieve the same success as their Non-First Nations counterparts and how teaching school science may interact with their success. Instead, the research is “a call for a kind of validity after poststructuralism in which legitimation [that follows] depends on a [community’s] ability to explore the resources for different contemporary inquiry problematics” (Lather, 1993, p. 676).

What constitutes validity, in this case, then becomes a matter of negotiation within the community of researchers. The Champagne and Aishihik First Nations and I spent a year and a half negotiating the Protocols and Ethics that would guide this research between the students, the Champagne and Aishihik First Nations and myself (Appendix B). The ethical guidelines of the University of Victoria Human Research Ethics Committee followed. The students were encouraged to include their Ethics and Protocols in Appendix B as well. The students and the Champagne and Aishihik First Nations were involved in and consulted throughout the research process. The research was therefore validated by the Champagne and Aishihik First Nations and the students as part of an ongoing process. Everyone involved in the research was responsible for situating the project in a space that encouraged a multitude of voices and validated them through respectful dialogue.

Research / Interviewee / New Imaginaries

Scheurich (1995) points out that questions and responses can mean different things to both the researcher and interviewee (p. 240). The researcher must be aware

that what emerges from the interview is only a result of the situation and may not be the same given another time and place (Scheurich, 1995). Further to this, the researcher themselves is partially responsible for the *type* of data that is collected. This research is situated whereby “the findings arise in an interpersonal relationship, yielding a narrative co-authored and co-produced by the interviewer” (Kvale, 1992, p. 182).

Since what we call data emerges from a certain space and time, it is always embedded in history, contradiction and culture. Research stories, therefore, can neither be replicated nor fully understood only from the perspective of the researcher. Scheurich (1995) suggests “[w]hat we need are some new imaginaries of interviewing that open up multiple spaces in which interview interactions can be conducted and represented, ways that engage the indeterminate ambiguity of interviewing, practices that transgress and exceed a knowable order” (p. 250).

In this thesis, as a way to approach a new imaginary, the students were informed about collaborating in this research. As collaborators, they were partially responsible for the topics and directions of the conversations, interpreting the research, and deciding the possibilities for dissemination. Expanding on the idea of a ‘new imaginary’, Giroux (1999), claims “[i]f we take the experiences of our students as a starting point for dialogue and analysis, we give them the opportunity to validate themselves, to use their own voices” (p. 18).

What followed were dialogues structured as conversations about school science, education, and culture. Greene (1996) insists:

the telling of stories help persons to identify their moral purposes, to orient themselves to some vision of what they believe to be decent and good and right. It is when spaces open among them, when their diverse perspectives are granted integrity that something they can hold in common may begin to emerge. (p. 312)

The students had the space to acknowledge their own concerns and agendas for this research, and as a result the 'data' that emerged was reflective of their insights. Deciding the parameters through which the data emerged was part of an ongoing dialogue between myself, the students and Champagne and Aishihik First Nations.

Culturally relevant approaches to research that are themselves without labels but reflective of the individuals own versions of collecting, telling, and enacting methodology and data exist (Bishop, 1998; Cole, 2002; Graveline, 2000; King, 1998; Lather, 1991; O'Riley, 1999, 2003; Smith, 1999). These authors put into writing and practice a different way of working.

An insight about a respectful approach taken through 'data' collection is exemplified in a work by Graveline (2000):

I would Heartfully recommend:

“data” collected by Talking Circle as Methodology

is best left Un-edited

Un-analyzed.

Preserve the content Intact

Circular

Flowing

Interconnectedness

If They want to know

“What does it all mean?”

Tell Them

Read between the Lines. (p. 369)

The nature of the research for this thesis inquiry with the Champagne and Aishihik First Nations and the students was collaborative and all participants had a part in shaping how the research was conducted and interpreted. It was, therefore, necessary to *let go* control over my designs for the research data and become more comfortable with not knowing how the research would be written or enacted. By letting go of control of certain research aspects, I anticipated others would have more opportunity and space to address their concerns and agendas. As an example, conversations with the students were mostly student-directed. Prompt questions were used to initiate dialogue only; the students were responsible for the direction the conversation took and the topics that were addressed. The students were the ones who decided the amount of time spent discussing education and the number of meetings we had.

Ethics

The approach taken through this research attempted to bring closer together the researcher and the participants so that a collaborative research design was established.

Essentially, goals were established with the Champagne and Aishihik First Nations where they saw an overlap between their interests and mine. Because they were interested in proving better information about First Nations education in the Yukon, they agreed to provide consultative assistance to this project. The

Champagne and Aishihik First Nations were involved in all ongoing consultation and had the opportunity to review the work at every step. Following guidelines in Battiste and Henderson (2000) “[r]esearch reports or parts of the reports were not to be published if there was reasonable grounds for thinking that publication would violate the privacy of individuals or cause significant harm to participating Aboriginal communities or organizations” (p. 138). At the request of the Champagne and Aishihik First Nations, I devised a list of suggestions for ethical conduct within the scope of this research. Over the next year and a half, this list was revised and edited through email conversations between the Champagne and Aishihik First Nations and I. At the discretion of the Champagne and Aishihik First Nations, a Champagne and Aishihik First Nations Heritage Officer who had experience writing protocol and ethics commented and made further suggestions. The Heritage Officer provided brief consultative assistance on the list of protocols that the Champagne and Aishihik First Nations and I had written at that point in time. The Protocol that was determined with the community prior to initiation of the research with the students was followed at all times.

An email was sent to the Principal of the high school outlining the goals for the research project, requesting permission to conduct research within the school, and excusing students from some classes. The principal was very supportive and suggested I contact the teachers before students were excused from class. The names of the high schools mentioned in this research have been changed.

Participant selection was at the discretion of the Champagne and Aishihik First Nations. An advertisement was placed in the Champagne and Aishihik

Newsletter calling for Grade 11 and 12 students to participate as volunteers in a project discussing science, culture and education. As well, an announcement calling for students interested in participating in a science research project was made at Sunnysdale Secondary by the Cultural and Counseling Education Worker for the Champagne and Aishihik First Nations.¹² This was the first school he was going to be visiting in the beginning of September. The students who responded to this announcement were those who participated in the research.

Student participation was on a voluntary basis and they were permitted to leave the project at any time. If they did leave, they could choose to include the information they provided in the study or to have it returned to them. During the project, they decided if they wanted to include/exclude information. The students decided at the beginning to use their actual names and confirmed this again at the end of the research. They were involved in every step of the project as co-creators and collaborators; including determining together how the project was to be shaped and how it was to be written/spoken/enacted. There was an area on the consent form where the students could add their concerns and protocols to the agreement (Appendix B). This form was signed by the student.

Method

The study was conducted in Whitehorse, Yukon. A letter was written to the Chief of the Champagne and Aishihik First Nations in Haines Junction, Yukon (Appendix A). The goals, protocols and ethics of the project were decided with the First Nations (Appendix B) depending on where they saw a need for my interest

¹² Sunnysdale Secondary is a pseudonym for a high school in Whitehorse, Yukon.

areas or where they felt a need for research within the community. During the first meeting with two Champagne and Aishihik First Nations individuals from the Education, Employment and Training Branch, I explained my goals and vision for this research. I asked if they saw a need for this research or if they had other ideas that might be more appropriate. The following year was spent deciding the protocols and ethics for the research through email conversations.

Four high school students and one high school graduate participated in this research. In response to an announcement calling for volunteer to participate in a research project, four students from the high school met with me after school. During an orientation meeting, I discussed some of my areas of interest with the students, asked what some of their interests were and asked if they would be interested in co-creating and collaborating on this project. They were asked if they would like to participate in group and individual discussions. I encouraged students to consider what some of their ethical guidelines and protocols might be and to add them to the form (Appendix B).

The Champagne and Aishihik First Nations suggested I provide some form of honoraria to the students for their participation and encouraged soliciting local businesses for donations. The students were informed there would be honorariums donated from local organizations given once they had decided they were finished participating. Prior to their participation, consent forms were given to the students to sign (Appendix C). The same four students returned the following day with their consent forms signed. The students did not add any more conditions to the form,

and explained it looked fine the way it was. They also chose not to use pseudonyms and confirmed their decisions throughout the research process.

The Culture and Counseling Education Worker for the Champagne and Aishihik First Nations suggested I organize a group meeting over their lunch period as an ice breaker. Four students (Doris, Melissa, Brent, and Chris) attended the first session, and talked about the experiences they have had in school and what subjects they were taking. Another student, Krystle, who had graduated the year before, attended the following meetings (after agreeing to participate). Based on the age and social grouping of the students, they felt more comfortable meeting in 2 different groups.

Teachers were supportive of the students participating in the research. One group consisted of the two boys (Brent and Chris) who were both in Grade 8. The other group consisted of the 3 girls, one of whom was in Grade 9 (Melissa), one in Grade 11 (Doris) and one had graduated the year before (Krystle). Individual discussions took place with Krystle and Melissa. I will refer to all the participant as students because they all spoke from the perspective of present and former students.

Because the students were unsure about where to begin the conversations, I used all of the following prompt questions for the large group discussions:

- Which science courses have you taken?
- What was your junior high experience of science?
- What did you think of science education up until then?
- Were there certain experiences you remember most?
- What did you think was most/least important?
- What did you find interesting?
- Which senior science courses have you chosen?
- Why did you choose these courses?
- What are your expectations for the course?

All the following questions were used as prompts in the small group (2-3 individuals) and individual discussions:

- What science course(s) are you taking?
- How are you doing in the course(s)?
- Are you happy with the course?
- What are some of the things you like most/least about the course?
- If we were to design a science course, what could we do to make it better?
- Describe your cultural background.
- Do you see any of your culture reflected in the curriculum?
- Would you like to see your culture reflected in the curriculum?
- What types of activities would make science more cultural?
- What aspects of your culture would you say are scientific?

It is important to emphasize that these questions were used to initiate conversation only. If this was to be collaborative, it was necessary the voices of the students guide the path of the discussion. As much as possible, I wanted the space to allow for the students to express their cultural agendas, concerns and interests and “move towards mutual, symmetrical dialogic construction of meaning, within appropriate culturally constituted contexts” (Bishop, 1998, p. 208).

The girls organized the meetings based on their school, social, and employment schedules. I met with Doris, Melissa, and Krystle once at the school during classes. Doris, Melissa, and I met at the school over their lunch hour, and Doris, Krystle, and I met at a fitness centre near their houses. The meetings were very informal and casual, requiring only a few initial prompt questions to initiate conversations. They were familiar with one another both inside and outside of the school setting and were confident in sharing their experiences and thoughts both in a group and individually. At the end of the meeting with Doris and Melissa, Melissa decided to meet one further time with only myself at a coffee shop. At the end of the meeting with Doris and Krystle, Doris felt she had said enough and Krystle

scheduled one final individual meeting to take place at her house later that week.

Both times I met with Brent and Chris were at the high school during class hours. Based on their academic schedules, the boys decided what time of day we would meet. The first conversation with the boys required a lot of prompting. They may not have felt comfortable conversing because of my presence, the setting, the situation or any number of personal reasons. The boys seemed to feel much more comfortable and free to discuss during our second conversation. The students were the ones who decided how long the interviews would last (usually for a class period – 80 minutes) and decided when and how often we met.

During our conversations, students discussed how they would like this work shared with the community. The students wanted this information to be received by others in the teaching community, namely the teachers. They agreed the best way to communicate their comments would be to put them into a clear and succinct form so that others could read them. They did not elaborate further, however, on how to interpret the conversations.

I would have left the conversations intact and unedited, however, if the students wanted this information shared, it would be impractical for someone to pick up the transcription pages and read over 14 pages of one conversation so that they might become better informed about the issues facing First Nations students (more impractical still to read the entire 140 pages of conversations).

Because the students wanted a clear and succinct way of representing their thoughts, I spent a month transcribing the conversations and sorting the comments

into themes which are discussed further in Chapter 4. This process allowed me to gain a better sense of their ideas and issues as a collective.

Half of the themes emerged as a result of the prompt questions I asked (from the above paragraph). The students had a lot to say about these issues when given the opportunity to speak. Their answers and suggestions based on those questions were very similar. They also discussed issues not based on the questions I asked but issues they felt were important and needed to be addressed within the school system. The other half of the themes emerged from here.

The students' recommendations were very similar, leading me to believe that, despite differences in age, gender, and background, their experiences with and comments about certain issues were shared. I read through the transcripts and identified certain topics. Reading through the transcripts a second time, sections of the conversation that were identical in topic were grouped together. If the sections of the conversations (content) fit well with the topic, and there were more than two sections, the topic became a theme. The conversations were, therefore, grouped into themes and the contents within the themes were subthemes. As an example,

Theme: General Teaching

Subtheme: Melissa (Grade 9): I think there should be more Aboriginal teachers.

Subtheme: Doris (Grade 11): There should be more one on one [teacher to student interaction].

At this point, I struggled with how to approach the project. I had sent a copy of the transcripts and a list of the themes to the students, however, I did not receive any

feedback from the students in terms of how to interpret the themes or what beyond the themes could be done with the information. I did not feel comfortable with the list of themed and coded data I had given to the students as I felt it violated ethical protocol and conduct within a First Nations community. Themed and coded data seemed to be Western scientific ways of dealing with research information. My sense from reading literature written by First Nation authors was that representing data in such a way would be inappropriate (Battiste & Henderson, 2000; Cole & O'Riley, 2002; Castellano, 2004; Graveline, 2000).

Castellano (2004) explained that “[r]esearch that seeks objectivity by maintaining distance between the investigator and informants violates Aboriginal ethics of reciprocal relationship and collective validation” (p. 105). I felt that the categorized list of the students’ suggestions might detach their voices from the research, voices that were an integral component of the work if it was indeed a collaborative effort.

Battiste and Henderson (2000) are critical of how Eurocentric knowledge systems categorize differences. They claim “[t]he strategy of differences is inconsistent with Indigenous thought and interrelationships, and its dualisms have to yield to more holistic thought if there is to be a relationship between Indigenous and Eurocentric knowledge” (p. 94). The conflict between knowledge systems is echoed by Knudtson and Suzuki (1992) who stated “[the Native Mind] tends to see the entire natural world as somehow alive and animated by a single, unifying life force, whatever its local Native name. It does not reduce the universe to progressively smaller conceptual bits and pieces” (p.14). There exists inherent conflict in the

knowledge systems of First Nations and European groups. Christie (1991), as previously mentioned, explained that Aboriginal systems are not separate from the natural world while school science places humanity apart and above the natural world; Aboriginal systems understand events in terms of complex webs whereas school science seeks to isolate itself into various disciplines. The ability of a researcher to recognize and respond to this conflict is imperative if the research is to be respectful and appropriate.

First Nations and Indigenous peoples are not the only group to find the idea of coding data is troubling. St. Pierre (1997) explains that through a qualitative research methodology “we believe we must translate whatever we think are data into language, code that language, then cut up pages of text in order to sort those coded data bits into categories...and produce knowledge based on those categories, which, in the end, are simply words” (p. 179). Attempting to analyze her set of data, she discovered that “[d]ata that escaped language ...exploded all over [her] study – data that were uncodable, excessive, out-of-control, out-of-category” (p. 179). As a result, she presented her data in a manner that demonstrated the difficulty and veritable impossibility of coding such information.

Because the idea of coded and categorized data was incommensurable with a First Nations perspective and troubling as a qualitative approach to research, it was necessary to present the students and Champagne and Aishihik First Nations with something that was respectful and meaningful and would open up the channels of engagement and dialogue. However, if the information was to be presented back to the students for critique, it was necessary to devise a way to present the information

in a way the students might find interesting, creative and useful for disseminating to other teachers.

Re-thinking the Method

As a way to approach data, Scheurich (1995) suggests “[w]hat is needed is research on interviewing itself – some “playing around” or experimentation with interviewing and with ways to represent interviews that highlight the indeterminacy of interview interactions, ways that allow for the uncontrollable play of power within the interaction” (p. 250). Because the students had ideas of sharing this research with other teachers, the idea of an audience for this information helped shape the way the data was presented. Vignettes, as described by Ely, Vinz, Downing, and Anzul (1997), seemed an appropriate way to represent the data because “[t]hey offer an invitation for the reader to step into the space of vicarious experience, to assume a position in the world of the research – to live the lived experience along with the researcher” (p.72). Furthermore, “the vignette sandwiches together the particulars of people, time, places, or events to reveal implicitly the significance of the story told” (p.72). Vignettes seemed a more ethical and respectful way of representing the conversations and communicating the ideas the students had shared. Presenting the data as vignettes also opened the doors for engagement by giving the students the opportunity to contribute to the way the data was presented. The process I used to create the vignettes is explained further in Chapter 4.

In order for this project to be complete, input from the students was an integral aspect of the final development. Swisher (1998) notes that although much of the research about First Nations is written through stories, metaphors, and

experiences “much research still is presented from an outsider’s perspective” (p. 191). It was necessary, then, that I rethink my role in maintaining the integrity of the project particularly if our collaborative effort was to determine how the information was enacted/written/spoken. A second visit with the students was necessary to engage in a fully collaborative effort to ensure their voices were at the foreground of the research.

The students were sent copies of the vignettes and asked (via telephone and email) if they would like to meet for a second set of meetings about the vignettes in a month and a half’s time. The students seemed keen on the idea of the vignettes and were interested in meeting again to discuss them further in terms of editing and dissemination. The four vignettes were intended to springboard further collaboration during the second visit with the students.

Upon my arrival at the school it was evident that meeting with all the students was not a possibility as one of the students had since dropped out of school and moved to another address, another felt he had too many things happening already in his life to make meetings a priority. Three of the students and I were able to meet, however. Although students were pleased with the vignettes, explaining that they were a funny and accurate representation of their thoughts and ideas, they had few comments to make in terms of the content, structure, and possible dissemination. The students made a number of suggestions in terms of where the project could go; however, I did not feel they had a clear sense of what they were building towards. Some of their suggestions included doing a radio drama, writing a letter to the Minister of Education or having local drama troupes perform the skits. I

sensed that the students were skeptical of the likelihood that their suggestions would be implemented. This may have been due to my absence as an individual within the school community or their having felt like they had said as much as they would like to say about school science.

The students indicated at this point that they had enjoyed collaborating together and having the opportunity to speak about school science and felt they had nothing further to contribute in terms of sharing their thoughts and experiences. In addition, the Champagne and Aishihik First Nations had not yet indicated how they would like to see this information used; further opportunities for consultation with the students are pending.

Chapter 4: Talking the Talk

Data

As explained in Chapter Two, the interpretation of the conversations was initially approached through coding and categorizing the data into themes. This process was not in keeping with the holistic nature of this research with the Champagne and Aishihik First Nations and as a result, the conversations were reinterpreted through the use of vignettes. This chapter discusses the process through which the conversations were themed, how the conversations were constructed through the use of vignettes, and elaborates on the use of the vignettes as a tool of dissemination.

The Themes

The first time I met with the students they expressed their interest in sharing what they had said with teachers, and other people and/or organizations involved in education. Initially, presenting the conversations as themed data seemed an appropriate way to convey meaning to others in the community. Conversations with the students, then, were grouped into themes centered around our discussions on school science, culture and education. The transcripts were read through and different topics based on statements the students made were recorded. The topics were then grouped together and if there were more than two of the same topic, the topic became a theme.

Some of the more prominent themes and issues students spoke at length about in conversation included:

- General Teaching Suggestions

- Science Suggestions
- Culture Suggestions
- Culture and Science
- Science/Education and Jobs
- Science Interests
- Success/Goals
- What is important/relevant to their lives
- Remembered Stories
- General Suggestions
- Stereotypes

General Teaching Suggestions included ideas the students might suggest to teachers. For instance suggestions on how teachers might present new information in the classroom to accommodate different learning styles. As some students commented, “I think teachers should listen to their students a bit more. I think they don’t really like, they just kind of take you for granted. Sometimes they [the students] really do have something important to say.” “The teachers should explain what to do a lot better and if you don’t understand you could just stay after class and ask the teacher what you have to do for homework and other stuff.”

Science Suggestions were suggestions that related directly to science; spending more time out doors in a science classroom, or visiting science related organizations within the community. Doris suggested students could visit “the electrical place [a power generating station] because science is electricity” and Chris suggested students “learn about natural stuff. Wilderness and animals and weather and stuff like that.”

Students' discussions on how culture and education/curriculum overlapped or diverged, was themed *Cultural Suggestions*. As a way to incorporate more of her cultural background into a classroom, Melissa suggested that classes have "more cultural activities." When asked to think about how she thought of her culture and school, Doris explained, "I think they're together but sometimes I think they're separate. Like it depends what you're doing. Like with school I think it's together right now because, I mean, I'm learning my language [Athapaskan]."

Culture and Science was a category that included their comments on how science and culture existed and/or could exist within the school community. Krystle was optimistic about the possibility and stated "I'm sure you could tie things in with science, like I was saying, scientifically somehow they made bannock. So you could tie things in like that in science and stuff. They should probably talk to our Elders and find out stuff that way."

How they understood science and education being related to their future prospects for employment is themed *Science/Education and Jobs*. A couple of students recognized science to be an important skill for future employment and stated: "I am going to have to have science to get a job" and "[science is useful in order to] get a job, get a career."

If the students began discussing aspects of science that they particularly enjoyed, they became part of the *Science Interests* category. Activities such as "making rockets" and "looking up bones and stuff and fossils" would peak a couple students' interest.

Success/Goals focused on what success meant to the students, what attributes were required to be successful, what their goals were for high school, and their future careers. Doris reflected that this year she is [p]aying attention, like I'm actually doing this year." Other students continued: "[y]ou just gotta stay focused" "and listen."

Comments on ideas, issues and people who impacted their lives or occupied a lot of their time were themed *What is important/ relevant to their lives*. To Melissa, her "little brother and school" were the most important things to her at this point in time. Brent and Chris elaborated on the more detailed aspects of the movie *The Matrix*.

When students would discuss stories that were significant or remembered for one reason or another, they were themed *Remembered Stories*. A detailed story of a bison hunt was told by Brent. In part of the story he explained how "they taught us how to make a fire with one match and how to make little huts out of snow." In another discussion, Chris shared some of his knowledge about the solar system and mentioned that "[s]tars are like the sun. I heard that they could fit over two billion earths in it."

Although this last theme, *Stereotypes*, was not spoken of at length, I felt the comments were significant enough to include the category with the list of prominent themes. In response to a question about what the students were hoping to gain from their courses, one student stated "I'm getting my second language, Athapaskan, out of my courses", to which another student replied "Gibberish."

Finally, *General Suggestions* encompass any suggestion the students made with regards to education/school/curriculum that did not fit into the other categories. In

terms of how grades were organized, Krystle explained that she liked the “whole middle school [Grade 7, 8, 9] idea” and Chris would like to “[g]o on big outings. Like sometimes for the whole day.” Although the amount of information the students shared was extensive, these examples illustrating the themes provide an overview of the type of information the students shared.

The Vignettes

As explained in the previous chapter, leaving the conversations as a list of themed and coded suggestions was an inappropriate mode of interpretation for a collaborative project with the students and the Champagne and Aishihik First Nations. For this reason, the comments I identified as thematic were used to construct the vignettes. The students were very prolific in their descriptions and provided an ample amount of material to work with organizing the vignettes.

In constructing these vignettes, I chose four topics that I believe best represented the themes. The content of the vignettes comes largely from the transcribed comments the students made about each theme. As the vignettes were my interpretation of the conversations, the names of the students were changed to protect their anonymity. In the instance where one of the students' teachers read and had a negative reaction to the vignettes, I would not want the teacher to identify the student in his or her classroom and penalize the student as a result of their reaction to the vignettes. The names of the students were changed in the vignettes to protect their anonymity. Students spoke about what school was presently like for them and gave many suggestions about how to integrate culture, science, and more favorable teaching practice into the school setting. The disparity between their comments on

what school is like and what it could be like, compelled me to construct two vignettes based around those two ideas. A vignette that was presented as a conversation between the students, an illumination of the flow of their conversations that focused on culture, science, and education was also chosen as an appropriate vignette focus. The students spoke briefly about racism in the school. I chose to write a vignette on this topic because the words of the students were so powerful in describing the situation as it exists to them.

The content of the vignettes includes the voices of the students, myself, philosophers, storytellers, and other researchers. I thought including comments from others in the storytelling, academic or research community might demonstrate that the ideas the students had were shared and supported. As an example, I included a quote by Silverstien (1974) to introduce a vignette entitled *What Should Be*. The students were optimistic about how a classroom could become an engaging environment where students would look forward to learning. As an invitation to such a place Silverstein (1974) inspires readers to “come sit by my fire, [f]or we have some flax-golden tales to spin. Come in!” (p. 9).

The four scripts presented give voice and action to all of the themes listed above. The titles I chose give the reader an idea of the content of the script. Script One; “What is” and Script Two; “What should be”, show the contrast in the students’ ideas about what school is presently like and what it could be like. Script Three, “When Culture Met Science: A Brainwave”, attempts to bring together culture and science using the students’ ideas to shape what this type of class might look like. Finally, script Four, “The Dark World of Stereotypes”, demonstrates a

backlash of educational reform and equity within the education system. The meaning of some of these themes will become evident as they are enacted through the voices of the students and the characters in the vignettes.

Because of the collaborative nature of the research, validity was established through negotiation with the Champagne and Aishihik First Nations and the students. In her discussion on *Ethics of Aboriginal Research*, Castellano (2004) states “[c]ulturally different approaches to knowledge creation imply the need for different methods of gathering and validating information. Participatory research has received a positive reception in Aboriginal communities and has gained acceptance in some quarters of the research community” (p. 106).

The vignettes were presented to the students before we met for the second time. The students had one month to consider the layout, the information contained in them, and whether they wanted to add or remove comments. The vignettes were also presented to the Champagne and Aishihik in following with the Ethics and Protocol written prior to beginning the thesis (Appendix B). As explained in the previous chapter (p. 66), the students had few comments to make and had felt they had contributed an ample amount to the project. The Champagne and Aishihik First Nations indicated the vignettes were a creative and powerful way to present the information; however, they too had few comments to make.

The interpretation of the vignettes is the responsibility of the reader. The reader may choose to read the four vignettes in any order and all at once or separately on their own. Ideally, the scripts would be performed by the students who

participated in the research in a manner they deemed appropriate, or as one student suggested by other student actors.

With the permission of the students and the Champagne and Aishihik First Nations, sharing the vignettes and results of this research is a possibility. Some examples of how this research might be shared with the community might be to give the fourteen First Nations in the Yukon Territory a summary of the research. The final report may be made available to teachers through a presentation during a Professional Development Day. Yukon Territorial Government employees who work to develop curriculum and programs could be provided with the outline and findings of the research. Individuals in various departments at Yukon College could have the opportunity to access the report as well as individuals in the Yukon Native Language Centre. The effects of such vignettes on the educational system, however, is outside the scope of this thesis research.

Scripts

Script One

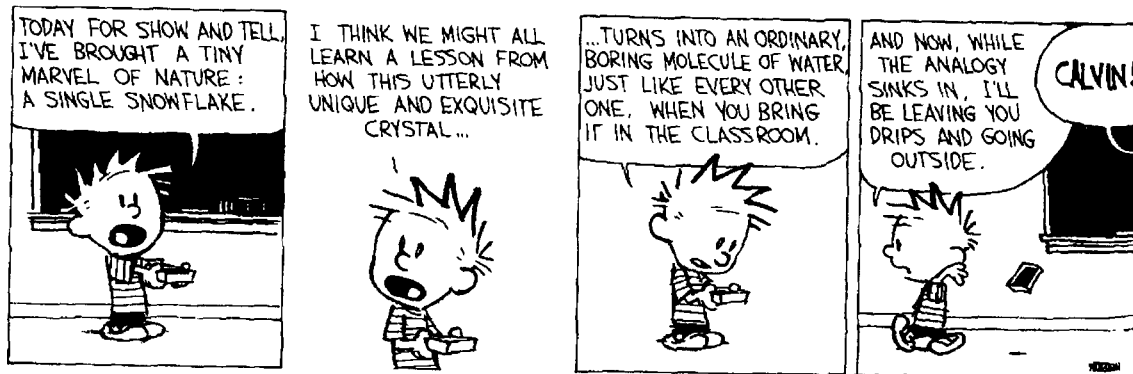
What Is

Figure 7. Calvin and Hobbes comic strip

¹³ CALVIN AND HOBBS © 1994 Watterson. Dist. By UNIVERSAL PRESS SYNDICATE. Reprinted with permission. All rights reserved.

Cast of characters:

Voice off Stage (a.k.a. the discourse of science)

Teacher

Penny (Grade 11)

Tracy (Grade 9)

Patrick (Grade 8)

David (Grade 8)

Setting:

- A classroom with 28 desks all in rows facing the teachers desk at the front of the class
- 2 windows along one side of the classroom
- pistachio shell colored walls
- A few posters on the walls about literacy and soil contaminants
- Teacher at the front of the class
- Students sitting in desks
- Strange, eerie music playing (e.g. the X-Files tune)

Students are chatting and walking around the classroom. The bell rings. The teacher walks in with a super-sized triple espresso, frown marks etched into her forehead. The students sit attentively in their desks with their homework ready to hand in.

Teacher: Alright class, hand in last night's homework in the bin at the side of the class.

All but 2 students hand in homework.

Teacher: Penny, Tracy, you don't have your homework done?

Penny: No.

Tracy: Nope.

Teacher: Now, what do we know is important in being successful students class?

Patrick: Try to keep track of everything you have to do after school and try to do more than the teacher asks.

Teacher: And what can we do in class to ensure this happens?

Patrick: Stay focused.

David: Focused and eye contact, and listen instead of fooling around and not listening. Pay attention.

Teacher: Penny, anything to add?

Penny: Showing up, getting my work done, and getting good marks and trying to get the best marks that I can.

Teacher: *(Thinks - I knew from the beginning she would be difficult).* Tracy?

Tracy: Paying attention.

Teacher: That's right.

The Voice off Stage: Yeeessss, that IS right. You know what you have to do my precious children. Just relax your minds, listen listen listen

Teacher: Now, everyone take out your texts to chapter 9, page 78 and I'll discuss the properties of acids and bases.

Teacher talks for the next 45 minutes at the front of the class, reading from the textbook and her notes. Students listen? Most students sit quietly giving the illusion of attentiveness but a couple, at the back of the class (where else), are clearly disgruntled.

Teacher: Alrighty everyone, now get into your groups and I want you to do the lab that we discussed yesterday, outlined at the end of the chapter. I trust you all have copied the appropriate charts from last night homework. Move your desks together to make it easier to work as a group. Yes Penny?

Penny: I was wondering how we were suppo-

Teacher: -Penny, if you didn't do your homework, I don't have time in class to answer those questions. (The teacher turns the music level up one notch).

Penny looks back at her teacher, wanting to give her the finger and slam the door as she walks out of class. She looks at the pistachio colored walls and thinks... what is it about that music? She is calm again and can't remember what was upsetting her.

Group 1: Penny, Tracy, David and Patrick shuffling desks together.

Patrick: So, did everyone get a chance to look at the discussion questions? Personally, I think that the acid is going to turn the indicator pink. I was reading that cabbage juice can be used as a good indicator and thought I'd try –

Penny: -Why do we have to take science? Do we even need it?

Tracy: I just want to get my Grade 12.

Penny: I only come here because I want to graduate.

David: Maybe so you can go to university and get a higher paying job. You gotta get an education.

Patrick: Well, say if I was in Grade 12 and um I think my nephew would be in Grade. 7 or 8 and I'd feel like helping him with whatever he was studying. I'll need science to be an RCMP officer.

- Teacher: (Muttering that the music must not be working)
(to the students) What would you say your experience of science has been so far?
- Penny: Boring.
- Tracy: Yeah, very boring. It'd be funner if we did something but we are just sitting here.
- Teacher: Humph. Back to the class. I heard you all talking about graduating and I wondered what that had to do with this lab?
- David: Penny just asked why science was important.
- Teacher: (aghast)
SCIENCE...NOT IMPORTANT....Why I never heard such nonsense!
- The Voice off Stage: Uh-oh, we have another one. Questioning of all things! Set the alarm and have the stun gun ready for her at the end of the class.
- Tracy: Well, you've graduated (to teacher), do you use everything you learned in science class? Do you walk down the streets with your friends and say "acids and bases are fun!"?
- Teacher: (Face draining of blood, frozen in her footsteps. Her eyes dart to the left and then to the right looking for the nearest escape. Her palms are sweaty and she is grabbing at her skirt. Having no response for Melissa and feeling trapped, all she can think to do is yell)
HEY, WHAT IS THAT AT THE FRONT OF THE CLASS!

All heads turn to the front of the class. With expert stealth, the teacher slips out of the classroom undetected...never to be seen again.

Script Two

What Should Be

It's not the learning that's important but the leaning. You must lean toward your questions, your problems; lean slowly so that you don't bend the solution too badly out of shape" (Peter Blue Cloud, 1996, p.102).

"I want the readers to find an "elsewhere" from which to envision a different and less hostile order of relationships among people, animals, technologies, and land. Like actors in the stories that follow, I also want to set new terms for the traffic between what we have come to know historically as nature and culture" (Haraway, 1989, p. 15)

Cast of Characters:

Nikki

Lexi

Penny, Tracy, Jane, Patrick and David

David's uncle

Meteorologist

*If you are a dreamer, come in,
If you are a dreamer, a wisher, a liar,
A hope-er, a pray-er, a magic bean buyer...
If you're a pretender, come sit by my fire
For we have some flax-golden tales to spin.
Come in!
Come in!*

- Shel Silverstien, 1974, p. 9.

Setting:

- Classroom is a greenhouse. Students are responsible for the care of all the living things in the class.
- The floor is glass and there is an aquarium with various fauna and aquatic life underneath.
- There are comfortable chairs, tables, couches and bar stools and a bar-style table set up.
- 2 teachers in the classroom that are with the students all semester.
- 7 students in the classroom that are together all semester.
- Large calendar shows the various excursions the students will be taking, the guests that will be coming to the class and general activities. It shows there is

a trip to up the Dempster to Inuvik planned for the spring. It is also clear that the classroom provides a home base to the students but does not represent the space where all the learning takes place.

It's evening in the late fall. The students trickle into the classroom and leisurely make themselves a cup of tea or coffee. The teachers are sitting on the couches talking to the students as they walk in. Some students are feeding and tending to all the plants and animals in the class. The students are in the classroom taking care of some loose ends before heading out for the night on a field trip to Miles Canyon to watch the meteor shower. Meeting them to speak about the 'Western scientific' and 'First Nations traditional' ways of understanding will be a local meteorologist and one of the students' uncles.

Nikki (teacher): Alrighty everyone, I found out that we won't be able to meet next week with the fellow from DFO (department of fisheries and oceans). Any other suggestions about how we could spend that day?

(Jane: We want to be able to make our own choices.)

Penny: We could go to the dam, the electricity place. Because science is electricity, electricity is science. And then we could learn how the energy is used and write a 1 page paper on it.

Jane: What about visiting the fish camp at Army Beach? We could do hands on stuff like cleaning, gutting and cooking the fish.

Patrick: I liked the idea about going to the fish ladder.

Tracy: We could do both and have a longer day, and take a few hours off the next day.

(Penny: We need more First Nations teachers.)

Lexi (First Nations teacher): It is up to you all. Just make sure you'll give yourselves enough time to begin work on the salmon spawning project. Remember, you'll need to make time to meet with people in the community.

Nikki: So that is okay with everyone to have a bit of a longer day and go to both the fish ladder and Army Beach?

Everyone nods.

Penny: Just as long as I don't have to get up before noon. That might kill me. I feel so sorry for those people who have to wake up at 7am to go to school. UGH!

David: We should get going if we are going to be on time to meet my uncle and the meteor guy at Miles Canyon at 7.

Students pack up thermoses, extra warm clothes and lawn chairs for maximum star gazing/listening comfort. Teachers and students drive to Miles Canyon in the class van and are ahead of time to meet the speakers. The meteorologist leads them to this one spot he has in mind and the students and teachers and David's uncle get settled.

Penny: I think education and culture should be together.

Meteorologist: So, how much can you people tell me about what we are looking at right now?

David: Stars are just like the sun.

Meteorologist: Exactly and what do our scientific textbooks tell us about the sun?....*(continues with talk, making sure students are always engaged).*

Students have time to ask questions at the end of his talk and thank him before he leaves. Taking a break they gather some wood and make a small fire to warm up and move around before David's uncle begins.

David's uncle first explains how he came to understand the relationships between humans and the planets and stars. He begins with a story told to him by his grandmother that helped him to understand the interconnections.¹⁴ He then asks the students questions about their understanding of the story they just heard.

Everyone thanks both speakers for spending time with them.

(To audience)

So, you can see how hard it is to envision what a cultural science classroom would look like. How do you merge culture and science in equal, equitable ways? Part of the problem is exemplified through the following response:

¹⁴ People performing the vignette would include a story they would deem appropriate.

Jane: I don't know, it's really hard to think differently from what you've been used to for years and years. That's where I'm having the problem saying what would I like because I'm stuck on what I've had to do. That is where I am stuck right now.

Nikki: Well I guess you and I are in the same position, because I don't really know where to go from here.

Angayuqaq Oscar Kawagley & Ray Barnhardt: (*Jane and Nikki turn to the left to hear them*). "All learning should start with what the student and community know and are using in everyday life" (1999, p. 119).

Madeleine MacIvor: (*Jane and Nikki turn back to the right to hear MacIvor*). "Traditional [First Nations] science...must become an integral part of the curriculum" (1995, p. 88).

William Cobern & Cathleen Loving: (*Jane and Nikki turn again to face Cobern and Loving – looking clearly exasperated*). "...indigenous knowledge is better off as a different kind of knowledge that can be valued for its own merits, play a vital role in science education, and maintain a position of independence from which it can critique the practices of science and the Standard Account" (2001, p. 51).

So where does this leave us? Should First Nations knowledge be *integrated* into the science curriculum, or should it remain a separate body of knowledge? Who gets to decide?

Doorknob from Alice in Wonderland: "Read the directions and directly you will be directed in the right direction" (Carroll, 1969).

Jane: (With an incensed expression). Okay, okay, everybody STOP!

March Hare from Alice in Wonderland: "I have an excellent idea, LETS CHANGE THE SUBJECT!" (Carroll, 1969).

Thomas King: "Coyote comes by my place. She wag her tail. Make them happy noises. Sit on my porch. Look around. With them teeth. With that smile. Coyote put her nose in my tea. My good tea" (King, 1993, p. 67).

Okay then, so we are clearly in an unclear state. The last number of comments from Jane and the researchers demonstrate that discussing how culture and science relate to one another is a difficult task, one that is best undertaken in

consultation with educators, researchers, and students so that many voices have the opportunity to be represented.

Script Three

**When Culture Met Science.
A Brainwave.**

Cast of Characters:

High school students:

Wendy
Adrienne
George
Mark
Nancy

Mediator:

Dale

Setting:

It is a crisp Sunday afternoon in December. Six students are sitting in the Midnight Sun coffee shop, huddled over their lattes and hot chocolates, watching the steam rise out of their mugs. The conversation is courteous and jovial. None of the students are sure what to expect or what the right thing to say might be. We have all met 3 months previous to this and the students spoke at length about their thoughts and experiences in science class and in school.

Dale: You talked before about some things, if you see your culture reflected in the stuff that you do in school.

Adrienne: You rarely ever see anything to do with culture in science class.

Nancy: Basically in science they're talking about English technology and English science and blah blah blah like most of the people they talk about that made all these things are like English people, so....Unlike Social Studies, which it's not science but they talk about different things. They talk about First Nations, presidents and all this other stuff in First Nations. They talk about other things too like all types of cultural stuff. But like science, they don't.

Wendy: There's lots of Native technology.

Nancy: Exactly.

- Dale: What do you think about that?
- Nancy: I think maybe we do need more culture in [science class]. Not only will it teach us more but it might give us more comfort. I think it would help.
- Adrienne: I think that they should have some culture in math, er, science. Because, you know different backgrounds have done different things.
- Mark: How to like survive in the wilderness and stuff. See what's not poison and what is. What weather is going to come. Try to learn about that, weather and stuff.
- Wendy: I think they should have one whole class that's cultural. Like instead of just the language, that you're learning everything about your culture. I'd like that, that'd be cool.
- Adrienne: A cultural class for the Natives.
- Wendy: Not the Natives. I mean like everybody.
- Adrienne: Yeah, for everybody.
- Wendy. Like everybody should be learning it.
- Adrienne: About First Nations.
- Wendy: Because they've always got the classes about the non- Natives and they're learning about the non-Natives but I mean what about the Native, are we just chop liver and nobody wants to know about them? Like seriously.
- Pause
- I barely know anything about my culture and I'd like to learn more.
- George: Maybe often you go on a field trip to look for bones. Maybe you could look at it in the classroom and look at it in books to see what kind of bone it is. Try to find more.
- Mark: Learn about natural stuff. Wilderness and animals and weather and stuff like that. If you get lost in the wilderness you can tell what

kind of stuff is good to eat, is bad to eat, like mushrooms and stuff.
how to build a little quinsy.

- George: Huts.
- Mark: Huts and stuff like that. How to make fire and how to hunt food and stuff. How to make food, how to survive and eat stuff. And so you'd get ready and you might know what kind of weather is going to be the next day and stuff like that.
- George: Every person should know how to survive out in the wilderness. Because if they don't they might just get lost or die because they have no food and they have no water.
- Mark: Because you can get poisoned by stuff or you can learn about food that are poison and not poison. Because you get poisoned you could die, or get sick, you could learn how to take care of yourself in the wilderness. Try to learn how to make nets, spears and stuff.
- Dale: So even if someone grew up in a big city, do you think it's important that they know these things too?
- George: One day they just might go out in the bush and then have to learn it in a few days when they're with other people. They might have to know how to protect themselves if a bear came.
- Dale: Anything else you guys can think of?
- Nancy: Maybe they should have a couple of different languages at the school a couple of people that talk different languages.
- Wendy: They should have Tlingit and Southern Tutchone and Northern Tutchone instead of just Athapaskan.
- Nancy: Because I think learning our own language is important because a lot of our language is getting lost. Besides English, but that's everywhere. That's mostly what people speak.
- Shel Silverstien (1974):
 Once I heard and answered all the questions
 of the crickets,
 And joined the crying of each falling dying
 flake of snow,
 Once I spoke the language of the flowers...
 How did it go?
 How did it go? p. 149

- Wendy: How they got around. How they got the horses and trained the horses.
- Nancy: Transportation. Yeah, because they teach you all that about cars and stuff.
- Adrienne: How they started building boats and how they come across things. Stuff like that.
- Nancy: And housing too.
- Wendy: Oh, the dance, the traditional dance. I used to do that.
- Nancy: Herbs and different medicines.
- Wendy: History, language, cooking and crafts.
- Dale: So who do you learn these things from?
- George: Elders.
- Mark: Elders.
- Wendy: Get some elderly guests.
- Adrienne: I don't know, like go to the Bands and see what they do, like go to the Band office.
- George: Adults, people who know a lot about the wilderness and just learn from them and memorize it and keep on doing the stuff that they taught you.
- Mark: Pass it down to your –
- George: To the younger ones.
- Mark: Pass it to the little ones and nephews and cousins.
- Adrienne: Now what the Natives are worried about, well some of them anyways, is that um, like the Elders, they're not passing down their teachings that their parents and their grandparents taught to them so they're worried that the culture is going to die out and like doing a course where you learn about culture, get a couple of Elders in you

know, and then you know that the culture's not going to, people aren't going to forget about it.

Dale: So then how can we make sure that people don't forget?

Louise Profeit-Leblanc: “[W]e must take up the work of documenting as many...stories as possible so the next generations can learn from them, so that the knowledge they contain can be utilized far into the distant future. These stories are the foundations which have been embedded in the territory since the beginning. They have been time-tested and contain such invaluable information that surely it is worth our efforts to record and preserve them for future generations” (1996, p. 18).

George: I went there [Tombstone campground] for a camp in Grade 5. We had to run 1 mile in the morning before we had breakfast. Had to get up there, everybody had to be there and I had to run all the way up the big hill and come back. It was half a mile up and half a mile down so that'd be a mile. And if we got to the top of it first, we'd run back down and make breakfast and then Fish and Wildlife people would come and tell us about bears and not to bring food in our tents. So the Fish and Wildlife would tell us about these bears and they'd let us try some bear spray. They told us this story about people spraying themselves with bear spray.

Nancy: I did this in Grade 7. I went out and it was winter and we tested different kinds of snow and things for like the weather to see how it changes and then a couple months later we tested something like the water or something like that and we did this thing that went on for a while but it was in this area where I was going to school and that like I think it would be good if they had to do something once a week or something like that.

Dale: So, as a 'researcher' I am not quite sure what my suggestions for this project are.

Fyre Jean Graveline: I would Heartfully recommend"
"data" collected by Talking Circle as Methodology.
is best left Un-edited
Un-analyzed.
Preserve the content Intact
Circular
Flowing
Interconnected.

(2000, p. 396).

Adrienne: For teachers to listen to it, to see what we are seeing.

Nancy: Well the most beneficial thing is even if things don't change right away, at least you made an honest effort to get heard, or someone might hear you. I mean, I'm not in high school anymore, but my brother is going into high school later on and my cousin and stuff like that. So, if it doesn't get better for me, it might be better for them. So I think about it that way.

The end.

Script Four

The Dark World of Stereotypes

Cast of Characters:

High School Students:

Wendy
Adrienne
Mark
George
Nancy

Stereotype police

Teacher:

Nikki Morningstar

Setting

- A Cultural Science Classroom
- Many posters and student work displayed around the classroom.
- Plants
- Colorful pictures
- 5 chairs to each circular desk.
- Corner of the room sectioned off for students to write comments, display current events cuttings, tradebooks, magazines
- Pile of crafts in the middle of each desk

The bell rings, students settle to their chairs. The teacher is at the front of the class, leaning against her desk, sipping her green tea with Echinacea preparing to give the morning lesson.

Nikki Morningstar: Mussi cho or “good morning” as us English say.¹⁵ We have an exciting class this morning. Now we have been discussing dreamcatchers and how they can be used as a metaphor in understanding the web of life. What was the story again (pause) oh well. So today, we are going to make dreamcatchers. I’ve found these wonderful hot pink and lime green feathers. Everything you need should be in the middle of your desk. Just follow the instructions on the chalk board and off you go! Enjoy.

The instructions on the board are as follows:

¹⁵ Mussi cho means *thank you* in Norther Tutchone. Yukon Native Language Centre (personal communication, January 22, 2004)

How to make a Dreamcatcher:

Materials required to make a 5 inch diameter Dreamcatcher

- 1 5" ring
- 4 yds Suede Lacing 1/8 inch
- 3 yds Imitation sinew
- 1 Small Concho
- 12 Pony Beads Colour 1
- 6 Pony Beads Colour 2
- 12 Feathers

The colour scheme is entirely up to you.

You will also require: scissors, glue, a clothes peg.

Step by step guide:

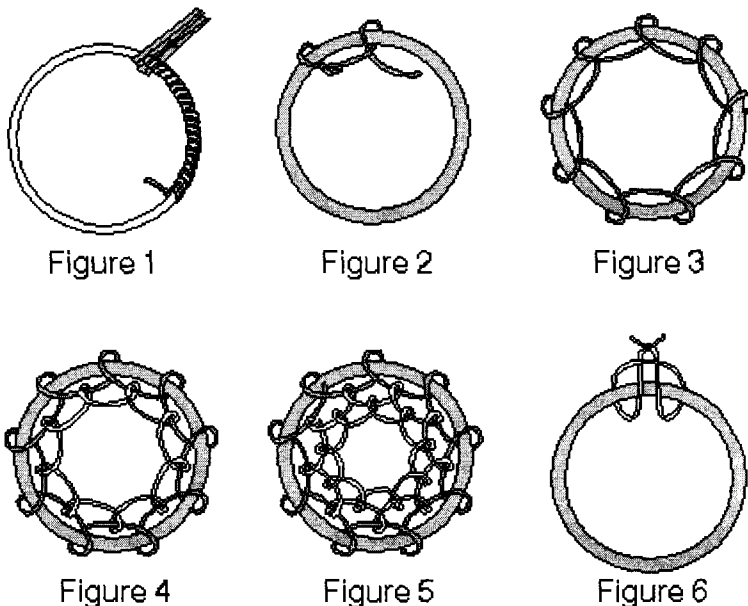


Figure 8. A Step by Step illustration to making dreamcatchers.

¹⁶ Reprinted from Karp Styes Web Design, n.d. Adapted with permission.

Wendy: Is she on crack?

Mark: This is a joke right?

Nancy: I think this is her way of combining culture with science.

Stereotype police: Whoa Nelly! Where is this gal from? Using Northern Tutchone words she doesn't understand, bringing cultural

activities she knows nothing about into the classroom in inappropriate ways!?

Students begin working on dreamcatchers. Reluctantly piecing their crafts together mostly by trial and error. As they work their conversation wanders...

Adrienne: This is stupid.

Stereotype police: How is this supposed to be about culture and science? Does a course exist where students can actually learn what they are supposed to be learning?

Wendy: All they do is they teach about non- Native people and they don't teach about Natives. At least I'm getting my second language, Athapaskan, out of one of my classes.

George: (Smirks). Gibberish.

Stereotype police: (To the audience). Why would George say that the Athapaskan language was gibberish? Think about this. How does this make Wendy feel? What will her reaction be?

Wendy: What do you know? (To Adrienne and Nancy) I don't like Native guys, they're all assholes.

Nancy: You sound like your grandmother now.

Stereotype Police: What has Wendy experienced to say what she did about 'Native guys'? Is it something she has experienced or something she has heard or maybe something else?

Adrienne: Most of them are at Sargent Park. ¹⁷A lot of them are at Sargent Park.

Nancy: Most of THEM?

Stereotype Police: Aaaah, Nancy's presenting a bit of a challenging question. What will come of this?

Wendy: A lot of Natives are at Sargent Park.

Adrienne: Yeah.

¹⁷ Sargent Park Secondary is a pseudonym for one of the high schools in Whitehorse.

Wendy: That school has lots, but I mean they're all druggies and alcoholics. That's like the worst school.

Nancy: Not all of them.

Wendy: Not all of them but a lot of them. That school is like the biggest –

Adrienne: I got kicked out of that school last year.

Nancy: Let's not talk about this.

The bell rings and the students put away the work they had done and get out their pocket change to hit the Coke machines for their 10 minute break.

Nikki Morningstar: Wonderfully creative work everyone. Really. When you get back to class we'll brainstorm something we can do for the talent show.

Students leave the classroom.

Pause

The break ends and the students sit down in class.

Nikki Morningstar: So now for some suggestions about how we can infuse some culture into this school talent show. This is completely anonymous and remember we respect ALL suggestions and comments.

Stereotype Police: The fact that she has to remind students about respect leads me to think there is not respect in the classroom. What is her version of respect and does she know what she is expecting from the students? How does she enact respect?

Students reluctantly scribble down some ideas on scrap paper and put them into the hat the teacher is holding out as she walks around the classroom.

Nikki Morningstar: Let's take a look at some of these suggestions. (Her ruby red fingers sift through the hat and open up a folded piece of paper). The first one, "Do a cooking demonstration, example how to make bannock".

Wendy: Teach dumb kids how to make bannock.

Nikki Morningstar: Well, that sounds nice and all, but really, how does cooking relate to culture?
(Crumples the paper into a ball and sends it arcing into the trash bin).

Stereotype Police: What the?!!!! What just happened there. Sure, she may have scored a 2-point basket but I think her rating with her students took a nose dive.

Sound: A plane descending and crashing.

Nikki Morningstar: (with an expression of jovial oblivion).
And the next one reads "Learn a traditional dance".

Wendy: So the only thing about that is that everyone would be making fun of it. Because the schools up here now are so full of racist people. That's the only problem, there's so many racist people up here. That's what I notice. And there's getting to be more and more every year.

Nikki Morningstar: Racist you say mmmmm? (pause) Nope, haven't noticed.

Stereotype Police: She hasn't noticed eh? I wonder why not. Now if we were to go back in time and write this script over, what might we change?

The end

Reflection on the Vignettes

Ely, Vinz, Downing, and Anzul (1997) offer “[i]f vignettes are taken seriously as a useful interpretive tool, you might find that writing them raises more questions than answers about how you are representing participants...” (p. 72). They further explain that vignettes “help [the researcher] tap into what you are learning as well as help you identify gaps, silences, and contradictions you might address” (p. 72). In terms of the way in which the conversations were (re)presented, a reflection on the vignettes revealed to me more about the ways in which I am enframed by the discourses I seek to deconstruct.

I wrote about the students (even thought it was their comments I had used) in the way that I see them in the classroom. They had ideas, but ultimately, it was my vision that structured the vignettes. This vision, consistent with a Social Critical Theory methodology, saw students as oppressed within a science classroom, and is illustrated in *Script One: What is*. In my methodology, I diverged from Social Critical Theory here and attempted to deconstruct the research space, not wanting to speak for the oppressed, or to even claim who was oppressed, but to engage in a dialogue with community members working towards common goals. What emerged from this was the (re)telling of the students’ stories through vignettes.

In their critique of the Western worldview Knudtson and Suzuki (1992) explained that the world is viewed as sets of dualisms. This contrasts to an Indigenous worldview where the universe is understood as a complexity of interactions (Knudtson & Suzuki). The extent to which binary thinking pervades Western society and limits their *vision* is evident in the vignettes I constructed. The

first two vignettes are set up as binaries to one another. It was simplistic to represent school science in such a linear fashion. *Script One: What is* exemplifies a bad teacher, limited curriculum, and uninspiring classroom. This type of classroom, as described previously in this thesis by Aoki (1999), “tends to reduce “teaching” to mere instruction-structuring pre-givens into learners’ heads - “learning” to mere acquisition, and “assessment” to mere measuring the acquired” (p. 180). In contrast, *Script Two: What Should Be*, exemplifies good teachers, a broad curriculum, and an inspiring classroom. The latter classroom legitimized the lived curriculum. Within the curriculum the roles of students as part of a larger community organization were legitimized and assessed

Upon reflection of the second vignette I realized I had claimed to know what was right and needed to happen to facilitate appropriate change in science education. This was demonstrated in the title of *Script Two: What Should Be*. I thought I had diverged from a Social Critical Theorists path by claiming not to have the answers to questions about First Nations student success in school science but to engage in dialogue with community members and students so that they might inform science curriculum. This did not seem to be the case.

The examples of setting the vignettes as dualisms and representing the students as oppressed demonstrated how a researcher can unwittingly engage the discourses they are attempting to deconstruct. Although the main purpose of the vignettes was to interpret the conversations with the students, the scripts did provide an appropriate venue for me to examine the “gaps, silences, and contradictions” hidden in the process of interpretation (Ely et al., 1997, p. 72). The students or

Champagne and Aishihik First Nations may decide to work with these scripts in the future, in which case editing may ensue. For the purpose of this thesis research, however, the scripts will remain as they are.

Chapter 5: Science is Science

The topics of the vignettes were my interpretation of the main ideas the students had made during our conversations. These main ideas included how school science is taught (Script One), the possibilities for teaching science in conjunction with First Nations Knowledge (Script Two), their ideas on culture, education, and science (Script Three), and how racism can manifest in the school setting (Script Four). At this point I would like to engage in a more elaborate discussion about the limitations of the research, the comments the students made, the research process, and recommendations for future endeavors.

Limitations

The methodology described earlier in this project could not be fully enacted for a couple of reasons; there was no time given to form a relationship with the students prior to the research, and there was minimal support for the students should they have wanted to share the work. Another factor that may have further limited the research was the low number of student participants.

One of the most significant limitations was that I was not a part of these students' lives as a teacher or individual they might see regularly within the school setting. Although I had grown up in the Yukon and was familiar with the teachers and school, I was an outsider to the students. I was only spending a short period of time in the Yukon and thus could not develop any rapport with the students prior to this project. Expecting that the participants would be "involved in every step of the project as co-creators and collaborators; including determining together how the project was shaped and how it was written/spoken/enacted" (Krocker, p. 57) was

presumptuous. I believe that had we been able to develop a relationship based on trust and familiarity, and been able to work towards some long term goal, the students and I may have felt in a better position to discuss common goals and the development of a project together.

I may have been able to gain some confidence from the students because there was not the student/ teacher dynamic already in existence between us. Put more concisely, the students' conception of me exists as a result of our meeting on almost 'neutral' territory, not because I was their teacher and it was their business to listen to me and learn what I had to say.

Future projects of this design would benefit if there were a previously established relationship between student and 'researcher', taking on the form of some investment by the researcher such as teaching, assisting in the classroom, or participating with the students outside of the classroom.

Further, the researcher should be willing to support the students and First Nations, should any further work be conducted such as dissemination to teachers and community members. The idea of 'personal investment' on the part of the researcher is discussed by Bishop (1998) who states:

[W]hile it appears that "personal investment" is essential, this personal investment is not on terms determined by the "investor." The investment is on terms of mutual understanding and control by all participants, so that the investment is reciprocal and could not be otherwise. The "personal investment" by the researcher is not an act by an individual agent but emerges out of the context within which the research is constituted. (p.202)

The researcher should be prepared to provide support for the students should they choose to continue the work afterwards. Students might continue to disseminate the research to their peers in school or to the teaching community by writing letters or giving presentations. This support students required from the researcher would be at the discretion of the students but might include assistance from other teachers/community members, support within the classroom, places to meet, mediating meetings, or organizational support. Ideally, the students should have the opportunity to continue the work begun through this type of project if they choose to do so. Although providing this support was not written into the agreement between myself and the students, it was made clear to the students during our first and second set of meetings that I would be able to provide support should they intend to share these results with teachers or community members. Not having built a relationship with the students prior to beginning the research may have been a factor in their reluctance to continue sharing this research with the community.

Another factor that limited the research was the number of participants. Only five students volunteered to participate in the research project which limited the amount of information that could be shared. More student interest may have been generated had I been a part of a classroom prior to the research project. At the time the project was ending, one student had priorities elsewhere and another one of the students had dropped out of school and was unable to be reached. To this extent, the comments the students made on the vignettes that were presented was minimal.

More significant, however, were the reasons the latter student had for dropping out of school. During our conversations, she spoke of her goals in high school and her future plans for employment:

Nikki: What are important things to you right now?

Doris: Showing up, doing your work, passing. Paying attention like I'm actually doing this year. School. So I can graduate next year. Attend university, be a teacher. Yeah, I want to be an elementary school teacher.

What would cause someone who was motivated to graduate high school and become a teacher, to leave school? Were her experiences similar to other students who chose to leave school early? How should educators address the issue of students leaving school early? What role can students contribute to informing educators about their experiences?

Comments and Questions

The discussions with the students illuminated a number of issues they felt important to share through the scope of this research. They indicated their experience in science classes had been minimal, the science curriculum they had been exposed to was not relevant to their lives or to their traditional values, and that they felt marginalized within the school system.

Nikki: What things do you remember most about science or anything like science?

Doris (Grade 11): I don't remember anything about science. The highest science I have is Grade 5 so I didn't learn any of that.

Chris (Grade 8): I don't know, I wasn't really in science.

Doris had not been enrolled in any science courses because she had left the school system after Grade 6. Chris had also left the school system at about the same time as Doris. Both students may have been exposed to school science as part of their regular classroom studies, however, this would have been before they exited the school system.

In terms of the students' backgrounds in science education, one student who had already graduated had taken Science and Technology 11.¹⁸ A Grade 11 student opted out of taking a science/science-related course in her 11th year because the last level of science and schooling she had taken was Gr.5. Two students were taking science at the Gr. 8 and 9 levels and the last student at 13 years of age, was placed in a Work Experience/Life Skills program (WELS) – a program designed to replace all his other courses, and give him the skills he would need to find a job and succeed in society upon leaving the school setting. No generalizations can be drawn from this study, however, it is rather coincidental that the students seemed to be streamed out of core science courses or allowed to consider other courses as their science credits. Streaming students away from science may be one of the reasons participation rates in high school science courses for Aboriginal students are less than half the rates for all students in British Columbia (see Table 3, p. 19).

Although students had only minimal experience in science classrooms, they had general definitions of what science meant. They were not, however, able to articulate how a science classroom might become more engaging.

Nikki: What is science to you?

¹⁸ Science and Technology 11 is a course offered through the British Columbia Ministry of Education that integrates knowledge of science and its applications for technological development.

Melissa (Grade 9): Science is science.

Brent (Grade 8): Making rockets.

Chris (Grade 8): Discovering stuff.

Nikki: So if you guys could think of a science class differently, what would you do with it, or what would you like to do in a science class?

(pause)

Melissa (Grade 9): More hands on.

Doris (Grade 11): More stuff outside.

Given the hypothetical possibility of creating a more engaging science class, these students were limited in their ability to articulate their vision of what could be. Why was this? Students perhaps have found themselves so detached from science that they really did not have a good understanding of how it could be different or more relevant. Perhaps school science was not relevant to their lives at all.

It was evident that discussing possibilities of change was difficult. It seemed hard for students to imagine a classroom that met their needs in terms of instruction, structure and classroom dynamics. Therefore, discussing how the content of a science course could be envisioned so as to be more engaging was challenging.

Krystle (Graduate): It's hard to think outside the box when you've been doing the same thing. I don't know, it's really hard to think differently from what you've been used to for years and years. I believe the 'same thing' Krystle speaks of is a school science continually presented as facts students must memorize and regurgitate. This school science is disconnected from the lives of students and irrelevant to their community and cultural background. Once students become embedded within this cyclical

monotony, it is hard for them to imagine a science curriculum they can identify with in terms of their culture and community.

From the discussions we had, it seems as though the science classes offered through the British Columbia Ministry of Education followed in Yukon schools did not provide any relevancy to the lives of the students and did not contain information consistent with their traditional values or interests.

Doris (Grade 11): We're not interested in science, eh.

Melissa (Grade 9): Why do we have to take science? Do we even need it?

Students didn't seem to find any relevance between school and other aspects of their lives.

Doris (Grade 11): I keep the school life and the social life separate. I don't talk about school when I'm outside it.

The students frequently mentioned the importance of family support as well as their role in the passing of information from one generation to another. They speak of a support network within the family setting and a responsibility to others in your family. At the high school level, including parents in the school setting is far less important than it was at the elementary level. The importance of a family network within the school setting is diminished as students move up in grade level.

Chris (Grade 8): Pass it down to your---

Brent (Grade 8): ---to the younger ones.

Chris (Grade 8): Pass it to the little ones and nephews and cousins.

As well, they did not see any of their own cultural heritages reflected through the curriculum.

Nikki: So when you're in a science class, how do you see culture and education together?

Krystle (Graduate): I don't really see it together.

Melissa (Grade 9): No culture in science.

The comments made by Doris, Melissa, Brent, Krystle, and Chris emphasize the disconnection between the lives of the students and school science. As well, comments by Brent and Chris call attention to the importance of relationships and integrated knowledge within the family and community. The statements made by the students reflect the sentiments of many scholars (Aikenhead, 1996; Aoki, 1993; Barnhardt & Kawagley, 1998; Bowers, 2003; Gough, 2002; MacIvor, 1995; Steele, 1999) and may provide insight to curriculum developers in terms of how to make school science more relevant to the lives of students.

It is not only the disconnection between their lives and school science that students find troubling. Some of the students had been challenged by more than science curriculum within the school:

Krystle (Graduate): I had this one teacher that told me I was stupid and crumpled up my thing and threw it in the garbage.

Melissa (Grade 9): I hate teachers that assume. Like you walk in the first day and they go 'oh, that's going to be a bad student' or you know, a mean student.

How do teaching practices impact the success and well-being of students who may already feel marginalized within the system?

The type of instruction the students had received through their minimal experiences in science class was important to consider. How a teacher is able to

convey meaning of a concept is directly linked to a students' ability to make meaning and connections surrounding that concept (Allen & Crawley, 1998; Brickhouse, 1990; Jegede & Aikenhead, 1999). To better understand the nature of science in the classroom researchers may consider how consistent views of science are between teachers. An area of further study might be to consider how well a teacher is able to articulate their understanding of science to the students and how well a student is able to convey their understanding to the teacher. The evolving understanding by students of the nature of science would be crucial to further study.

What students want

Through the scope of this research, the students were hoping to share their thoughts and ideas about curriculum with other teachers and community members. Some of their ideas were as follows:

Melissa (Grade9): Teachers to listen to it. Send it to all the science teachers.

Krystle (Graduate): Whatever could help me be heard. So, if we could take it to somebody who would listen.

The issues of relevancy and culture are at the core of many discussions on education (Aoki, 1993; Berkowitz, 2001; Blades, 1992; Bowers, 2002; Glenn, 2000; Kawagley & Barnhardt, 1999). The voices of students can better inform educators and curriculum developers about issues affecting First Nations youth and how they relate to school science. These quotes demonstrate the desire for students to have an active role or perhaps a voice in the decisions that are made regarding their school curriculum. The students' interest and creativity demonstrate a level of commitment to curricular content issues and providing more relevant opportunities for others like

themselves. Many academics agree that students' comments and ideas should be an integral component of the curriculum development process (Blades, 1992; Coalition for the Advancement of Aboriginal Studies, 2002; Rankin, 1993).

Talking about how school could be different challenges people to critically examine their experiences, biases, and ideas. This process of coming up with new ideas for curriculum is one that is better done as a collective because it is so challenging in nature. Listening, collaborating and sharing ideas, therefore, should be the core of curriculum development.

At this point in time, the students feel they have made an adequate contribution to the project and are content to leave what has been done in its present state. There is the possibility of engaging in discussion and dialogue with regards to dissemination in the future. This, however, would be at the discretion of the students.

Questions the Research Process Opened Up

It was evident through the comments the students made that their experience in science curriculum was minimal. While some of their experiences in science class were inspiring, in general these students found their science education to be uninteresting, culturally irrelevant and disconnected from their lives. They did, however, provide suggestions for curricular reform; these suggestions could be applied to science classrooms as well as other curricular areas.

If science education in the Yukon is part of the core curriculum until Grade 11, it is problematic that these students had not spent much time in science classes. Further to this, the students perceived *most* of the course work they were required to

complete in the same way they did school science. They found their courses in general to be monotonous and unrelated to their lives in the community. The results of this research put into question how science curriculum, as well as other school curriculum, was not meeting the needs of the students (Aikenhead, 1996; Blades, 2000; Bowers, 2003; Brickhouse, 1990; Coalition for the Advancement of Aboriginal Studies, 2002; Fler, 1999; MacIvor, 1995; Murfin, 1994). At a first glance, these needs involve providing the opportunity to access science courses, retaining students and having them succeed within the many disciplines of the education system including science. On a much deeper level, having students recognize aspects of their culture and lives outside of school within the curricula and are also important to consider. Addressing these needs may lead to better experiences for students who are already struggling within the system.

In the discussions, students expressed their experience in school had been quite difficult. A few students mentioned incidences of bullying or racism within the school. Of the students who had participated in this research, three of the five students had left the school setting for a period of time, either at the request of the administration or through choices they had made.

Chris (Grade 8): I dropped out of school since Grade 5.

Doris (Grade 11): The highest science I have is Grade 5.

Melissa (Grade 9): That was a bad year. I got kicked out of Sargent Park last year.¹⁹

It is surprising that the students who were most motivated to volunteer in this research had already experienced the difficulty of leaving the school setting. If the

¹⁹ Sargent Park is a pseudonym for one of the high schools in Whitehorse.

education system as a whole does not meet the needs of these students, how is it able to meet the needs of the students who are not motivated to be in school? What types of opportunities exist for the people who leave the school system without graduating? When do most of these students leave the school system and what are the possibilities of them returning? Of the students who are motivated to be in school, what is the nature of this motivation? The results of this research open up a set of broad and challenging questions that could be addressed through further research.

Despite the challenges these students have faced, they remained optimistic that schools, in the future, may provide a more relevant science and school experience and gave some examples about how they thought schools might be able to do this. The students agreed that a traditional First Nations course should be developed and that it be a requirement for all Yukon students. They also noted that most of the historical figures in Science courses are of European decent and they would prefer to learn about how other cultures, including First Nations, have contributed to the body of scientific knowledge.

Recommendations

It was necessary to consult with the local First Nations and discuss where the expertise of the researcher might fit in with the goals of the First Nations. It was important to emphasize that research be conducted *with* the First Nations not *for them* and at all times following the Protocol as stated by the First Nations. In terms of conducting research in Aotearoa/ New Zealand, Russell Bishop (1997) stated, “the concentration by non-Maori researchers on questions of their own making has created knowledge about Maori people that is radically different from that which

Maori people themselves may wish to define/construct” (p. 26). The consultation process between the Champagne and Aishihik First Nations and myself ensured that research was conducted in a way that was respectful of all people involved. In terms of shaping the research, both the Champagne and Aishihik First Nations and the students had the opportunity to contribute. Because of this previous consultation, I had a connection to the First Nations community which allowed me the ability to move into the school atmosphere with greater ease.

Ideally, this project could have been done over a longer period of time, perhaps as a component of a class or as a class on its own, having students themselves, design and implement a curriculum. A longitudinal study that monitored students’ experiences in science classes would also contribute to the body of knowledge surrounding the issue of low success and enrollment rates among First Nations students in the Yukon.

Whether or not it is appropriate to *merge* Indigenous Knowledge and school science depends on what educators, parents, students, and Elders deem appropriate for their community. The students involved in this research described a course that aimed to bring aspects of school science and traditional First Nations knowledge together so as to create a class that would be an essential component of the curriculum for all students. This type of course could be developed with the participation of students, teachers, parents and community members. These people could also design appropriate ways of evaluating the program to make sure it is meeting the needs of the student participants.

I believe it is important to connect school science with the community and the culture of students' lives. An educator can begin to do this by bringing community members into the classroom and having students interact with community members outside of the classroom as part of the curriculum. However, the aspects of culture in the curriculum are dependent upon what others, in the case of this research First Nations, deem appropriate to share and include. The five students involved in this research have provided an idea of what that might mean. I believe their comments should be a starting point for further discussion on the possibilities that exist for providing students with a more culturally relevant, community-oriented science education.

Last words

It is important to recognize First Nations populations within curriculum, particularly because many of the students in our classrooms are First Nations. The Government of Yukon 2001 census quotes the First Nations population in the Yukon Territory as 23% (Statistics Canada, 2001b). This statistic may in fact be higher due to the large amount of individuals living in remote areas and unable to access census information or do not make it a priority.

This thesis outlines the issues involved in the creation of a more culturally-relevant curriculum. It highlighted how school science is taught and what possibilities exist for addressing the lived curriculum with a classroom. Discussions with the students indicated that a curriculum rooted in their community and culture would provide the relevancy that school science is lacking. Additional research

would necessitate the participation of parents, guardians, teachers, and community members.

There has been much work completed in the areas of First Nations Culture and Language from the Yukon Native Language Centre (2002), Alaska Native Knowledge Network (2003), and the Western and Northern Canadian Protocol for Collaboration in Basic Education (2000). However, little work has been done that aims to examine the possibility of culturally relevant, community-based curriculum and school science in the Yukon Territory. This thesis provides educators and curriculum developers with an example of how to begin a culturally respectful dialogue that included developing common goals between a university researcher, students, and a First Nations community. Validation for the cultural appropriateness of the research findings would include further collaboration and dissemination of the vignettes to teachers and other community members.

I anticipate the retention and success rate of First Nations students in science education may increase as a result of a culturally-relevant curriculum (Berkowitz, 2001; Cajete, 1999; Henderson, 1996; Mullens, 2001). All students would experience a curriculum that is reflective of First Nations cultural values and be able to connect that learning to their community and world around them. A curriculum that addresses the needs and concerns of the students and community will provide students with a more representative view of the political and social issues facing non-Aboriginal Canadians. In their discussion on the importance of remembering Canada's history with the First Nations peoples, the Coalition for the Advancement of Aboriginal Studies (2002) speak of how it is necessary that "Canadian policy-

makers...and [y]oung Canadians – tomorrow’s business, community and political leaders” do not pursue any further cultural eradication within or through the education system (p. 156). They clearly demonstrate there is history and knowledge important for all Canadians to understand.

The process through which students were able to engage in discussions in regards to the curriculum is extremely valuable to both the students and curriculum developers. Students were able to share their thoughts and play a role in shaping ideas of the future.

Curriculum developers may gain a better understanding of the issues facing First Nations youth, the reasons why First Nations students’ performance and achievement is lower, and the areas that may need addressing within the school system. The students noted that school science should include knowledge reflective of their cultural background. Their recommendations suggest that other forms of knowledge such as the knowledge that arises from interacting with other students, community members, Elders, and the environment become part of the curriculum and student assessment process within school science. Addressing the “lived curriculum” (Aoki, 1993) touches on the issues of relevancy and success for all students including First Nations students.

At the very least, the results of the discussions with the students open up the opportunity for dialogue about how the curriculum can meet the needs of all students and through whose vision it should do so. This thesis draws attention to the underlying constructions of school science and attempts to elaborate on how school science and culture may be addressed in a respectful and appropriate manner.

References

- Aikenhead, G.S. (1996). Towards a First Nations cross-cultural science and technology curriculum. *Science Education*, 81(2), 217-238.
- Aikenhead, G.S. & Huntley, B. (1999). Teacher's views on Aboriginal students learning western and Aboriginal science. *Canadian Journal of Native Education*, 23(2), 159-175.
- Alaska Native Knowledge Network. (2003). *Culturally-Based Curriculum Resources*. Fairbanks, Alaska: Author. Retrieved January 5, 2003 from <http://www.ankn.uaf.edu:591/cbcr3.html>
- Allen, N.J. & Crawley, F.E. (1998). Voices from the bridge: Worldview conflicts of Kickapoo students of science. *Journal of Research in Science Teaching*, 35(2), 111-132.
- Aoki, T. T. (1993). Legitimizing lived curriculum: Towards a curricular landscape of multiplicity. *Journal of Curriculum and Supervision*, 8(3), 255-268.
- Aoki, T.T. (1999). Interview: Rethinking Curriculum and Pedagogy. *Kappa Delta Pi Record*, 35(4), 180-181.
- Apple, M.W. (1982). *Education and Power*. Boston, London & Henley: Ark Paperbacks.
- Barnhardt , R., & Kawagley, A.O. (1998). *Culture, Chaos and Complexity: Catalysts for Change in Indigenous education*. University of Alaska, Fairbanks. Retrieved September 24, 2002, from <http://www.ankn.uaf.edu/ccr.html>
- Battiste, M., & Henderson, J. Y. (2000). *Protecting Indigenous knowledge and heritage*. Saskatoon: Purich Publishing Ltd.

- Berkowitz, P. (2001, December). Western science meets Mi'kmaq knowledge. *University Affairs*, 16-20.
- Bishop, R. (1997). Maori People's Concerns About Research into Their Lives. *History of Education Review*, 26(1), 25-39.
- Bishop, R. (1998). Freeing ourselves from neo-colonial domination in research: A Maori approach to creating knowledge. *Qualitative Studies in Education*, 11(2), 199-219.
- Blades, D. W. (1992). Conversations from the margins: Grade 12 students' perceptions of their senior high school science program and possibilities for change. *Alberta Science Education Journal*, 25(1), 8-18.
- Blades, D. W. (1997). Towards a Post-Modern Science Education Curriculum-Discourse: Repetition of a Dream Catcher. *Journal of Educational Thought*, 31(1), 31-44.
- Blades, D.W. (2000). The Simulacra of Science Education. In J.A. Weaver, P. Appelbaum, & M. Morris (Eds.), *(Post) Modern Science (Education), Propositions and Alternative Paths* (pp. 57-93). New York: Peter Lang.
- Blades, D.W., Johnston, I. & Simmit, E. (2000). *Cultural Diversity and Secondary School Curricula*. Edmonton, Alberta: University of Alberta, Department of Secondary Education.
- Blue Cloud, Peter [told by]. 1996. Coyote's anthro (Mohawk). In W.S. Penn (Ed.), *The Telling of the World: Native American stories and art* (pp.100-103).
- Bobbitt, F. (1918). *The Curriculum*. Cambridge, MA: The Riverside Press.

- Bowers, C.A. (1997). *Culture of Denial: Why the environmental movement needs a strategy for reforming universities and public schools*. In D.W. Orr & H. Wilson (Eds.), *SUNY Series in Environmental Public Policy*. Albany, New York: State University of New York Press.
- Bowers, C.A. (2002). Toward a Cultural and Ecological Understanding of Curriculum. In W.E.Doll, & N. Gough (Eds.), *Curriculum Visions* (pp. 75-85). New York, New York: Peter Lang Publishing, Inc.
- Bowers, C.A. (2003, Spring). Can Critical Pedagogy be Greened? *Educational Studies*, 11-21.
- Brickhouse, N.W. (1990). Teachers' beliefs about the nature of science and their relationship to classroom practice. *Journal of Teacher Education*, 41(3), 53-62.
- British Columbia Ministry of Education. (2003a). *Science 8 to 10 Learning Outcomes*. British Columbia, Canada: Author. Retrieved January 9, 2004 from <http://www.bced.gov.bc.ca/irp/curric/sc810lo.htm>
- British Columbia Ministry of Education. (2003b, October). *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools 2002-2003: Presentation Slides*. British Columbia, Canada: Author. Retrieved August 27, 2003 from <http://www.bced.gov.bc.ca/abed/perf2003.pdf>
- British Columbia Ministry of Education. (2003c). *Enhancing Learning: Report of the Student Achievement Task Force*. British Columbia, Canada: Author.
- British Columbia Ministry of Education. (2003d). *Interpreting and Communicating British Columbia Foundation Skills Assessment Results* (ISBN 0-7726-4411-X). British Columbia: Author.

- British Columbia Ministry of Education. (2003e, October). *How Are We Doing? Demographics and Performance of Aboriginal Students in BC Public Schools 2002-2003: Technical Notes*. British Columbia, Canada: Author. Retrieved March 3, 2004 from http://www.bced.gov.bc.ca/abed/perf2003_notes.pdf
- British Columbia Ministry of Education. (2003f). [Participation and Success Rates for Aboriginal Students in British Columbia]. Unpublished raw data.
- British Columbia Ministry of Education. (2003g). *2001/2001 Participation Rates for 20 Provincial Exams*. British Columbia, Canada: Author. Retrieved March 11, 2004 from http://www.gov.bc.ca/bvprd/bc/content.do?brwId=%402IPMj%7C0YQtuW&navId=NAV_ID_province
- British Columbia Ministry of Education. (2003h). *About Grade 12 Provincial Exams: Graduation Requirements: Handbook for Procedures: Handbook: Procedures: Chapter 1: What are Provincial Exams*. Retrieved February 29, 2004 from <http://www.bced.gov.bc.ca/exams/handbook/chapter1/whatareexams.htm>
- Bryson, M. & de Castell, S. (1996). *Queer ethnography: Identity, authority, narrativity, and a geopolitics of text*. Paper presented at Simon Fraser University.
- Cajete, G.A. (1999). *Igniting the Sparkle An Indigenous Science Education Model*. United States: Kivaki Press.
- Carroll, L. (1969). *Alice in Wonderland*. Toronto: McClelland and Stewart. Retrieved November 16, 2003 from

<http://www.amazon.com/exec/obidos/tg/detail/-/B00004R99L/103-6604291-3731864?v=glance&vi=quotes-trivia>

Castellano, M.B. (2004). Ethics of Aboriginal Research. *Journal of Aboriginal Health*, 1(1), 98-114.

Christie, M.J. (1991). Aboriginal science for the ecologically sustainable future. *Australian Science Teachers Journal*, 37(1), 26-31.

Coalition for the Advancement of Aboriginal Studies, (2002, November). *Learning About Walking In Beauty: Placing Aboriginal Perspectives in Canadian Classrooms*. Canadian Race Relations Foundation.

Cobern, W.W. & Loving, C.C. (2001). Defining "Science" in a Multicultural World: Implications for Science Education. *Science Education*, 85(1), 50-67.

Cole, P. (2002). aboriginalizing methodology: considering the canoe. *International Journal of Qualitative Studies in Education*, 15(4), 447-459.

Cole, P. & O'Riley, P. (2002). Much Rezadieux about (Dewey's) Goats in the Curriculum: Looking Back on Tomorrow Yesterday. In W.E.Doll, & N. Gough (Eds.), *Curriculum Visions* (pp. 132-148). New York, New York: Peter Lang Publishing, Inc.

Davis, S., Harris, J. & Traynor, S. (1980). Community based programs for Aboriginal schools. *The Australian Science Teacher's Journal*, 7, 2-10.

Dempster, B. (2001). *what is postmodernism?* Retrieved February 25, 2004 from <http://www.fes.uwaterloo.ca/u/mbldemps/phil/pomo-whatism.htm>

Ely, M., Vinz, R., Downing, M., & Anzul, M. (1997). *On Writing Qualitative Research: Living by Words*. Washington, D.C.: Falmer Press.

- Fleer, M. (1999). Children's alternative views: alternative to what? *International Journal of Science Education*, 21(2), 119-135.
- Fort, D.C. & Varney, H.L. (1989). How students see scientists: Mostly male, mostly white, and mostly benevolent. *Science and Children*, 26(8), 8-13.
- Giroux, H.A. (1992). *Border Crossings: Cultural Workers and the Politics of Education*. New York: Routledge.
- Giroux, H.A. (1999). Dialectics and the Development of Curriculum Theory. In William F. Pinar (Ed.), *Contemporary Curriculum Discourses* (pp. 7-23). New York: Peter Lang Publishing, Inc. (Original work published 1980)
- Glenn, R. (2000). Traditional Knowledge, Environmental Assessment, and the Clash of Two Cultures. *Handbook for a Culturally Responsive Science Curriculum*. Retrieved May 5th, 2002, from University of Alaska Fairbanks, Alaska Native Knowledge Network Web site: <http://www.ankn.uaf.edu/handbook.pdf>.
- Gough, N. (2002). Thinking/acting locally/globally: Western science and environmental education in a global knowledge economy. *International Journal of Science Education*: 24(11), 1217-1237.
- Government of Newfoundland and Labrador. (2000). *Biology 2201 Curriculum Guide: Outcomes, Specific Curriculum Outcomes*. Retrieved February 1, 2004 from <http://www.gov.nl.ca/edu/sp/sh/sci/bio2201/Bio%202201%20Outcomes.pdf>
- Government of Yukon. (2003a). *Yukon Department of Education Public Schools Branch Annual Report 2002-2003 School Year*. Whitehorse, Yukon: Author.

- Government of Yukon. (2003b). [Percentage of First Nations Student Enrollment by Grade and Year]. Unpublished raw data.
- Graveline, F.J. (2000). Circle as methodology: enacting an Aboriginal paradigm. *International Journal of Qualitative Studies in Education*, 13(4), 361-370.
- Greene, M. (1996). Educational Visions: What are schools for and what should we be doing in the name of education?. In Joe L. Kincheloe & Shirley R. Steinberg (Eds.), *Thirteen Questions: Reframing Education's Conversation* (2nd ed., pp.305-313). New York: Peter Lang Publishing, Inc.
- Grumet, M.R. (1999). Autobiography and Reconceptualization. In William F. Pinar (Ed.), *Contemporary Curriculum Discourses* (pp. 24-30). New York: Peter Lang Publishing, Inc. (Original work published 1980)
- Hanohano, P. (1999). The spiritual imperative of Native epistemology: Restoring harmony and balance to education. *Canadian Journal of Native Education*, 23(2), 206-219.
- Haraway, D. J. (1989). Introduction: The persistence of vision. In Donna J. Haraway, *Primate visions: Gender, race, and nature in the world of modern science* (pp. 1-15). New York and London: Routledge.
- Henderson, M. (1996). A Mohawk Vision of Education. *Green Teacher*, 49, 15-18.
- Indian and Northern Affairs Canada. (1996). *Aboriginal Post Secondary Education and Labour Market Outcomes, Canada*. Winnipeg, Canada: Author.
- Jardine, D.W. (1998). *To dwell with a boundless heart: essays in curriculum theory, hermeneutics, and the ecological imagination*. NY: Peter Lang.

- Jegade, O.J. & Aikenhead G.S. (1999). Transcending Cultural Borders: implications for science teaching. *Research in Science & Technological Education*, 17(1), 45-66.
- Karp Styles Web Design. (n.d.). *How to make a Dreamcatcher*. Retrieved November 10, 2003, from <http://www.geocities.com/TheTropics/2793/instruct.html>
- Kawagley, A.O., & Barnhardt, R. (1999). Education Indigenous to Place. In Smith & Williams (Eds.) *Ecological Education in action: on weaving education, culture, and the environment* (pp. 117-140). Albany: SUNY.
- King, C. (1998). Here come the anthros. In Thomas Biolosi & Larry Zimmerman (Eds.), *Indians & Anthropologists: Vine Deloria Jr. and the critique of anthropology* (pp. 115-119). Tucson: The University of Arizona Press.
- King, T. (1993). *One Good Story, That One*. Toronto, Canada: Harper Collins Publishers Ltd.
- Knudtson, P. & Suzuki, D. (1992). *Wisdom of the Elders: Sacred Native Stories of Nature*. Toronto, Canada: Stoddart Publishing.
- Kvale, S. (1992). *Inter views and postmodern knowledge*. Paper presented at the American Educational Research Association annual conference, San Francisco, 1992.
- Lather, P. (1991). Staying dumb? : Student resistance to liberatory curriculum. *Getting smart: Feminist research and pedagogy with /in the postmodern*. New York and London: Routledge.
- Lather, P. (1993). Fertile Obsession: Validity after poststructuralism. *The Sociological Quarterly*, 34(4), 673-693.

- MacIvor, M. (1995). Redefining Science Education for Aboriginal Students. In M. Battiste & J. Barman (Eds.), *First Nations Education in Canada: The Circle Unfolds* (pp. 73-98). Vancouver, British Columbia: University of British Columbia Press.
- Malhotra Bentz, V., & Shapiro, J.J. (1998). *Mindful Inquiry in Social Research*. Thousand Oaks, Ca: Sage.
- Marker, M. (2000). Lummi identity and white racism: when location is a real place. *Qualitative Studies in Education*, 13(4), 401-414.
- McDonald, L. (1992). *Yukon First Nation Education and Research - A Cross-Cultural Perspective*. Unpublished master's thesis, Carleton University, Carleton, Ontario, Canada.
- McDonald, L. (2003). *Two Trails...One Vision: First Nation of Nacho N'Yak Dun School Drop-out Study*. Nacho N'Yak Dun First Nation, Mayo, Yukon.
- McLaren, P. (1991). Field relations and the discourse of the Other: Collaboration in our own ruin. In William B. Shaffir & Robert A. Stebbins (Eds.), *Experiencing fieldwork: an inside view of qualitative research* (pp. 149-163). Newbury Park, CA: Sage.
- McLaren, P. (1996). Education as a Political Issue: What's missing in the public conversation about education? In Joe L. Kincheloe & Shirley R. Steinberg (Eds.), *Thirteen Questions: Reframing Education's Conversation* (2nd ed., pp.267-280). New York: Peter Lang Publishing, Inc.
- Ministry of Industry Statistics Canada. (2003). *Aboriginal Peoples Survey 2001-Initial Findings: Well-being of the non-reserve Aboriginal population* (ISBN 0-662-34985-

- 7). Ottawa, Canada: Author. Retrieved January 14, 2004 from <http://www.statcan.ca/english/freepub/89-589-XIE/school.htm>
- Mullens, A. (2001, November). Why Aboriginal Students Aren't Taking Science. *University Affairs*, 8-17.
- Munro, P. (1999). Resisting "Resistance". In William F. Pinar (Ed.), *Contemporary Curriculum Discourses* (pp. 425-457). New York: Peter Lang Publishing, Inc. (Original work published 1996)
- Murfin, B. (1994). African science, African and African-American scientists and the social science curriculum. *School Science and Mathematics*, 94(2), 96-103.
- Nelson, N. & Clark, K. (2000). *Framework for Developing First Nations Curriculum*. First Nations Education Division, Greater Victoria School District #61.
- O'Riley, P. (1993). *Re/Visioning the Maps of Postpositivist Inquiry*. Unpublished document. The Ohio State University, Columbus: Ohio.
- O'Riley, P. (1999). *Opening technology discourses to difference: A rhizoanalysis*. Doctoral dissertation, The Ohio State University, Columbus: Ohio.
- O'Riley, P. (2003). *Technology, culture, and socioeconomics: A rhizoanalysis of educational discourse*. New York: Peter Lang.
- O'Riley, P. (in press). Shapeshifting Research on Aboriginal Peoples: From Manifest Manners to Self-empowerment. *Native Studies Review*.
- Profeit-Leblanc, L. (1996). Transferring Wisdom Through Storytelling. In B. Jickling (Ed.), *A Colloquium on Environment, Education and Ethics* (pp.18). Yukon College.

- Province of Manitoba. (2004). *Senior 1 Science: Manitoba Curriculum Framework of Outcomes*. Retrieved February 1, 2004 from <http://www2.edu.gov.mb.ca/ks4/cur/science/default.asp>
- Rankin, B. (1993). Curriculum Development in Reggio Emilia: A Long-Term Curriculum Project About Dinosaurs. In C. Edwards, L. Gandini & C. Forman (Eds.), *The Hundred Languages of Children: The Reggio Emilia Approach to Early Childhood Education* (pp. 189-211). Norwood, NJ: Albex.
- Reid, W.A. (1998). "Reconceptualist" and "Dominant" Perspectives in Curriculum Theory: What do they have to say to each other? *Journal of Curriculum and Supervision*, 13(3), 287-296.
- Saskatchewan Learning. (2002). *Evergreen Curriculum: Curriculum by Subject: Science: A Curriculum Guide for the Elementary Level: Grade One Science: Factors of Scientific Literacy Developed in Grade One*. Retrieved February 29, 2004 from <http://www.sasked.gov.sk.ca/docs/elemsci/gr1fsl.html>
- Scheurich, J.J. (1995). A postmodernist critique of research interviewing. *Qualitative Studies in Education*, 8(3), 239-252.
- Science Council of Canada (1991). *Northern science for northern society*. Ottawa: Supply and Services.
- Selin, H. (1993). Part 1: African and Native American achievements. *Science Across Cultures*, 60(3), 38-44.
- Silverstien, S. (1974). *Where the Sidewalk Ends*. New York, N.Y.: Harper Collins.

- Simons, H. (1998). Developing Curriculum through School Self-Evaluation. In L.E. Beyer & M.W. Apple (Eds.), *The Curriculum: Problems, Politics, and Possibilities* (2nd ed., pp. 358-379). Albany, N.Y.: State University of New York Press.
- Simpson, L. (2002). Indigenous environmental education for cultural survival. *Canadian Journal of Environmental Education*, 7(1), 13-25.
- Smith, L. T. (1999). *Decolonizing Methodologies: Research and Indigenous People*. London: Zed Books Ltd.
- Snively, G. & Corsiglia, J. (2001). Discovering Indigenous science: Implications for science education. *Science Education*, 85(1), 6-34.
- Statistics Canada. (2001a). *Census: Data: Aboriginal Peoples of Canada: Selected Educational Characteristics (29), Aboriginal Identity (8), Age Groups (5A) and Sex (3) for Population 15 Years and Over, for Canada, Provinces, Territories and Census Metropolitan Areas, 2001 Census - 20% Sample Data*. Retrieved March 1, 2004 from <http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=73631&APATH=3&GID=517770&METH=1&PTYPE=55496&THEME=45&FOCUS=0&AID=0&PLACENAME=0&PROVINCE=0&SEARCH=0&GC=99&GK=NA&VID=0&FL=0&RL=0&FREE=0>
- Statistics Canada. (2001b). *Census: Population: Population by Aboriginal group*. Retrieved February 5, 2004 from

<http://www12.statcan.ca/english/census01/products/standard/themes/RetrieveProductTable.cfm?Temporal=2001&PID=62715&METH=1&APATH=3&PTYPE=55440&THEME=45&FREE=0&AID=0&FOCUS=0&VID=0&GC=99&GK=NA&SC=1&CPP=99&SR=1&RL=0&RPP=9999&D1=0&D2=0&D3=0&D4=0&D5=0&D6=0&GID=355324>

Statistics Canada. (2002). *At a Crossroads: First Results of the 18 to 20- year-old Cohort Youth in Transition Survey* (Statistics Canada Catalogue No: 81-591-XIE). Quebec, Canada: Author.

Steele, A. (1999, April 5). Culture begins in the classroom. *The Yukon News*, retrieved January 19, 2004 from

<http://www.yukonweb.com/community/yukon-news/apr5.html#/>

Stephens, S. (2000). *Handbook for Culturally Responsive Science Curriculum*. Retrieved May 5th, 2002, from University of Alaska Fairbanks, Alaska Native Knowledge Network Web site: <http://www.ankn.uaf.edu/handbook.pdf>.

St. Pierre, E.A. (1997). Methodology in the fold and the irruption of transgressive data. *Qualitative Studies in Education*, 10(2), 175-189.

Sumara, D.J. (1999). Of Seagulls and Glass Roses, Teachers; Relationships with Literary Texts and Transformational Space. In William F. Pinar (Ed.), *Contemporary Curriculum Discourses* (pp. 289-311). New York: Peter Lang Publishing, Inc. (Original work published 1993)

Swisher, K. G. (1998). Why Indian People Should Be the Ones to Write about Indian Education. In Devon A. Mihesuah (Ed.), *Natives and Academics:*

Researching and Writing about American Indians (pp. 190-199). United States of America: University of Nebraska Press.

Thom, J.S. (2002). re-PLACING academic community. *Educational Insights*, 7(1). Retrieved March 23, 2004 from <http://www.csci.educ.ubc.ca/publication/insights/v07n01/confrontingtext/thom/>

Watterson, B. (1994). *Homicidal Psycho Jungle Cat: A Calvin & Hobbes Collection*. Kansas City, Missouri: Andrews McMeel Publishing.

Wein, C.A & Dudley-Marling, C. (1998). Limited vision: The Ontario curriculum and outcomes-based learning. *Canadian Journal of Education*, 23(4), 405-420.

Western and Northern Canadian Protocol for Collaboration in Basic Education. (2000). *The Common Curriculum Framework for Aboriginal Languages and Culture Programs*. Canada: Author.

Western and Northern Canadian Protocol for Collaboration in Basic Education. (2003). Retrieved February 5, 2004 from <http://www.wcp.ca/>

Yukon Bureau of Statistics. (2003). *Annual Report: Public Schools Enrollment*. Whitehorse, Yukon: Author. Retrieved January 11, 2004 from <http://www.gov.yk.ca/depts/eco/stats/annual/school2003.pdf>

Yukon Native Language Centre (2002). *Native Language Teacher Training*. Retrieved March 15, 2003, from <http://www.yukoncollege.yk.ca/ynlc/Contents.html>

APPENDICES**Appendix A : Letter to the Chief**

1-1326 Burleith Crescent
Victoria, British Columbia
V9A 4B4
ph. (250) 382-3628
fax (250) 382-3628

Suite 100, 304 Jarvis Street
Whitehorse, Yukon
Y1A 2H2
ph. (867) 668-3627
fax. (867) 667-6202

Dear Chief:

I am a high school science and biology teacher from Whitehorse, Yukon. I am completing a Masters of Arts in Curriculum and Instruction at the University of Victoria.

As part of my research project, I would like to work with the Champagne and Aishihik First Nations and grade 11 students to learn more and comment about how we can write science curriculum that is respectful of First Nations knowledge and practice. I am wondering how my research might work to serve the Champagne and Aishihik community.

I would like to return to Whitehorse in the middle of August and I am wondering if it might be possible to discuss this in further through a teleconference should you be interested.

Sincerely,

Nikki Krocker
University of Victoria
(phone): (250) 382-3628
(email): nikkik@uvic.ca

Appendix B:
Ethics and Protocols

Changing Spaces: What is it with Science Curriculum? Stories told from Northern Places
(Research for completion of M.A Curriculum and Instruction)

Co-Researchers

Nikki R. Krockner, BSc., Bed.
School of Curriculum and Instruction, University of Victoria – Graduate Student
(250) 382-3628

Students (number may vary)

Name: _____
Name: _____

Community Members (number may vary)

Name: _____
Name: _____

Ethics and Protocol

- Ethics and Protocol will be negotiated and renegotiated as an ongoing process throughout this research process.
- Miss Krockner will provide the Champagne and Aishihik with at least 2 weeks notice should she request a meeting. The meeting will be held using Aboriginal Protocols.
- Permission to use the information from the Champagne and Aishihik libraries and archives will be given at the discretion of the Champagne and Aishihik and/or Heritage Department.
- Co-participants will be determined by the Champagne and Aishihik First Nations.
- The Champagne and Aishihik will be involved in all ongoing consultation and will review the work throughout and prior to completion.
- Should there be reasonable grounds for thinking the work might contravene the privacy of individuals/community or cause significant

harm to participating First Nations communities or organizations, the work will not be published.

- It is understood by both parties that the Champagne and Aishihik can only offer a minimal amount of time to this project.
- Permission to consult with Elders and members of the First Nations will be at the discretion of the Champagne and Aishihik and will follow CAFN Protocol.
- The Champagne and Aishihik will be provided with a list of all the sources used in the research.
- Any completed work will be shared between the Champagne and Aishihik, the participants, and Nikki Krockner.
- The community has the final say in all aspects of the research.

Student's Ethics and Protocols (to be negotiated with students):

-
-
-
-
-

Community Members Ethics and Protocols (to be negotiated with community members):

-
-
-
-
-
-

By signing below, you certify you have read and understood the above.

I give my informed consent to participate in the project,

Community Member

Student Researcher

Date

Signature of Member

Signature of Researcher

Graduate Researcher Signature

Appendix C:
Research Consent Form

UNIVERSITY OF VICTORIA
OFFICE OF THE VICE PRESIDENT
RESEARCH
HUMAN RESEARCH ETHICS COMMITTEE

Participant Consent Form

Discussions on Science Curriculum: Stories told from Northern Places

You are being invited to participate in a study entitled Discussions on Science Curriculum: Stories told from Northern Places that is being conducted by Nikki Krocker. Miss Krocker is a graduate student in the department of Curriculum and Instruction at the University of Victoria and you may contact her if you have further questions by phone at (250) 382-3628.

As a graduate student, I am required to conduct research as part of the requirements for a degree in Curriculum and Instruction. It is being conducted under the supervision of Dr. David Blades. You may also contact my supervisor at (250) 721-7775, if you have any questions.

This research is being partially funded by the Association of Canadian Universities for Northern Studies.

The purpose of this research project is to gain an understanding of the secondary science curriculum as experienced by First Nations students in the Yukon Territory.

Research of this type is important because it may provide an alternative model to the curriculum development process. Because the focus of the project is on the experiences of First Nations students, it is also of interest to organizations wishing to initiate culturally respectful and collaborative programs.

You are being asked to participate in this study because of your experiences in science education and your ethno-cultural background. Participation will include a two hour group discussion and a one hour individual interview. A second, follow up, interview can be arranged if you choose.

If you agree to voluntarily participate in this research, your involvement will include your sharing in a group discussion and an individual discussion. You can refuse to answer any question or discuss any topic, and can withdraw consent at any time without explanation or consequences. If you do withdraw from the study your data will be destroyed unless you have otherwise given your consent for it to be used in the project.

Participation in this study may cause some inconvenience to you, including the time taken to participate in the study.

There are no known or anticipated risks to you by participating in this research.

The potential benefits of your participation in this research include the opportunity to discuss science curriculum as well as collaborate on a project. As well, you will be invited to engage in discussions that may provide perspectives on your own views and ideas about culture and science.

To make sure that you continue to consent to participate in this research, I will ask if you choose to remain involved with the project at the beginning of each of the sessions.

To protect your anonymity you will be asked at the start of the research if you prefer a pseudonym or your real names be used in the final thesis.

Your confidentiality and the confidentiality of the data will be protected by the researcher who will keep discussion notes, audio tapes and any further notes in a locked filing cabinet in a locked office. Only the researcher and supervisor will have access to the data. Because you will be involved in a group setting, it is important all participants respect the confidentiality of others. Again, confidentiality cannot be guaranteed because this project will involve group discussions. Discussion groups will be video taped only with your permission. This video tape will be destroyed once Nikki Krockner has transcribed an audio tape of the conversation.

Data (discussion notes, audio tapes and any further notes) from this study will be retained by the researcher until the researcher has successfully defended her thesis, after that time the data will be destroyed or returned to the participants upon request.

In addition to being able to contact the researcher [and, if applicable, the Supervisor] at the above phone numbers, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Associate Vice-President, Research at the University of Victoria (250-472-4362).

This form will also serve as consent to participate from the school you currently attend, if time during school hours is to be used.

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

Name of Participant

Signature

Date

Name of Parent/Guardian

Signature

A copy of this consent will be left with you, and a copy will be taken by the researcher.