CONNECTING MATHEMATICS AND CULTURAL RELEVANCY FOR ADULT ABORIGINAL LEARNERS

By

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A thesis submitted in partial fulfillment of

the requirements for the degree of

MASTER OF ARTS

In

DISTRIBUTED LEARNING

Focusing on Leadership, Learning and Technologies

We accept this thesis as conforming

to the required standard

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ROYAL ROADS UNIVERSITY

November, 2007

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Direction du Patrimoine de l'édition

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence
ISBN: 978-0-494-36669-1
Our file Notre référence
ISBN: 978-0-494-36669-1

Abstract

Academic upgrading in mathematics tends to be a subject area viewed by many Aboriginal adult learners as a barrier to enrolment in post-secondary programs or is approached with apprehension. This purpose of this research study was to examine the need to supplement existing mathematics curriculum with online culturally relevant content for a diverse Aboriginal adult learner population. Research methodologies included a literature review, semi-structured interviews with community members, and a learner survey resulting in both qualitative and quantitative data. The findings were organized into seven themes which have implications for instructional practice as well as for curriculum and program development for Aboriginal adult learners. Community feedback and involvement will be essential in guiding the development of the recommendations arising from the study.

Acknowledgements

There are many individuals without whose support and contributions this major project would never have been completed.

To the educators, community members, and learners who graciously took the time to participate in the research and for their generosity and willingness to share their experiences, insights, and visions for the future.

To the two MADL cohorts I was so privileged to have been a part of, especially my Camosun and Vancouver Island colleagues, for their friendship, motivation, and for creating such unique opportunities for learning.

To the faculty and staff at Royal Roads University from whom I have learned so much, with a special mention to Melody Anderson for her continual support and encouragement throughout my major project.

To my project sponsor, Janice Simcoe, with whom I don't think I have ever had a casual conversation and who always asks the right questions. Her wisdom, knowledge, and commitment to Aboriginal education continue to challenge and inspire me and those around her.

To my employer who was encouraging right from the start and has made it possible for me to complete my program, and to the CCFA for their much appreciated financial sponsorship.

To my project supervisor, Dr. Mary Kennedy, for her always timely, succinct, and constructive advice and feedback. Thank you.

And finally to my family, friends, and colleagues who have stood by me with all their encouragement, support, and cajoling. And especially to my wife, Linda, for her incredible

patience and for so selflessly facilitating the emotional and physical space needed to complete this project.

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Chapter One – Study Background

The Opportunity

> Math, to be taught effectively in any community, has to begin where the children are, with the language and the knowledge to which their developing conceptual view of the world is related. It must move with the children as they develop mathematical concepts in relevant and meaningful situations which are organized for them in such a way that further mathematical ideas emerge. (Graham, 1982, p. 4)

For many adult Aboriginal learners intent on returning to formal education, mathematics tends to be a subject area that acts as a barrier to enrolment or is approached with apprehension. Unfortunately, attitudes towards the learning of mathematics are often determined by early learning experiences and for many of the adult learners whom the researcher has been working with for the past four years, those early experiences have been negative. These negative experiences often contributed to a lack of success in school and a diminished self-confidence in the ability to successfully learn mathematics as adult learners. The repercussions of being perceived as unsuccessful continue to influence adult learners in their career and educational decision-making and have contributed to low completion rates in certain courses.

Research suggests that one of the contributing factors to low completion and success rates of Aboriginal learners relates to the mathematics curriculum itself and the nebulous connection it has to personal and cultural relevancy for Aboriginal learners. However, with online course materials and resources being readily available and accessible to learners, educators are no longer restricted to viewing curriculum as a static component to the educational process. The advent of multi-media as an instructional tool provides educators with the opportunity to

incorporate timely and culturally relevant content to support and enhance existing curriculum. As post-secondary institutions expand into the community and target non-traditional learner populations, online resources will play an increasing role in connecting learners to course or program curricula.

The goal of the following major project proposal is to determine the need of supplementing existing mathematics curricula for adult Aboriginal learners with culturally relevant online content. The outcome of the proposed research will hopefully support the development of an online cultural component that will complement established mathematics curriculum and will improve the relevancy of learning mathematics skills for adult Aboriginal learners.

The following has been identified as the research question for this major project: Is there a need for an online cultural component to be incorporated into an intermediate mathematics course intended for a diverse Aboriginal adult learner population? This question in turn led to the development of two sub-questions: (1) Would Aboriginal adult learners value the inclusion of a cultural component – even if its inclusion extended the duration of the course; and, (2) Can the cultural component be designed to meet the cultural needs of a diverse Aboriginal population?

The researcher has a personal interest in the opportunity presented by this proposal in that it engages much of what interests him in his professional life: working with communities of learners in their own communities, contributing to an environment where both learners and their communities are involved with their learning, and developing the skills and professional resources to be a more effective instructor.

The Significance of the Opportunity

"The big challenge facing education in the future is to manage diversity while converging toward universality" (D'Ambrosio, 1994, p. 688).

Camosun College currently has three satellite Academic Upgrading programs that are offered in partnership with First Nations communities. These academic upgrading courses are intended for a diverse adult Aboriginal adult learner population and are offered in classrooms provided by the community. The courses offered are also academic prerequisites for admission into post-secondary courses and programs. Mathematics upgrading courses are offered in either classroom or blended (online and face to face) learning environments. Many of the learners have had previous negative experiences with learning mathematics and attach either little value or applicability to learning the content. Consequently, a significant number have difficulty completing the courses in a reasonable time or withdraw from the courses. As a result, learners perpetuate the cycle of viewing themselves as not being capable of learning mathematics and therefore they limit their career and educational options. Without finding additional means of engaging the learners in their learning, significant non-completion rates will continue and learners will be limited in their ability to enter post-secondary courses and programs.

Learning technologies are utilized in all three satellite programs offered by Camosun College as a means of providing content as well as instructional support through the use of videos and supplemental exercises and quizzes. While some Aboriginal learners have registered in an advanced level online mathematics course, there has not been much success with learners completing online courses at the intermediate level. However, engaging in a mathematics course that follows a linear model of program delivery may be less engaging than

interacting with a cultural component that is designed specifically for a targeted population and can provide relevancy to the material to be learned. The introduction of a cultural component could provide learners with the opportunity to connect principles of mathematics to their cultural and ethnic background and enable them to apply mathematics skills in a variety of contexts. In addition, the research would involve the learners and communities impacted and thereby meet the goals of community-based action research "to engage people directly in formulating solutions to problems they confront in their community and organizational lives" (Stringer, 1999, p. 38). Finally, should a cultural component have a positive and significant impact on completion rates, learners will have more educational and career options as well as the confidence to pursue them.

The Organizational Context

Located in Victoria, BC, Camosun College is a comprehensive community college providing educational and training opportunities to the residents of Southern Vancouver Island. The college offers over 100 programs and over 1,500 courses (Camosun College, 2007a) in the arts, sciences, business, health, human services, and trades and technologies. The college currently has an annual enrolment of "more than 8,400 students in credit and vocational programs and another 7,000 in part-time continuing education programs, including 800 international students from 40 countries and 500 First Nations students from 50 Nations" (Camosun College, 2007b). In addition to its two main campuses, the college also provides off-campus educational programs and learning opportunities in a number of community based agencies and organizations, including three Aboriginal communities.

As part of its program and course delivery, Camosun College currently offers 52 online courses using such platforms as WebCT, Desire2Learn, Moodle, and Podcasts, and offers professional development and technical support through its Distributed Education department (Camosun College, 2007c).

As will be seen in the following section, the college has a commitment to First Nations education and currently offers a number of programs for Aboriginal students including First Nations Academic Upgrading, First Nations Community Studies, First Nations Family Support Worker, and First Nations Home Support/Resident Care. The college also has a dedicated First Nations Education and Services Department which provides "services and programs for First Nations, Metis, Inuit, and Native American students; we support other First Nations programs in the college, and we help provide linkages between Camosun College, First Nations students, and the local First Nations community" (Camosun College, 2007d).

Review of Organization

Within Camosun College there are a number of documents that provide support for the proposed research. While some of the documents fall in the public domain, others are internally generated and produced for individual departments or schools and are intended to provide information and data for educational planning. The following list outlines the documents that were examined:

1. The Camosun College's Strategic Plan, 2006-2008. Under the ten issues identified by the college as the focus for the next three years, the proposed research falls under two issues in particular: Issue 1, Populations, Strategy 1.1 – "serve the unique needs of First Nations, international and working adults as identified populations for the

planning period" (Camosun College, n.d., p.5); Issue 2, Responsive Programming, Strategy 2.1 – "implement and act on an effective program of research aimed at understanding the educational, access, and service needs of our diverse populations" (p.7); and, Issue 4, Indigenization, Multiculturalism and Global Citizenship. Strategy 4.3 – "implement the indigenization project and internationalization strategies". (p.13).

2. As part of the funding received from the Ministry of Advanced Education's Aboriginal Special Project fund (Ministry of Advanced Education, 2007), Camosun College produced a curriculum framework intended to support its college-wide indigenization project. Indigenizing Post-Secondary Curriculum: A Framework (Camosun College, 2005) examines the development and delivery of First Nations curriculum, utilizing four phases of indigenization: consultation, collaboration, creation, and reflection/validation.
3. Camosun College currently has affiliation agreements with three First Nations communities: Victoria Native Friendship Centre, Saanich Indian School Board, and Songhees First Nation. All three agreements address the issue of designing education and training programs to meet the needs of First Nations learners.
4. The Educational Research and Planning department at Camosun College provides summary retention and completion data on courses offered by the college. The results of the reports produced by this data are intended for internal use only. The researcher requested data comparing retention and completion rates, as well as average completion times, for Aboriginal and non-Aboriginal learners enrolled in academic upgrading mathematics courses. While average completion times were not available, data from the Fall 2004 to Spring 2006 terms indicated a difference in completion

> rates between Aboriginal and non-Aboriginal learners. While rates varied across Aboriginal learning centres, overall completion rates for Aboriginal learners were significantly lower in all academic upgrading levels compared to the on-campus non-Aboriginal student population (Max Sternberg, personal communication, July 7, 2006).

As Camosun College is a publicly funded institution, a number of Ministry of Advanced Education (MAVED) documents were also reviewed as public post-secondary institutions are impacted, both financially and strategically, by government policy.

The first document examined was the *Aboriginal Post-Secondary Education and Strategy Plan* (Ministry of Advanced Education, n.d.), which states as one of its goals:

Goal 1: Close the educational gap for Aboriginal learners.

Objectives:

- Increase the access, retention, completion and transitions opportunities for Aboriginal learners.
- Increase the receptivity and relevance of post-secondary institutions and programs for Aboriginal learners.
- Strengthen partnerships and collaboration in Aboriginal post-secondary education. (p.2)

The second MAVED document examined was a review of projects funded by the Aboriginal Special Projects Fund (Human Capital Strategies, 2005). The Ministry administers this fund "to provide limited, short-term financial support that assists BC's public postsecondary institutions in developing and delivering culturally-sensitive and quality educational programming and support services for Aboriginal learners" (Ministry of Advanced

Education, 2007, ¶ 1). A review of previously funded projects revealed that there was only one project that focused on the indigenization of mathematics curriculum at the academic upgrading level. The College of New Caledonia (CNC) received funding to develop and deliver an ethnomathematics curriculum to Aboriginal learners at the fundamental level in mathematics (Human Capital Strategies, 2005, p.126), which included some Aboriginal content as well as a Northern BC perspective. The goal of the project was similar to the motivation underlying the research questions for this major project: improving retention and completion rates and educational and training opportunities for Aboriginal learners. A program evaluation of the ethnomathematics course at CNC (McGregor & MacMillan, 2004) provided valuable insights into the design and delivery of such a course.

A review of the existing internal and external documents provides strong organizational and MAVED support for developing programs and curriculum that can meet the needs of Aboriginal learners. Furthermore, the review of documents also supports the research questions of this major project and reinforces the need for First Nations to be involved in the design, development, and delivery of First Nations curriculum.

Chapter Two – Literature Review

Introduction

Using resources obtained from online databases, libraries, and private collections, four key topics have been identified for a literature review: Aboriginal education in Canada, the teaching and learning of mathematics and Aboriginal learners, Aboriginal learning and distributed learning, and Indigenous research methodologies.

Although much of the literature on the indigenization of mathematics focuses on curriculum at the elementary and secondary school level, many of the key concepts apply to the post-secondary system, given that many academic upgrading courses are based on similar K to 12 standards and competencies.

Aboriginal Education in Canada

> We are convinced that you mean to do us Good by your Proposal [to educate our young men]; and we thank you heartily. But you, who are wise, must know that different Nations have different Conceptions of things and you will therefore not take it amiss if our ideas of this kind of Education happen not to be the same as yours ... We are ... not the less oblig'd by your kind Offer, tho' we decline accepting it; and to show our grateful Sense of it, if the Gentlemen of Virginia will send us a Dozen of their Sons, we will take Care of their Education, instruct them in all we know, and make Men of them. (Drake, as cited by Castellano, Davis, & Lahache, 2000, p. xii)

The first section of the literature review examines Aboriginal education in Canada, with a focus on adult learners, and provides an overview of the history, trends, and issues for Aboriginal learners and educators in Canada. No exploration of historical educational policies

can ignore the significance or the lasting impact of residential schools on Aboriginal people in Canada. Although the majority of residential schools were closed by the mid 1970s, the legacy of the schools continues to be felt from generation to generation and at all levels of Aboriginal communities (Milloy, 1999). Reviewing the topic from the perspective of the politics of colonization, assimilation, and acculturation (Adams, 1999; Schissel & Wotherspoon, 2003) provides an historical and sociological perspective for Aboriginal participation and completion rates in the secondary and post-secondary education system. However, recent increases in both rates, especially among residential school survivors, are also viewed by some as a means of reconciliation or healing:

> It is not surprising that the pursuit of education has become an important vehicle for many Survivors on their healing journey. This pursuit has allowed Survivors to channel their energies toward a positive goal while reclaiming, as adults, what was denied them as children. (Stout & Kipling, 2003, p. 49)

Since the National Indian Brotherhood/Assembly of First Nations' (1972) policy on Indian Control of Indian Education, Aboriginal educators and scholars have argued for the inclusion of First Nations cultural knowledge in the development of Aboriginal curricula. This is viewed as being essential to counteract assimilation and the years of the Eurocentric approach to education propagated by the residential school system (Adams, 1999; Hampton, 2000). "For many years, Aboriginal knowledge was invalidated by Western ways of knowing. This unconscious, subconscious and conscious means of invalidating Aboriginal knowledge served to perpetuate a superior/inferior relationship around knowledge and how this knowledge is passed on" (Stiffarm, 1998, p. xi). For many Aboriginal educators and researchers, indigenous knowledge and ways of knowing are central to advancing Aboriginal pedagogy (Battiste, 2002;

Castello, Davis, & Lahache, 2000; Swan, 1998; Huntley, 1998). In the process of identifying the needs currently facing Aboriginal education, Cajete (1994) developed a set of defined elements and axioms of indigenous teaching and learning (p. 223). Likewise, Isbister (1998) reports a common Aboriginal world view or paradigm based on a set of spiritual beliefs that can guide Aboriginal pedagogical practices (p. 79).

From the perspective of Aboriginal epistemology and pedagogy, Battiste (2002) contrasts the concept of indigenous ways of knowing with the Eurocentric idea of what constitutes culturally relevant and integrated curricula. Among her 23 recommendations to the National Working Group on Education and the Minister of Indian and Northern Affairs, Battiste (2002) suggests that First Nations Centres for Aboriginal Knowledge be established to research, develop, and support Aboriginal pedagogy (p. 35). However, she also cautions against a standardized, homogenous methodology being applied to all curriculum development as it would fail to take into account the diversity of Aboriginal knowledge and culture.

Implementing or integrating Aboriginal content into curricula presents some unique challenges in terms of what should be included and how the content should be presented (McCaskill, 1987). Richardson and Blanchet-Cohen (2002) describe the current three approaches that apply to developing adult Aboriginal curriculum: the add-on, the partnership, and the First Nations Control approaches, with the partnership approach having particular relevancy for post-secondary programs.

The Teaching and Learning of Mathematics and Aboriginal Learners

The classic example of the structure and function of the schools originating from outside the social milieu of the school's clientele is the colonial situation of the late 19th and 20th

> centuries. Even today, many schools in the former colonial territories still reflect the cultural standards derived from the former colonial power more than from the culture or cultures indigenous to the area. (Conkright, 1975, p. 14)

This section focuses on the teaching and learning of mathematics and Aboriginal learners. As with Australia's pioneering work in the teaching of mathematics to Aboriginal learners, much of Canada's literature focuses on teaching and learning strategies for primary and secondary learners. While there does not appear to be much research regarding adult Aboriginal learners and mathematics, post-secondary institutions have begun to indigenize their mathematics curriculum, such as the Math 030 course offered by the College of New Caledonia, Prince George, BC, (McGregor & MacMillan, 2004), or the science program at the Native Education Centre in Vancouver, BC, (Haig-Brown, 1995).

Ezeife (2002, 2003) examines the low mathematics enrolments and completion rates in Canada and argues that the both can be improved upon by integrating culturally sensitive curricula and using indigenous approaches and practices. One of the reasons offered for the low enrolment and completion rates concerns the lack of cultural relevance. "With most Aboriginal students, mathematics receives superficial attention because there is no linkage between it and their cultural values, little or no relevance to their daily life, and so no connection is established" (Ezeife, 2002, p. 185). Consistent with Ezeife's (2002, 2003) research are the findings from similar studies regarding the under participation and underachievement of Native Americans (Agbo, 2001; Bradley, 1984; Cheek, 1984a, 1984b; Demmert, 2001) and Australian Aboriginals (Frigo, 1999; Nichol & Robinson, 2000). Also consistent in much of the research is the importance of considering and implementing socio-cultural perspectives in the teaching, learning, and researching of mathematics.

The idea that the development of mathematics is influenced by social and cultural factors has been widely discussed in the literature since Ubiratan D'Ambrosio promoted the term ethnomathematics in 1985: "Making a bridge between anthropologists and historians of culture and mathematicians is an important step towards recognizing that different modes of thoughts may lead to different forms of mathematics; this is the field which we may call "ethnomathematics"" (D'Ambrosio, 1997, p. 14). This socio-cultural perspective "stresses the discipline of mathematics as a human construction that also impacts upon and reflects political and social reality" (Fitzsimons, 2002, p. 110). As the field of ethnomathematics developed, D'Ambroiso's (1998) definition of the term evolved to describe the symbiotic relation between quantitative and qualitative practices (¶ 5). Likewise, Bishop (1988, 1990, 2002) supports the cultural roots of mathematics and argues against its cultural hegemony (1990). Furthermore, Bishop (2002) questions why mathematics curricula tend to be similar in many countries compared to other school subjects:

> Mathematics and science are areas of human knowledge just like any others, and their development has been subject to cultural and social influences as have all forms of knowledge. Why then, one can ask, has this not resulted in curricular diversity, rather than apparent curricular homogeneity? (p. 119)

Mathematics instruction, seen from the socio-cultural perspective, necessitates making mathematics meaningful in the context of the learners' real life and everyday experiences (Masingila, 1994). Not connecting mathematics to culture and real life experiences runs the risk of creating a learning environment whereby "many students view mathematics as a spectator sport rather than one in which they can participate" (Barta et al., 2001, p. 4).

However, the need to consider cultural and social influences in the design and delivery of mathematics curricula is not shared by all academics. Rowlands and Carson (2002, 2004) contend that mathematics can be taught successfully without connecting it directly to culture and that the danger in teaching mathematics from an ethnomathematics perspective is that it reduces mathematics to a "life skill" and jeopardizes it as formal academic discipline (2002, p. 98). They further claim that:

> First Nations peoples are people of the modern world, who have come to recognize that it is possible to master more than one cultural system, which morally we can do. This will become, perhaps, the standard of an educated person in the twenty-first century: one who has mastered both the traditional culture of his or her forebears as well as the scientific culture that has spanned the globe. (2004, p. 340)

In their rebuttal to Rowlands and Carson' 2002 article, Adam, Alangui, and Barton (2003) maintain the transformational function of ethnomathematics as "it neither downplays, nor devalues, nor removes, any aspect of conventional mathematics" (p. 330). Among the five different approaches for an ethnomathematics curriculum they identified, their preferred approach involves the "integration of the mathematical concepts and practices originating in the learners' culture with those of conventional, formal academic mathematics" (p. 331). It is this approach that will hopefully guide the research in this study.

Critical to integrating mathematics and culturally relevant curricula is the involvement of community (Agbo, 2001; Bradley, 1984; Cheek, 1984; Dillon, 1993). One of the issues relating to the design of culturally relevant curricula is the pedagogical approach used.

> Most of this type of material takes the museum approach to curriculum development, focusing on a static view of the material aspect of traditional Indian culture. Little

> attention is paid to the non-material aspects of culture such as worldview, beliefs, or values, or to contemporary issues. (McCaskill, 1987, p. 167)

However, when developing curricula it is also important to take into consideration the diversity of Aboriginal cultures, geography, and traditional knowledge (Nichol & Robinson, 2000). And it is not just the traditional knowledge specific to an Aboriginal community that must be considered; Swan (1994) discusses that "educators, non-Aboriginal and Aboriginal, must change their instructional methods to accommodate the Aboriginal teaching styles of the communities" (p. 49).

In order to gain an understanding and appreciation for what should be taught and how it should be taught, educators and community members need to engage in a process of dialogue: "Aboriginal pedagogy must contain the tenets of dialogue that are the reflections for understanding and the commitment to act on the understanding" (Ermine, 1998, p. 25). Bradley (1984) reinforces the idea that regardless of the Aboriginal culture, any improvement in mathematics education for Aboriginal students requires the "cooperation between the Indian community and the educational community" (p. 104).

Aboriginal Learning and Distributed Learning

> Technology needs to support and reinforce community and culture. It cannot be separated from community goals of economic development and health, nor can it ignore issues such as unemployment, substance abuse and family dislocation. Educators need to ensure that learning technologies are used in a way that addresses these issues so students do not feel detached from their cultural and situational reality. (Greenall & Loizides, 2001, p. 58)

This section examines the relationship between Aboriginal learning and online or distributed education. Currently, the research and literature on the subject is limited, with much of the research focusing on technology and connectivity (Statistics Canada, 2005) and how it relates to the public school system. As technology and distance education continues to impact education at all levels, it has the potential for the promotion of Aboriginal language and culture, especially if the content and curriculum is community based and controlled by Aboriginal institutions and programs (Davis, 2000, p. 245). Conversely, it also has the potential to further contribute to the acculturation and assimilation of Aboriginal students to Eurocentric knowledge (Battiste, 2002) and to "significantly affect Aboriginal values, cultural traditions, and language" (Greenall & Loizides, 2001, p. 4).

The use of information and communication technology (ICT) as a means of improving pedagogy and participation and completion rates for Aboriginal students is fairly recent. Cheek (1984) proposed examining computer assisted instruction as an application for culturally-based curricula, and D'Ambrosio and D'Ambrosio (1994) predicted that ICT would play a new and important role in managing cultural diversity, especially with regard to mathematics and language (p. 688). From the perspective of stimulating change in American Indian educational practices, Agbo (2001) argues that computer, media, and audio-visual literacy should complement cultural curricula (p. 39). Battiste (2002) proposes the formation of "virtual Aboriginal colleges", whose role would be to promote indigenous knowledge and preserve indigenous languages (p. 31). This concept of a "virtual Aboriginal college" could also provide the kind of approach consistent with Cajete's (1994) view of a contemporary philosophy of Aboriginal education that would meet the "need to integrate, synthesize,

organize, and focus the accumulated materials from a wide range of disciplines about Indian cultures and Indian education" (p. 22).

One of the challenges in delivering computer or web-based educational materials is ensuring that Aboriginal values and perspectives are incorporated into the curricula. "If distance education is to fulfill its promise, then it will need to evolve in ways that enable Aboriginal communities to define their own educational priorities and to determine the values and perspectives that pervade the educational experience" (Davis, 2000, p. 247). Likewise, Greenall and Loizides (2001) found in their research that Aboriginal communities emphasized the importance of the technology supporting and enhancing "Aboriginal traditions, values, and practices" (p. 8). As in other areas of designing Aboriginal curricula, increased Aboriginal control and ownership of Aboriginal pedagogy and community involvement in all stages of the development process is considered critical (Cheek, 1984; Davis, 2000).

McLoughlin (2000) states that web-based instructional design processes must contain elements that not only encourage learner access and participation, but also promote cultural inclusivity. "The rationale for considering culture as a dimension of effective WWW instruction is simple: it enables learners to develop a cognitive anchor for new knowledge and enables them to relate and integrate new concepts within a coherent perspective that recognises diversity" (McLoughlin, 2000, p. 239). Accordingly, McLoughlin (2000) proposes a design process influenced by Vygotsky's sociocultural theory, which emphasizes socially and culturally contextualized learning, and outlines ten principles for designing culturally inclusive instruction:

- Awareness of learner needs and preferences
- Communication and social interaction

- Authentic task design
- Multiple perspectives and access to resources
- Scaffolding and support
- Flexibility in goals, modes of assessment and learning outcomes
- Tutor roles
- Collaboration and co-construction
- Clear communication of aims, objectives and requirements
- Self direction and integration of skills

(McLoughlin, 2000; McLoughlin & Oliver, 2000).

Indigenous Research Methodologies

> Objectivist research has contributed a dimension of insight, but it has substantial limitations in the multidimensional, holistic, and relational reality of the education of Indian people. It is the affective elements - the subjective experience and observations, the communal relationships, the artistic and mythical dimensions, the ritual and ceremony, the sacred ecology, the psychological and spiritual orientations - that have characterized and formed Indigenous education since time immemorial.
>
> (Cajete, 1994, p. 20)

Among the many issues to be considered when engaging in the research process is the theory of knowledge that drives the research question, the selection of the methodology or methodologies, the philosophical assumptions underlying the methodologies chosen, and the strategies selected to obtain the data. Palys (2003) suggests that "*what* we find – the "truths" we unearth about the world – is only partly related to how the world *is*, but also is related to

where we look and *how* we choose to examine what we find there" (p. 3). Given the importance of the researcher's perspective in influencing the outcomes of a study, this final section focuses on indigenous research methodologies.

At the core of much of the current debate surrounding indigenous research is the issue of ownership of indigenous knowledge. Among the indigenous research community there is a strong faction arguing that much of the research that has taken place has perpetuated a worldview of imperialism and colonialism (Bishop, Berryman, Tiakiwai, & Richardson, 2003; Cole, 2004; Fleras, 2004: O'Riley, 2004; Smith, 1999). Writing from the perspective of a New Zealand Maori and as an indigenous researcher, Smith (1999) asserts that research involving indigenous peoples cannot proceed without a concurrent analysis of imperialism and the colonization of knowledge.

> It appals us that the West can desire, extract and claim ownership of our ways of knowing, our imagery, the things we create and produce, and then simultaneously reject the people who created and developed those ideas and seek to deny them further opportunities to be creators of their own culture and own nations. (p. 1)

Likewise, both Fleras (2004) and Bishop et al. (2003), also writing from the perspective of the Maori people of New Zealand, contend that indigenous peoples and scholars reject the "inherent hegemony implicit within western intellectual traditions" (Fleras, 2004, p. 117). Instead, indigenous researchers need to move towards advancing "a means of knowing that denies distance and separation and promotes commitment and engagement" (Bishop & al., 2003, p. 213). Bishop et al. (2003) describe how the researcher's role among indigenous peoples in New Zealand has traditionally been one where apart from academic interest, the researcher has no connection to the communities being studied and yet "has been the story

teller, the narrator, and the person who decides what constitutes the narrative" (p. 223). Similarly in Canada, the Saskatchewan Indian Federated College (2002) discusses the exploitive practices concerning indigenous research in Canada and argues for a paradigm shift towards an agenda that "'deproblematizes' Indigenous people in theory, method, and practice, and provides a more holistic approach that takes into account a wide range of historical and contemporary conditions" (p. 13). O'Riley (2004) reports that "through the eyes of many Aboriginal peoples, 'research' is yet another form of European imperialism and colonization" (p. 89), while Cole (2004) describes the resentment arising from the preferential treatment by Canadian funding bodies of non-Aboriginal researchers and academics over Aboriginal researchers:

> this practice of sshrc awarding the wolf's share of the 'Aboriginal' research grants to white indian expert primary investigators and pretty much nothing to First Nations faculty or community leaders as primary investigators is an encouragement an invitation a plea for cultural outsiders to appropriate our voices our power (p. 16)

Connected to Western university-centred methodologies are issues of power and control and the notion that indigenous epistemology cannot be understood or framed in traditional academic models of data collection and analysis (Fleras, 2004). Furthermore, among indigenous researchers is the perception that the researcher's biases, interests, and intentions determine the direction of the research and who benefits from the outcomes. However, as Aboriginal communities are taking action in controlling their knowledge and pedagogy, many communities are also now taking control of research protocols and methodologies. Smith (1999) contends that research is no longer strictly seen as an academic exercise but as "an activity that has something at stake and that occurs in a set of political and social conditions"

(p. 5), and where the outcomes can be applied to increase or enhance community capacity (Fleras, 2004; O'Riley, 2004; Smith, 1999).

Consequently, indigenous researchers and academics propose that new, collaborative methodologies need to be applied that can address "power differentials and cultural differences" (O'Riley, 2004, p. 90), including those differences that occur between non-Aboriginal researchers and Aboriginal communities. The influence of critical ethnography can be seen in a number of indigenous methodologies as one of the underlying assumptions is its "concern with unmasking dominant social constructions and the interests they represent" (Anderson, 1989, p. 254). Additionally, critical ethnography is not just concerned with the reporting of the communities or participants studied but has as its goal to "transform unequal power relations" (Glesne, 1999, p. 12). Indeed, Smith (as cited in Smith, 1999) describes the Kaupapa Maori approach to research as being "a 'local' theoretical positioning which is the modality through which the emancipatory goal of critical theory, in a specific historical, political and social context, is practiced" (p. 186).

While maintaining that indigenous practices, worldviews, and ways of knowing must form the framework of any indigenous research, other academics propose models that can connect traditional research methodologies with emerging indigenous methodologies. Fleras (2004) outlines an Aotearoa research paradigm that bridges a "Maori-sensitive university based methodology within a Kaupapa Maori model of knowing and knowledge" (p. 125) and Innes (2004), while taking exception to Smith's claims that there is no ethical indigenous research, argues that American Indian Studies methodologies can lead to change and "have substance, ethics, accountability, and produce results for Native people" (p. 137).

The Report of the Royal Commission on Aboriginal Peoples (Indian and Northern Affairs Canada, 1996) outlined principles concerning indigenous research, acknowledging the unique perspectives and understandings of Aboriginal peoples. Additionally, the report also provided guidelines regarding Aboriginal knowledge, consent, collaborative research, access to research results, community benefit, and implementation (Volume 5, Appendix E, p. 33). However, as traditional, Western university-centred research is no longer accepted by many indigenous peoples and researchers, there are clear expectations for the further development of an indigenous research agenda that addresses some of the key issues relating to research involving Aboriginal peoples in Canada (Saskatchewan Indian Federated College, 2002). Summarizing some of the recommendations made to the Social Sciences and Humanities Research Council of Canada (SSHRC), O'Riley (2004) identifies seven key priorities to be acted on in order to "recognize and acknowledge the validity and legitimacy of Aboriginal epistemologies, methodologies, and protocols" (p. 99), with Aboriginal control of research and intellectual and cultural property being of primary importance. While considering some of the current research methodologies, as well as the ones under development, perhaps it is the questions asked in conducting research in cross-cultural contexts that are of greater significance. Smith (1999) and Meadows, Lagendyk, Thurston, & Eisener (2003) both identify some fundamental questions that can guide and support the research methodology chosen.

Chapter Three – Conduct of Research Study

Research Approach

The major project research was essentially a needs analysis and drew on elements of community-based research, based on the assumption "that all stakeholders – those whose lives are affected by the problem under study – should be engaged in the process of investigation" (Stringer, 1999, p. 10). The research methodology followed the steps outlined by a needs assessment; however, prior to outlining the steps there are a few definitions, terms, and concepts relating to a needs assessment that are examined.

The definition of a needs assessment, or analysis, varies somewhat depending on the application. From an instructional design perspective, a needs assessment is an analysis activity usually conducted before the actual design process begins. Its purpose is to determine the instructional problem, ascertain what is to be learned, learn more about the learners, understand the instructional context, explore the instructional problem and possible solutions, and establish goals that will address the instructional problem (Shambaugh & Magliaro, 1997). It is "an *investment*, which provides useful information so that optimal efforts can be spent on responsive designs." (p. 61). However, instructional design is just one area where a needs analysis can be applied, and Witkin & Altschuld (1995) have used a broader definition to encompass the full range of private, public, and community organizations that use needs assessments as a means of determining goals and priorities for program planning. They define needs assessment as "a systematic set of procedures undertaken for the purpose of setting priorities and making decisions about program or organizational improvements and allocation of resources. The priorities are based on identified needs" (p. 4). Their model addresses three levels of need and identifies three distinct phases of a needs analysis (pre-assessment,

assessment, and post-assessment), with each phase selecting the appropriate methods and criteria to fit the context of the assessment.

Generally, most needs assessments consist of four stages: planning, data gathering, data analysis, and reporting (Kemp, Morrison, & Ross, 1999). Often, as in Witkin and Altschuld's (1995) approach, data gathering and data analysis are combined under one stage. No matter how needs assessments are defined, they should nonetheless address seven key issues: objectives; target audience; sampling procedures; data collection methods; specifications for instruments and protocols; methods of data analysis; and, descriptions of how decisions will be made based on the data (The Standards, as cited in Rothwell & Kazanas, 1997, p. 47).

The terms needs analysis and needs assessment will be used interchangeably in the research project, although some writers make a distinction between needs analysis, needs assessment, and need identification. There is some debate among academics and practitioners as to how these terms are defined and applied with Watkins and Kaufman (1996) viewing the terms needs assessment and needs analysis as having distinct differences and playing different roles in the design and evaluation process: "A needs assessment should be designed to identify and prioritize needs, while a needs analysis should break an identified need into its component parts and determine solution requirements" (Watkins, Leigh, Platt, & Kaufman, 1998, p. 40). However, Watkins and Kaufman (1996) also recognize the relationship between the two terms and both concepts are integrated into Kaufman's Organizational Elements Model (OEM). Other writers such as Witkin and Altschuld (1995) are able to incorporate the concepts into their systematic approach to needs assessment without the need to discriminate between the three terms, "In our approach, identification and analysis of needs are parts of the total process of NA" (Witkin & Altschuld, 1995, p. 10). This research study followed the approach used by

Witkin and Altschuld – that the terms needs analysis and needs assessment are interchangeable.

While the term "need" is used throughout the literature, many authors preface their discussion of needs analysis by distinguishing between the definition of "need" as a verb and as a noun (Watkins & Kaufman, 1996; Witkin & Altschuld, 1995; Owen and Rogers, 1999). The former is generally defined as referring to what is required or needed ("needs" as means), while the latter is defined as being the gap or discrepancy between a current state and a result or desired state ("needs" as ends). Whereas some writers are quite clear in how the term "need" should be used – e.g., "A need is a performance gap separating what people know, do, or feel from what they should know, do, or feel to perform competently." (Rothwell & Kazanas, 1997, p. 45), other models, such as Kaufman's OEM, can accommodate both definitions within its framework. Regardless of how "needs" is interpreted, it is critical that researchers are methodical when implementing a needs analysis as confusion or misleading results can occur when a plan focuses on solutions prior to identifying the underlying causes to the actual problem or concern.

Gupta (1999) outlines five phases that constitute a needs assessment: gather preliminary data, plan, perform training requirements analysis (develop tools and conduct analysis), analyze data, and prepare report (p. 116). These five phases were used to guide the research methodology.

Additionally, working in Aboriginal communities requires an understanding of protocols and being respectful of established lines of communication and decision-making. Stringer (1999) discusses the importance of locating "informal patterns of influence to ensure that all significant people – sometimes called *opinion leaders* or *gatekeepers* – are included in the

early stages of the research process" (p. 52), and perhaps nowhere is this more significant than working with Aboriginal communities. Likewise, in describing an ethnography, Creswell (1998) also addresses the importance of a gatekeeper and describes this role as "an individual who is a member of or has insider status with a cultural group. This gatekeeper is the initial contact for the researcher and leads the researchers to other informants (Hammersley & Atkinson, 1995)" [p.117]. Through having worked in Aboriginal communities for the past four years, the researcher has established many contacts; however, of more significance, Camosun College has a highly respected and visible First Nations Education department, which provided some important contacts and was invaluable in helping to guide the research.

Research Methods and Tools

Three methods were used to collect the data. Lincoln and Guba (as cited by Creswell, 1998) use the terms trustworthiness and authenticity as concepts to establish the credibility of a study (p. 201), and one of the means of achieving this is through triangulation (Creswell, 1998; Glesne, 1999). This practice involves the use of multiple methods of collecting data and multiple data sources to enhance the confidence in the study findings. The premise of triangulation is "to indicate that the more sources tapped for understanding, the richer the data and the more believable the findings" (Glesne, 1999, p. 31). The three methods used to collect the data were a literature search, face-to-face interviews, and a learner survey.

Literature Search

The literature review was conducted using resources obtained from online databases, libraries, and private collections. The review focused on four areas: an overview of Aboriginal

education in Canada; Aboriginal learners and the teaching and learning of mathematics; the relationship between Aboriginal learning and online or distributed education; and, indigenous research methodologies. The results of the review were summarized and used as a baseline for current practices and as well as to guide the development of interview questions and survey instruments.

Interviews

The qualitative data was generated from ten individual, face-to-face interviews with key community members. The focus of the interviews was to determine the appropriateness of integrating a cultural component into the existing mathematics curriculum and, if appropriate, to determine the development process of the cultural component. The interviews were all conducted face-to-face and were guided by a set of predetermined questions; hence the interviews were semi-structured in terms of format. The decision was made to have all interviews conducted face-to-face in order to "enhance the quality of the data gathered" (Payls, 2003, p. 159) and to build relationships with the participants in anticipation of further research and follow-up. All interview participants consented to the interviews being audio recorded using a digital recorder and while maintaining confidentiality, audio recordings were subsequently transcribed for data analysis.

Glesne (1999) indicates that when developing interview questions,

> the questions you ask must fit your topic: the answers they elicit must illuminate the phenomenon of inquiry. And the questions you ask must be anchored in the cultural reality of your respondents: the questions must be drawn from the respondents' lives. (p. 70)

Interview questions were developed with these tenets in mind and were reviewed by the major project sponsor and by members of the Aboriginal community for cultural and language appropriateness. Open-ended questions were chosen as the most appropriate format as they are viewed as being superior "if the researcher is interested in hearing respondents' opinions in their own words, particularly in exploratory research, where the researcher isn't entirely clear about what range of response might be anticipated" (Palys, 2003, p. 176).

Survey

Surveying current and former Aboriginal learners enrolled in academic upgrading mathematics courses provided the research study with quantitative data. The focus of the survey was to determine attitudes towards the inclusion of a cultural component in the mathematics curriculum and to assess learner receptivity to having the component delivered in an online format.

Learners were offered the choice of first participating in the survey and secondly, if they consented, to completing the survey as a pencil and paper instrument or completing the survey online. The researcher presented the survey information to interested learners in classroom settings and the survey was administered by either the researcher or his colleagues. Presenting the information directly to learners was chosen as "face-to-face contact typically provides two things: higher response rates and the chance to both clarify ambiguities or misunderstandings and monitor the conditions of completion (Palys, 2003, p. 151). Although all learners who participated in the survey were computer literate and most had been enrolled in online courses, only one participant chose to complete the survey online.

Study Conduct

Interviews

Interview participants were community members identified through Aboriginal educators and professional contacts and included an Elder; Aboriginal educators working with adult learners in community, college, and university environments; Aboriginal educators from two school districts; band and agency staff who work with and support adult learners, and two previous academic upgrading students who have transitioned to post-secondary programs. All but one of the interview participants is Aboriginal. The non-Aboriginal participant has a number of years' experience working with Aboriginal learners in community settings as well as an academic background in Indigenous studies, and was recommended by a number of professional contacts including the major project sponsor.

Interview participants were contacted by the researcher in person, or by email (Appendix A) or phone (Appendix B), and all those contacted agreed to be interviewed. The interviews were conducted between July 13 and November 6, 2006, and were situated in a setting and time determined by the interview participants, ensuring as much as possible that the times and settings were "convenient, available, and appropriate" (Glesne, 1999, p. 78). The settings included two learning centres, administrative offices, an artist's studio, and cafes and restaurants.

All interview participants read and signed free and informed consent forms (Appendix C) and agreed to be audio recorded. The interviews consisted of nine or ten questions (Appendixes D and E) depending on whether the interviewee was a former academic upgrading learner or an educator or community member. The interviews were recorded using an Olympus™ Digital Voice Recorder and the resulting audio files were transferred to the

researcher's personal home computer as digital WAV sound files. The audio files on the digital voice recorder were then deleted. The audio files encrypted on the computer were reviewed with selected passages being captured as MP3 audio clips using Audacity™, an audio editing software. The MP3 audio clips were transcribed on a MS-Word document and both the audio clips and MS-Word document were saved in separate folders on the researcher's personal computer.

Establishing the trustworthiness of the data not only relies on the triangulation of data, but also on building credibility of the research findings (Glesne, 1999). One means of establishing this trustworthiness is to "share the interpretive process with research respondents" (p. 152), and transcripts of quotes used in the study findings, and the context in which the quotes were used, were shared with the interview participants for their approval and feedback.

One back-up copy of all the digital audio clips was made an encrypted on a USB flash drive, which is stored in a locked filing cabinet. Access to the researcher's personal computer and folders are password protected, and all audio files, audio clips, and transcribed MS-Word documents will be destroyed five years after acceptance of the final project.

At a minimum, interview participants will receive an executive summary of the project findings and will be advised that the full report is available through the researcher or publicly available through Royal Roads University.

Survey

The learners who participated in the survey were recruited through direct contact with the researcher who presented the project to separate classes of academic upgrading mathematics learners in two community learning centres. One of the three learning centres where Camosun

College has traditionally offered community programming was undergoing renovations, so learners from that centre were temporarily accommodated at one of the other learning centres, resulting in one presentation reaching two groups of mathematics learners.

Issues of free and informed consent, confidentiality, and data storage and disposal were addressed verbally with potential participants and it was reinforced during the presentation that participation was wholly voluntary. Learners were also offered the choice of completing the survey as a pencil and paper instrument or completing it online.

All survey participants completed free and informed consent forms (Appendix F) or in the case of completing the survey online, consent was implied by logging on to the survey (Appendix G). The surveys were completed between October 30 and November 6, and were administered by either the researcher or a colleague at one of the learning centres. Completed surveys were collected and assigned a number to serve as an identifier and filed in a folder that was stored in a secure location.

Only one learner chose to complete the survey online. SurveyMonkey™ was selected as the survey editor as many of the learners in community settings are computer literate and most of the learners who participated in the survey had been registered in online courses. The survey was supported by the college's server and could ensure participants' anonymity. As there was only one participant who completed the survey online, the responses were recorded manually and added to the results of those who complete the pencil and paper instrument. The survey was then closed and the participant's responses deleted.

The survey consisted of five categorical-response items, two scaled response items, and two open ended items (Appendix H). The survey questions were reviewed by both the major project sponsor and community members prior to submission to the participants. Two former

academic upgrading Aboriginal learners piloted the survey which resulted in no recommendations for changing the format or wording. The findings generated by the data analysis will be shared with the participants, and made available, at all three learning centres.

Analysis

Two approaches were used in analyzing the data collected from both the interviews and learner survey. All the interviews were recorded using a digital voice recorder. After each interview the audio file from the digital voice recorder was transferred to an individual folder on the researcher's personal computer. The audio file was then listened to using an audio editor. While listening to the audio file, notes were made on a MS-Word document. Participant responses were organized, in all cases where possible, according to the interview questions. Specific quotes were also captured as audio clips using the audio editor, and were fully transcribed and labelled. Due to the importance of giving voice to the interview participants, all audio clips were transcribed verbatim. Using a grounded theory approach (Palys, 2003, p. 74), and upon completion of all the interviews, the detailed notes and quotes from each interview were analyzed and examined for key statements, words, or concepts which were then highlighted or noted in the page margin. Subsequently, these statements, words, and concepts were organized into recurring patterns or themes, leading to the development of ten themes. A further review of all interviews and, in some cases, the further verbatim transcription of content, led to the collapse of the ten themes into the seven themes presented in the study findings.

Payls (2003) suggests that the "first and most straightforward step we can take toward summarizing our data is to create *frequency distributions* to summarize the number and

percentage of persons occupying each of our analytical categories" (p. 340). Consequently, the responses from the five categorical-response items and two scaled-response items from the learner surveys were categorized into a MS-Word table and summarized by creating frequency distributions for each category. The responses to the two open-ended questions were transcribed verbatim into a MS-Word table and grouped according to the question. Responses were then analyzed and examined for key statements or concepts. These concepts and the supporting statements were organized into the three themes presented in the study findings.

Ethical Considerations in Research

The research study was conducted in accordance to the Royal Roads University Research Ethics Policy (2000), and upon approval of the researcher's Royal Roads University Request for Ethical Review.

As the research involved Camosun College students and potentially Camosun College employees, the question of requiring an ethical review was posed to the college and no ethical review was required for the interview or survey participants beyond the ethical review from Royal Roads University. Nonetheless, as an additional precaution all interview and survey questions were reviewed by the college's Director of Educational Research and Development for appropriateness and no concerns were expressed.

As the study involved conducting research on First Nations territories and communities and involved community members, being respectful of any protocols and expectations was critical. The researcher ensured that approval to conduct the research was obtained from the three community settings and the community's input was sought in terms of the process and in reviewing interview and survey questions.

Palys (2003) states that "being 'ethical' as a researcher means that you have an obligation to consider things from research participants' perspectives and to ensure participants' rights are safeguarded" (p. 83). The researcher tried to keep this premise at the forefront of all activities and ensured that all participants were made aware and understood that their participation in the research was wholly voluntary, that free and informed consent forms were signed, and that confidentiality was assured. Palys (2003) also addresses the issue of conflict of interest and how it can be "particularly problematic when the researcher is in a position of power relative to the research participant" (p. 84). This concern was especially relevant for those learners who participated in the survey and for whom the researcher had direct academic responsibilities. Likewise, during the research study phase the researcher assumed leadership responsibilities for the department which changed the working relationship with some of the interview participants. In both situations, the researcher needed to be sensitive and respectful of any discomfort and to address any concerns directly with the prospective participants.

Chapter Four – Research Study

Study Findings

The purpose of the study was to determine the need for an online cultural component to be incorporated into an intermediate mathematics course intended for Aboriginal adult learners. The major project research also examined two related topics: whether Aboriginal adult learners would value the inclusion of a cultural component, and the feasibility of designing a cultural component that could meet the cultural needs of a diverse Aboriginal population. Completion of literature review and document analysis, ten interviews and sixteen surveys completed by learners comprised the three methodologies used to obtain the data, resulting in both qualitative and quantitative data. The analysed data are presented in two sections, the first concerns the themes generated from analyzing the data obtained from the interviews and the second section reports on the analysed data from the learner survey. These are related to the literature review and analysis of data in the Study Conclusion section.

The seven themes that arose from analysis of the interview data are:

1. Aboriginal adult learners face many barriers returning to school.
2. A personal and supportive relationship between instructor and Aboriginal learners is critical for academic success.
3. Aboriginal adult learners have a distinctive and personal connection to their culture and history.
4. Mathematics needs to be relevant and meaningful to learners.
5. The inclusion of a cultural component into a mathematics curriculum needs to be viewed from within an indigenized framework and philosophy.

6. The community needs to determine the process, content, and development of an indigenized curriculum.
7. Using online technology to connect Aboriginal cultural components to mathematics has both potential and challenges.

In presenting the study findings, the researcher is very aware of his role of being a non-Aboriginal researcher working in Aboriginal communities.

> When undertaking research, either across cultures or within a minority culture, it is critical that researchers recognize the power dynamic which is embedded in the relationship with their subjects. Researchers are in receipt of privileged information. They may interpret it within an overt theoretical framework, but also in terms of a covert ideological framework. They have the power to distort, to make invisible, to overlook, to exaggerate and to draw conclusions, based not on factual data, but on assumptions, hidden value judgments, and often downright misunderstandings. They have the potential to extend knowledge or to perpetuate ignorance (Smith, 1999, p.176).

Consequently, it is hoped that the voices and intentions of those interviewed have been accurately conveyed and have guided the study findings with, as much as possible, a minimum of assumptions, value judgments, and misunderstandings on the part of the researcher. Comments that provide support to each of the themes derived from the interviews are recorded as “Interviewee” with an identifying number to maintain the anonymity of the participant. Comments from the learner survey are not attributed to any one participant; therefore, an identifier is not required.

Barriers Facing Adult Aboriginal Learners

Principle #1: Aboriginal adult learners face many barriers returning to school

Interview participants, whether they were learners, educators, or community members, were able to identify barriers facing adult learners returning to school. For many learners, their early experiences in school formed their attitudes towards the educational system in general and while the themes of relevancy and culture will be presented further in the findings, educators consistently mentioned that the school system had failed many Aboriginal students.

> Interviewee #5: Every adult student who is returning to school has at some point not made it through the system. So there is a real barrier in the adult education level because everybody coming back through the door is facing that – dealing with that failure or that issue of having to have left earlier in their life - and so there is going to be some insecurity.

Their early experiences with the school system have created, for many learners, a lack of confidence in their abilities, particularly in the subject area of mathematics: Interviewee #1: "Confidence without a doubt. I really believe that a lot of the students who end up in front of me have, at various points in their education, been convinced by someone else that they cannot do math". This lack of confidence is often accompanied by fear and a reluctance to enrol in mathematics courses, especially at the high school level and subsequently at the academic upgrading level as adult learners.

> Interviewee #2: It was just like an inherent sort of thing that all First Nations students had a problem with math and if they're going to fail, they're going to fail math - to a point where people are saying "why should we take it because we're just going to fail anyway".

At the adult level, this fear of failure continues to be a barrier to both enrolling in an academic upgrading mathematics course and in persisting with the course when encountering difficulty or frustration. As remarked by an experienced educator and community member,

> Interviewee #10: A lot of them have great fear just like I had. There's a great fear in that they are not going to do well. It's like they've been pre-programmed; it's an automatic tape inside their head, "Oh, I don't want to do this; I really don't want to do this".

A number of factors were identified as contributing to early negative experiences with mathematics. Socio-economic factors play a significant role in terms of students being successful in school and most interviewees commented on the impact that issues such as poverty, health, and housing have on Aboriginal families. Interviewee #4: "Over and beyond math I think the major barriers facing most of our students is generally life itself. Systematically our people unfortunately kind of lead all the bad stats". In addition to the factors noted above, obligations to family and community also impact on the lives of students. Although these obligations provide a vital and positive connection to culture, it was noted that the educational system has not adapted to the reality of many Aboriginal students leading multi-layered lives. At the elementary and high school level family obligations and socio-economic factors often lead to absences, which for a subject like mathematics can result in students missing essential building blocks for future learning.

> Interviewee #7: I think that part of the work in our community is recognizing sometimes that when our kids travel around so much and do all kinds of things, it's like you're missing the building blocks. And sometimes they're classed as having learning

> disabilities when in fact what they really are is missing all these different building blocks. And for mathematics that's just fundamental and critical.

Because of the linear approach to teaching mathematics, the consequence for missing building blocks in one grade will be felt in subsequent grades, Interviewee #4: "If there are learning gaps in Grade 1, the consequence is that you're not going to do well in Grade 2. And so on and so forth – all the way throughout". These learning gaps may account, at least in part, for the decreased rates in meeting or exceeding provincial standards in foundation skills assessments between Grades 4, 7, and 10 ("Aboriginal Report – 2005/06", 2006). And because of the multigenerational impact of residential schools, parents and families are often unprepared to assist their children academically when students are lagging behind. Interviewee #4: "So we have families at home that perhaps would be intimidated by the subject material and may not provide or are unable to provide a learning environment at home to help the student". In trying to explain the how students are able to move through the school system with learning gaps, one interviewee felt that the school system as a whole needs to examine how and when it assesses students as well as the interventions and approaches used to deal with Aboriginal students who are experiencing difficulties.

> Interviewee #2: We just don't do enough as a community and we don't do enough as an education community. We're stuck in moulds and we say, "Well, I've been teaching this way for years and that's all I know how to teach", and you can't break that mould and say that "I guess I need a new way to teach or I need to look at different methods of teaching". Because Aboriginal people obviously don't respond to particularly high school curriculum and that's based on teacher attitude rather than student attitude.

The attitudes towards education and learning shaped during the school years often continues to be experienced, at least initially, by adult learners returning to upgrade their academic skills. As one instructor indicated,

> Interviewee #1: It's really frustrating for me to have to spend a lot of my time trying to essentially act as a counsellor undoing what has been done by another educator at some point in the past. You see this especially with the older students.

Similarly, when asked about the biggest challenges about returning to school as an adult, one learner answered that: Interviewee #8: "I think the personal issues and baggage that we carry around; it certainly has to be dealt with or pushed aside in order to stay focused on what's at hand". In addition to personal issues and attitudes many Aboriginal learners also have obligations and responsibilities to family, community, and culture.

> Interviewee #2: Most of them have already got to the point where they have families. Not only do they have to worry about caring for family but also maintaining a family, and trying to better themselves at the same time. So you can well imagine that if you have a bunch of kids running around your house you can't really sit down and do your studies.

The responsibilities to family also include caring for extended family members and attending and participating in events, such as funerals or potlatches. Likewise, a good number of learners are actively involved in the cultural events in their communities, and there is a noticeable drop in attendance at key times during the school year. Interviewee #9: "A lot get involved with our winter ceremonies with the long house, and they're there a lot, and a lot of the time have to be there rather than be in class".

Personal and Supportive Relationships

Principle #2: A personal and supportive relationship between instructor and Aboriginal learners is critical for academic success

The need for instructors to develop meaningful personal relationships with the learners in their classes was identified as one of the key factors in terms of fostering academic success in adult learners. All interview participants spoke of the importance of personal relationships, whether it was in relation to providing encouragement and support or with respect to indigenizing the curriculum. Especially for adult learners whose previous experience with the educational system was negative, encouragement and support is just as important, or more so, than instruction:

> Interviewee #4: A lot of any kind of curricula you look through is quite often dependent upon the individual ability of the teacher to be able to encourage and keep students going. A lot of it is encouragement with math, more so than actual instruction.

Understanding what motivates the learner was viewed as an important part of building relationships and enhancing the probability that learners will continue with the course, rather than withdraw, when they encounter difficulties or frustrations.

> Interviewee #3: The more you know about the person, the more they're going to be motivated to be there . . . If you can establish a strong relationship with the students and you can be encouraging of them and figure how to be encouraging, they'll stay.

In addition to the value of instructors and support staff developing personal relationships with learners, connecting learners to role models was seen as a valuable aid to supporting learner success. While having Aboriginal instructors teach Aboriginal students would be the ideal for both role modeling and relationship building, having Aboriginal role models who can

relate to the learners and provide inspiration and support are also very important to learner success.

> Interviewee #10: People who have been there, done it, but also people that are in the process of doing it or people that have just graduated from our program. People who have done the walk and can do the talk. Know what people's anguishes are, their fears, what can drive a success, anything like that – that's part of role modeling.

Personal relationships are also part of the foundation that needs to be in place in order to utilize the knowledge of the learners and community in the development of an indigenized curriculum. It is by establishing an environment of support and trust in the classroom that learners will feel comfortable in the sharing of their knowledge, culture and traditions.

> Interviewee #6: It's better . . . for me as the teacher to be skilled enough in the relationships that I can form that I can invite the knowledge that they have into the classroom and for that to be our starting point, rather than me thinking I would be able to bring in their cultural knowledge.

Furthermore, through contributing to the learning that takes place in the classroom, learners can gain self-confidence that comes from feeling that they can contribute to the learning in the classroom but also gain valuable leadership skills.

> Interviewee #5: And you're going to create leaders a little more so if you're drawing on knowledge that students have and they're treated like experts all of a sudden in the class. And then they realize that, "Hey, I do know something and I can contribute to this, and more so, this is something my teacher doesn't know or that nobody knows in here".

Connection to Culture and History

Principle #3: Aboriginal adult learners have a distinctive and personal connection to their culture and history

Nearly all the interview participants discussed the importance of culture in their lives and the importance of culture to Aboriginal adult learners.

> Interviewee #2: (Aboriginal culture, traditions, and history) applies to adult learners in the sense that they find some sort of foundation or grounding in the culture in the sense of belonging to a culture is very important and the integrity and pride that you have by being part of a culture. And when people lose that, they start floundering around in the community and they end up having a lot of social issues.

Instructors and staff interviewed also discussed their roles in the classroom where they do not see themselves as just being involved in the content delivery or helping learners with their academics. It is very much part of their role to help connect adult learners with their culture, although the introduction to culture doesn't necessarily need to be connected to the local territory.

> Interviewee #10: So it's important to get them in contact with a culture and it doesn't matter what it is; it's not the formal adoption, but it's ways of understanding. It's like healing; healing can take many forms and culture can take many forms. If I can connect a student with a grandparent or a grandfather role in the community or somebody with cultural experience that will further their development. And that would really directly impact on their academics and not just on their personal life.

When the learner is from a local reserve community, helping to make the connections is often fairly straightforward because of the resources readily available. However, when the

learners are from another community or from the urban community with little or no connection to their culture, the process is: Interviewee #1: "a much more complicated one" due to the diversity of backgrounds. But by including examples from the local territory, educators have been able to stimulate the learner's interest in their home community.

> Interviewee #1: We've had the interesting experience of students who came in knowing very, very little about their background, when we started doing that, were inspired to go and do an investigation into their own background . . . Because they thought, "Okay, so that's how it's done here; I wonder how my people do it." And they actually go and seek that reconnection.

As articulated by many of the interviewees, language cannot be separated from culture, or from learning: Interviewee #10: "Language has always been the foundation, I think, to any learning", and it provides the foundation for many cultural teachings which can also be applied to the teaching and learning of mathematics:

> Interviewee #10: I come from a cultural background so that I know how you can write songs with it, and if you have a song then you can create a dance, then if you have the words then you certainly can do your own self-governance and you can do your own ceremonies. And that means an immersion sort of program. But you cannot do that in a math, but you can introduce things in math using certain terms.

The importance of language, and its demise among the younger members of First Nations communities was further observed by one of the learners:

> Interviewee #9: I know we lost that a lot in the past so many years but I'd love to see it back. I see some of our elders when they sit down and see each other to chat and just talk with their native tongue. It's a beautiful sight to see and I wish that people my age

> could be doing that too. But I don't know, we just start losing it. . . I just wish that some of us could go to our elders and ask them to teach us, but it's like everybody is in a rush out in this world to get somewhere fast that they have no time for our elders any more.

Although the importance of a connection to Aboriginal culture was identified by all interview participants, it did not have the same priority or degree of importance among all.

> Interviewee #8: I really don't see the connection but in a different angle of it I think that in order to succeed and do well in something, in my education, I need to be connected or grounded with something and for me it was spirituality. And with others it might be their culture. I'm connected with my culture somewhat but I don't know a great deal about it. And spirituality is a big part of my culture but that's about as far as I go with the culture.

It is important to note, though, that further in the interview this same learner also acknowledged how her attitude towards her culture shifted as a result of being exposed to the cultural components that were integrated into the classroom and curriculum.

> Interviewee #8: Since starting at the (name of institution) it did spark an interest. So I have gone to a couple of functions that are within my culture so it has sparked an interest for me. So when I have had time I have participated, whereas I really didn't have the drive or interest before.

Mathematics and Relevancy

Principle #4: Mathematics needs to be relevant and meaningful to learners

Making mathematics relevant to the learner was another consistent theme that arose from the interviews, although there were marked differences in terms of how interview participants viewed connecting culture to relevancy in mathematics. All the interviewees who were educators expressed the concept that mathematics has to be meaningful to a learner and that the learner needs to see how mathematics can be applied to his or her life.

> Interviewee #5: The challenge always is to try and make curriculum as relevant and meaningful to the people that you're teaching. Like the work that you're doing, we're dealing with First Nations communities or First Nations learners that may not be able to see themselves in the math curriculum at all.

Especially for adult learners who have a great deal of life experience but perhaps little formal education, there is often a reluctance to acknowledge that they are experienced in using mathematics as a result of everyday life. However, recognizing that the skills they have learned are based in mathematical concepts and principles can impact positively on the learning experience.

> Interviewee #10: The strangest thing is that a lot of students already know this but to see it in writing; nobody's ever acknowledged that practical side of life. They've already lived that kind of math but they haven't enacted it, they haven't recognized it for what it was, "Oh that's algebra, that's trigonometry", things like that and say, "Oh, I know that; why didn't you just say so in my words." But a lot of the time they just need to see it.

Relevancy and practical applications were also recognized as being important factors in engaging students and contributing to their motivation to learn.

> Interviewee #1: It's really the ability to key into your individual student on what their motivation is and make it accessible to them, make it understandable and real life and practical to them and if you compare that with an understanding of what their personal motivation is you tend to get a much more engaged student.

And as an educator who works in the school system noted: Interviewee #7: "Math makes sense with what you do every day. I think that relevancy has to run through it so that they see a reason to get sparked up and to learn". Some interviewees accounted for some of the difficulties in learning mathematics as a result of the differences between mathematics and English as subject areas. English was viewed as being an easier subject to work with because of the familiarity due to everyday usage through speaking and reading:

> Interviewee #1: Even a student who doesn't understand the rules of English in terms of writing an essay tends to be able to communicate with spoken word so there's a common bond of language there that they can work with. With math quite often they feel it doesn't relate to their lives.

While there was strong support for making mathematics relevant and meaningful to learners, there were disparate views concerning connecting Aboriginal culture to mathematics. For some interview participants, particularly the learners, culture was seen as being quite separate from learning and education. For these participants, culture was defined in very personal terms.

> Interviewee #8: Education is one thing but being connected to culture and math is something very different. I think it's more of a personal thing. Certainly awareness, I suppose, or acknowledgement to be connected with education, but I don't feel it is important because they are two separate things.

Similarly, another learner also expressed the difference between education and culture, but viewed culture more in the traditional sense in terms of it being associated with the 'big house' or 'longhouse'.

> Interviewee #9: They're totally two different worlds. When I hear culture I'm thinking of our longhouse and in our longhouse it's more native tongue and all that talking throughout the whole ceremonies by the speakers. There is no really English or math involved in that at all.

The above views are also shared by some community members who believe that it is the role of the community to teach culture and maintain the integrity of those teachings. And this position does not negate the importance of education to First Nations communities.

> Interviewee #2: I can't see it as being relevant; I could see it in the sense of the community teaching culture. . . that's where we need to start. Because we've lost it somewhere; we've lost it in politics and treaties and everything else and the culture becomes secondary. So the culture is not what's on everybody's mind and even though we're Aboriginal people, it's not the main thing. I don't know if everybody sees things the way I do but there is an urgency around realizing how important education is.

This statement is reinforced by another interviewee who indicated that when working in consultation with the community the view is often expressed that some First Nations do not want to see culture introduced into schools.

> Interviewee #4: You'll get a lot of answers though from what community members may think and I hear quite often that they may not want to see their culture introduced into the school and they want the students to focus on their math and English.

However, the definition of what culture means to different people could impact how participants interpreted the question. If culture is just defined in terms of language and traditional teachings and ceremonies, it could restrict the perception of how culture could be connected to academic subjects. Interviewee #5: "You know, when we talk about First Nation culture we often think traditional, traditional, traditional and we always try to portray everything out of the past similar to a museum exhibit".

In contrast to those who saw a distinct separation of culture and formal education, there were also educators who were strongly in favour of seeing a more direct connection between academics and culture, as will be reported in greater detail in the section regarding an indigenized framework. This motivation for the inclusion of culture into the classroom appears to stem from a desire to create opportunities for learners to self-realize the knowledge they already possess.

> Interviewee #5: In the history of education or in the history of First Nations communities there's generations of people who have been taught to shun their culture or who have faced racism and all of those things. So there's a real shift now and some people are buying into it and some people who, in my opinion, are never going to be comfortable in their own skin. But the more we can contribute to making change and creating healthy opportunities for people to express the tools and the knowledge they have, I think, the better.

As with the previous section regarding the connection between culture and Aboriginal adult learners, language plays a significant role in that it: Interviewee #5: "forms a fundamental starting point for the delivery of lesson and delivery of activities". Upon further exploration of how language could be applied, this educator suggested that,

> Interviewee #5: Mathematically we can take phrases based in language that outline first the world view and perspective . . . that would relate to the activity and to the mathematical systems we are going to discuss. I think that would be a really good idea because then again it allows you to see that alternative perspective.

Although learners tended to see education and culture as separate, one learner did express the role that culture can play in the classroom as: Interviewee #8: "in the approach of presenting it (mathematics) perhaps or in the understanding of the instructor of where these people are coming from. Not to be speaking in the third person; I am a native person".

Indigenized Framework and Philosophy

Principle #5: The inclusion of a cultural component into a mathematics curriculum needs to be viewed from within an indigenized framework and philosophy

Interviewee #3: "There are two kinds of First Nations education: there's First Nations education for First Nations people, and there's First Nations education about First Nations people".

The major project research topic prompted a good deal of dialogue with some of the interviewees regarding the development of a cultural component contrasted to the development of an indigenized course or curriculum. The researcher was challenged throughout many of the interviews on his beliefs about what was involved in indigenizing a curriculum and on the assumptions underlying those beliefs.

There was a very strong belief among the educators interviewed that just having some Aboriginal examples to illustrate mathematical concepts and supplement exercises would be viewed as tokenism and would not by themselves constitute an indigenized curriculum.

> Interviewee #4: We have to make sure we do things correctly and that we don't indigenize the curricula by just adding certain examples, for instance replacing the speed boat in the math question with a canoe – although at times it's not a bad thing either; but it's a big undertaking to indigenize math curriculum and you have to make sure you go beyond tokenism.

It was argued that learners are very perceptive and would be able to ascertain whether an attempt at indigenizing was genuine. Interviewee #1: "Students are smart and in those cases where it's just an inclusion of a couple of names or pictures or something like that, they understand that it's a token gesture. That's just as infuriating as nothing at all". In order to indigenize a curriculum, a number of educators stated the underlying premise of needing to understand the world the learners come from:

> Interviewee #6: To just talk about indigenizing the curriculum and the words you use to describe it, you're assuming that it doesn't exist in the people and that the way that they're going to "get it" is if you're going to bring examples from their world. The problem is that you don't know their world.

And contributing to the lack of understanding, according to one educator, is the assumption that the Western-European world we are asking Aboriginal learners to interact with has, in turn, never been explained to them. Interviewee #6: "Nobody has explained to any of these generations this English world – nobody. They go to school, people are teaching, but we teach assuming that people are familiar with this English world".

Part of the process of understanding the world that learners come from is the acknowledgement that Aboriginal people have traditionally possessed knowledge of mathematical and scientific

concepts, but not necessarily in terms that are consistent with the Western-European forms of education.

> Interviewee #6: When someone has been really been immersed and schooled in their traditional ways they have a real understanding of mathematical concepts and principles, and scientific concepts and principles. They might not talk about it in the same way that testers would maybe assess their understanding, but they would have it. But it comes too in a very different form.

Another educator discussed the concept of Aboriginal ways of knowing and learning as a separate knowledge system and recognized the importance of maintaining the integrity of the system.

> Interviewee #4: To try and indigenize or kind of push our knowledge system into another I think is something we have to be careful with, because our knowledge system stands on its own and we have to be careful that we don't have to have it validated by another knowledge system. It stands by its own set of criteria and we don't have to force it into something that it's not.

Some educators viewed the indigenization of a mathematics course in relation to the need for an institutional-wide indigenization, the concern being that without it being system-wide the learner would have difficulty maintaining the necessary on-going connection with their Aboriginal culture and teachings.

> Interviewee #1: I think that theoretically an indigenization of the math course could have much more success if it's viewed as not just of the math course but more of an institution wide indigenization that's founded on an engagement with the social issues that are going on in the wider community and with the individual personality of the

> student himself, and that the student really understands this is something that's going to be part of their whole educational experience and not just the one class.

While all interview participants identified some of the difficulties in fully indigenizing a curriculum, there was also recognition of the multiple internal and external expectations imposed on an academic institution when developing and delivering a curriculum.

> Interviewee #5: We're so bound by the world out there – by the curriculum, expectations at the college level, or even at the Ministry of Education - that you can't stray too far off the path before you're not delivering what's expected of you.

Nevertheless, interview participants were also able to suggest strategies that could be taken towards indigenizing a course that could still be of benefit to learners while being respectful of Aboriginal ways of knowing and teaching.

> Interviewee #4: There are all sorts of little things you could probably do that may add up to helping out . . . permutations, combinations, maybe use local language examples. What we could do to help implement little things like that I think could be a big benefit if students did see local examples. . . but it has to be connected.

Experienced educators acknowledged the realities of trying to indigenize courses while working within an educational system that requires course outlines, learning plans, and learning objectives.

> Interviewee #4: It's a bit of a frustrating thing because once again you're looking at how you integrating Aboriginal knowledge with these little titbits but really you're just planting seeds and hoping that what you're doing is going to have a positive effect. Is it indigenizing the science curriculum? I don't know, but it's opening the door to even have the word "Aboriginal" in a prescribed learning outcome.

Most of the interviewees acknowledged the gains made in recent years and while not ideal in terms of indigenization, most agreed that introducing Aboriginal content and culture into curriculum does create a benefit for students. However, the connection with, and acknowledgement of, Aboriginal ways of knowing and learning must be maintained and respected.

> Interviewee #6: If you're really seriously indigenizing math then yes, you still could draw on some mathematical principles and then look at those from an indigenous world. But in order to be able do that you have to be willing to enter that world in a more holistic way. Because curriculum for me isn't just the content, it's not just talking about it and possibly drawing abstract examples from that world,; it's the way in which math is taught.

The view that "the way in which math is taught" is consistent with the view supported by all the educators interviewed: that despite the inclusion of cultural content into the course, the main focus of working with Aboriginal learners is in the relationships formed and the acknowledgement of the knowledge and experience of the learners.

> Interviewee #3: How do we make a math problem that is indigenized? It's more about what goes on in the classroom and how you approach things and again that acknowledgement that Native people knew a thing or two about math way back when and have a gift, in a lot of cases, for it and are able to do it again.

Community

Principle #6: The community needs to determine the process, content, and development of an indigenized curriculum

With regard to the question about who should be involved in the development of an indigenized mathematics curriculum there was unanimous agreement by interview participants that the community had to be involved. Interviewee #3: "It's important that you talk to community, work with community, and bring it back to community for further feedback and their approval". However, there were varied responses both about the timing and process of that involvement. Not involving the community in the design and then presenting the community with a completed model was seen as a major obstacle to obtaining any support for implementation.

> Interviewee #5: If you were going to build a model specific to a cultural group or a community, I would think that you would have to go in and even just ask the question or pose the question; you're going to have to get that community interest.

Throughout the interviews, Aboriginal educators referred to the goal of "Indian Control of Indian Education" (National Indian Brotherhood/Assembly of First Nations, 1972), as well as to the more recent Bill C-34: First Nations Jurisdiction over Education in British Columbia Act (55 Elizabeth II, Chapter 10, 2006). The beliefs, philosophy, and goals underlying these policies and legislation were seen as key reasons for engaging the Aboriginal community in determining educational policy and curriculum. Several educators and community members spoke of their communities' deep commitment to education.

> Interviewee #4: One of the things I think is pretty consistent throughout Aboriginal communities is that they recognize or have a strong belief in it, and I do too, is that education is a tool to help empower us. It's encouraging to see when educational institutions take the time to ask deep questions.

In addition to being respectful to established protocols and policies, interviewees indicated that involving the community in the indigenization of curriculum will also ensure that any curriculum is truly reflective of that community. In turn, this would contribute to the level of comfort and safety of the learners.

> Interviewee #5: In working with First Nations community, I think that philosophically what you can do is try to mirror or reflect the community in which they live. If you can take that framework and place that in the school, you're going make students feel more comfortable and they can relate to it much more.

There was a good deal of consistency in the responses with regard to who should be involved in the development of an indigenized curriculum. While it should be left up to the community to ultimately determine who should be involved, it was seen as critical of involving a number of individuals: someone who knows the community well, an elder, someone who has cultural knowledge, learners who have gone through the program, and educators.

> Interviewee #5: By doing that often, say in the example of looking at geometric lessons related to tepee construction or something like that, you're going to involve community because you're going to have to bring in elders or family members to describe all of that stuff. So you kind of empower more people and bring in that more holistic community based approach.

The importance of having someone who knows the community well was reinforced by almost all interviewees. Interviewee #9: "I'd say one person who would be is someone who really knows the community and is connected to the community and gets along with everybody. One of those types of people who are on the reserve". In contrast to someone who is from outside the community, having someone within the community who is known and respected was

considered invaluable due to the perspective they would bring and the level of comfort experienced among community members. In addition, it was recommended by one interviewee that community involvement not necessarily be limited by formal protocols, but that the community should also be involved in conducting any necessary research.

> Interviewee #5: I think by involving community not so much just at a recommendation or advisory level, but actually having someone in the community do the research – someone who may or may not be an expert or may or may not be a math guru – but at least they have those connections to the community so you are going to get some real genuine responses and input.

And lastly, learners were considered an important part of the community involvement because: Interviewee #3: "it only makes sense if you're trying to teach a certain group of people that you involve them in the actual design of what it is they are going to learn".

In terms of the process of developing an indigenized curriculum, some interviewees suggested that it is important that those involved with the process be: Interviewee #2: "tuned into education", otherwise it "can get pretty messy" and the process can get easily sidetracked. A number of interview participants focused on the importance of working within a framework and expressed some frustration with projects they have been involved in because there was no framework in place. There appeared to be consistency among the interviewees about the steps involved in establishing a framework:

> Interviewee #7: I think you do a focus group first with the community with different people that you would tap into and then you would go away and provide a summary of what you heard – that would be your framework. Then you come back with your

> framework and people then start weeding it out and adding their input. But I think that you get the initial context from your focus group.

Similarly, the process of developing a pilot project using a revised curriculum would follow the same process of consultation and feedback with the community.

> Interviewee #3: Then you go off and deliver a pilot. And then you bring the community back in and report back to them again and evaluate what you've done with them and then talk to them again about making changes. So they need to be involved at every phase.

Indigenizing curriculum that could meet the needs of a diverse Aboriginal population was considered by all interviewees to be challenge. Interviewee #1: "If you're going to indigenize the curriculum, you can't have something that is pan-indigenized". And while interviewees felt it would be difficult to meet that need, they were nonetheless able to offer some strategies that could provide inclusion of the larger Aboriginal community. In addition to providing resources from other First Nations and communities across Canada, one approach suggested when developing culturally sensitive curriculum is to start by acknowledging the traditional territory and teachings of the community and then acknowledge the teachings of the surrounding territories and how they are related. Interviewee #7: "In a cultural component, acknowledging for sure the traditional territory that you're in as a foundation, but then of course acknowledging what else is around there and the teachings that are woven throughout".

A number of interviewees discussed the advantages or benefits that can arise from trying to include diversity in an indigenized curriculum and how it can contribute to the learning for all Aboriginal peoples.

> Interviewee #5: In one community we can put a ton of emphasis on who we are and the cultural knowledge that we have and create that sense of pride, but you're not really sharing outside of that place. Whereas if you take all kinds of related cultural practices then there's benefit in that as well because we see our similarities and as well recognize our differences; and recognize that it's okay to have those differences in that they're all multiple perspectives.

Online Technology Potential Benefits and Challenges

Principle #7: Using online technology to connect Aboriginal cultural components to mathematics has both potential benefits and challenges

The questions relating to having an online cultural component available to learners taking mathematics courses provided some of the most varied responses from the interviews. There was general agreement that Aboriginal learners and community members were quite comfortable with technology, whether it be at the adult level or child and youth level. Interviewee #4: "I know a lot of youth and a lot of our peoples love computers! . . . It does seem to be a way that particularly our young people can communicate" ; and, Interviewee #7: "I certainly think accessing resources online is the way to go. It's certainly growing and flourishing". These opinions were supported by another interviewee who works at one of the adult learning centres, Interviewee #10: "Everybody who lives here that's used computers have found it beneficial, whether it's in everyday life or for academics . . . they begin to realize it's a tool that can be used for many different purposes". For adult learners who are new to technology there may be some initial apprehension about using computers; however, through

developing computer skills some learners indicated that learning computers also allowed them the opportunity to develop the self-confidence to take further academic upgrading courses.

> Interviewee #9: When I first started doing advanced computers I didn't want to do it because I was so afraid of going on computers as I wasn't that kind of computer person at that time. But by the time the term finished I was the top student in the class and was winning all our presentation awards and all that. Once I got that I knew I got that feeling inside of me - I knew I could do anything. That's what got me into my math and English; it was like I could do anything that I want if I can do this.

When asked questions about using computers to introduce cultural components to curriculum, some interview participants immediately thought of its application to teaching and learning First Nations languages, perhaps because of existing websites such as First Voices, which is "a suite of web-based tools and services designed to support Aboriginal people engaged in language archiving, language teaching & culture revitalization." (First Peoples' Cultural Foundation, 2007, Homepage). As one educator proposed, Interviewee #10: "Once it's delivered, once it's there in front of you, I think it's going to take off big time. I think students are just waiting for an opportunity to learn language and say, 'Hey, this is what I'm learning'".

While wondering what kind of questions would arise and how an online cultural component would be embraced by the community, other educators were very positive about the idea of connecting cultural content specifically to mathematics curriculum.

> Interviewee #5: It would be so groundbreaking. You would be tying oral tradition into a medium and using technology to deliver that. You'd be tying so many of the pieces

> together and bridging different ways of using technology to deal with current curriculum.

Likewise, some learners were in favour of the concept of using computers to present cultural components due to the prevalent use of computers in the classroom and at home.

> Interviewee #9: I think it's a good choice to go to. I believe that it's a computer way of life seems like it nowadays and almost everybody has a computer in every household. They would rather be on a computer than in a textbook.

When asked about the potential for using online components to connect Aboriginal culture and content to a mathematics course, this same learner was open to the concept.

> Interviewee #9: It's a good question. It'd be pretty exciting to experiment on I guess. I guess maybe try it with somebody and maybe see how they reacted to it. I never ever see anything like that, never ever crossed my mind. . . I guess it would be good to try out.

A number of educators were excited about the possibility of using online cultural content both as a way of connecting with the greater Aboriginal community and as a way of involving the community with the learning: Interviewee #7: "If you go online, then people from different communities can access it"; and, Interviewee #5: "But if the content is all there and the student is going through that, what prevents you from involving more community on a tutorial basis?".

While some participants were enthusiastic about the possibilities, other interviewees were hesitant due to a number of concerns. One learner expressed her concern in terms of the degree of comfort with her culture:

> Interviewee #8: I think it could work for some students. For myself I don't connect with that. But I can understand for some students it would. Because I guess I really don't have that grounding and secure understanding of my own culture.

Another concern expressed was around the technology itself and whether the hardware and software was sophisticated enough to meet the standards necessary to produce and present the content in a format that would make it functional. Further concerns centred on learners having access to the technology and being able to make the best use of the technology.

> Interviewee #4: It's easier said than done to try and integrate online learning in the classroom. Sometimes it's physical movement and moving people around and the computers, for all their benefits, seem to be expensive distraction machines, particularly with students who may have difficulty focusing.

Other participants expressed concerns about the appropriateness of the medium for learners at the fundamental and intermediate levels and advocated that a blended approach to online learning was the best approach to use for this level of learner. There were concerns that there could be a tendency for instructors to develop an over-reliance on the online content and not enough on the face-to-face interactions.

> Interviewee #10: What I find is that online learning should be a blended approach, has to be a blended approach. . . I love online learning but I need to have that social connection, that bonding, first. And all students have to have that. When you're coming in at the fundamental level you need to have that book in front of you; you need to have that teacher before you or besides you. So online learning is great for maybe the higher levels but blended is the way to go for this classroom.

The need for a blended approach was repeated by another educator who used the example of a smaller community to highlight the need for personal support for learners accessing content and resources online:

> Interviewee #7: One of the challenges, and I'm think of Kingcome Inlet because I'm familiar with that territory, is making sure that if it's online that you have the availability of someone in the village who can still help. Because with math if sometimes you don't get it, you still need someone to help you through the process.

The concerns about the appropriateness of using online delivery methods for fundamental and intermediate mathematics learners led a number of interviewees to reiterate their position on the importance of the personal relationship between instructor and learner. In their view, it is this relationship that will play a more significant role in learner success than adding online content.

> Interviewee #3: If all you did was build a web page that people could access and learn about math and culture my guess would be that people you would probably have the same amount of success as you did if you didn't have a website there. That sounds harsh and I don't know, I honestly don't know. . . . I think it's way more in the relationship and the environment that you build in the classroom that's going to actually keep people there and learning.

Another educator approached the question from very much of an indigenized framework, whereby some of the content would invariably raise issues that are embedded, directly or indirectly, into any exploration or discussion about Aboriginal culture.

> Interviewee #1: I think it's possible, but I personally am leery of large amounts of online content for indigenous students. The reason why is that I think that when you're

> dealing seriously with indigenous issues, which you're going to if you're going to take indigenization the core idea seriously, then you're inherently going to be talking about very emotionally powerful things - colonialism, residential school, the effects of FASD and all of that stuff . . . And I worry about students essentially being left alone or without the personal contact that is required to talk through those issues.

However, within an indigenized framework there appears to be an opportunity for cultural content to be integrated into curriculum. When asked about the appropriateness of having Aboriginal examples of certain mathematical concepts and problems being accessed online, one educator felt that it could be relevant given certain constraints:

> Interviewee #6: Only if there is real understanding of the indigenous world and it's explained from that perspective. And then if it's going to be used for math or science, it has to be skilful enough for people to be able to make the connection into this world. You're always making explicit the understanding in both these worlds. Not if you're only going in one direction; it has to be reciprocal.

A further concern expressed by a few of the participants had to do with some of the challenges involved in producing online content. In order to ensure cultural relevancy and be respectful to the local territories, teachings and stories would need to be drawn and obtained from the community. This raised a number of interesting questions around the process and protocols that would be involved. One educator raised the issue of the willingness of elders and other community members to participate or contribute to having stories or teachings recorded based on the traditional ways of knowing and teaching.

> Interviewee #3: When you teach someone something, when you share your knowledge with them, you have a great responsibility for the knowledge that you hold. You have a

> responsibility to only to pass it on to people who are ready. So it sounds like the stuff that you're talking about will be pretty harmless information to hand on to someone, but you might find some people who wouldn't be willing to be videotaped to share stuff in that way, simply because they want to meet the people that they are talking to so that they know and can sense how much they are ready to receive the information.

Questions regarding protocol and copyright were also asked by another educator who felt that certain questions would have to be anticipated and then negotiated with the communities involved.

> Interviewee #5: If you have an elder that is on the computer screen and five years later that person is gone, what do you do with that material? Is it something you get to keep there? Who does that knowledge belong to? Who accesses it?

Learner Survey

The survey provided the quantitative data for the research question. The survey consisted of seven scaled response items and two open ended questions. There were 16 learners who responded to the survey and who were distributed over three learning communities. Figure 1 demonstrates the prior education level of the participants, with the majority of learners indicated that they had achieved a Grade 10-11 in mathematics in the school system.

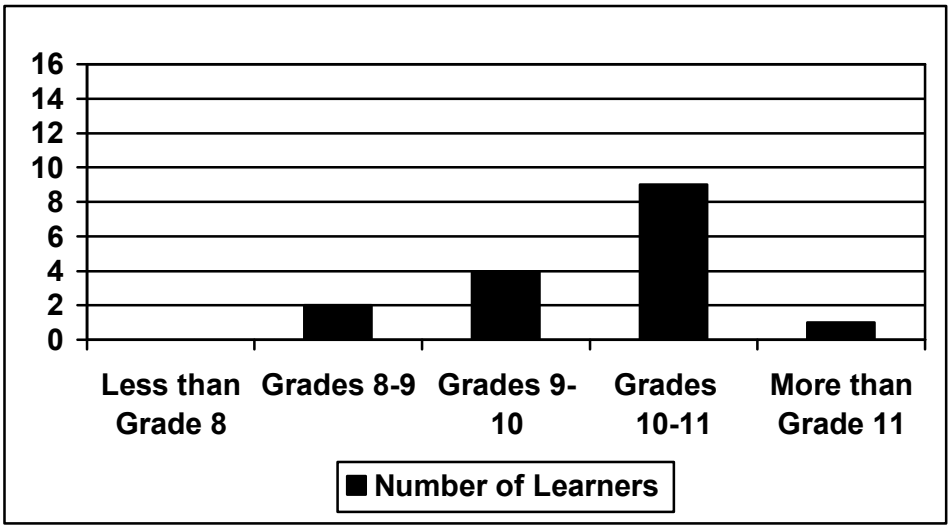

Figure 1. Mathematics background of learners.

However, as demonstrated in Figure 2 it is interesting to note that notwithstanding their previous level of mathematics education, the majority of learners were currently enrolled in either Fundamental Mathematics 034 or Intermediate Mathematics 052. While 66% of survey participants reported having Grade 10-11 mathematics, 43% were enrolled in Fundamental Mathematics 034, which is approximately equivalent to Grade 8 mathematics. Completing Fundamental Mathematics 032 and 033 provides learners with an approximately Grade 7 level of mathematics, while Intermediate Mathematics 052 and 053 is equivalent to Grade 10 mathematics and Advanced Mathematics 072 is equivalent to one half of Grade 11 mathematics.

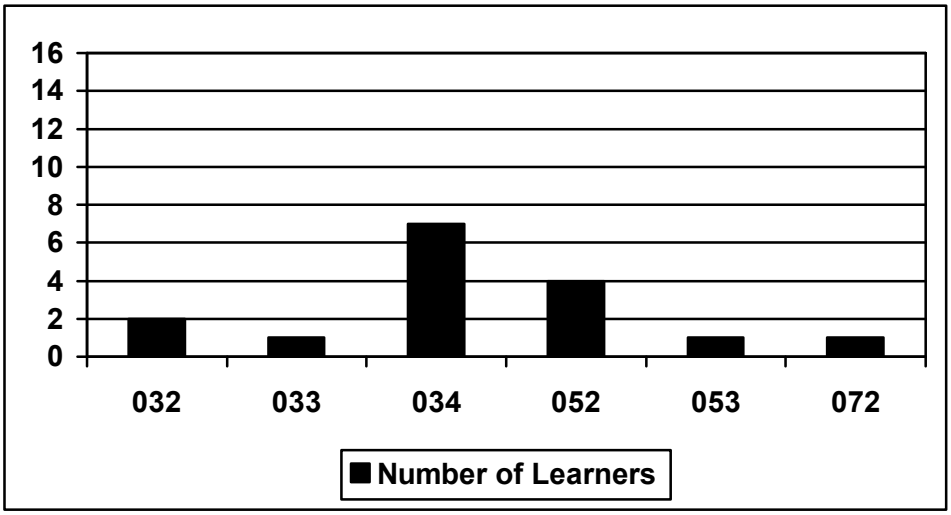

Figure 2. Number of current learner enrolments per academic upgrading course.

Sixty-three percent of learners reported that it was the first time they were enrolled in their level of Academic Upgrading, with 25% reporting it was their second attempt at their particular course level. Third and forth attempts were 12% combined. For those learners who were taking their course a second time or more, Figure 3 outlines the factors that contributed to their not successfully completing their course. Conflict with work, financial, personal or family problems were cited in 38% of responses, followed by 23% for both time management issues and that the instructional method was self-paced.

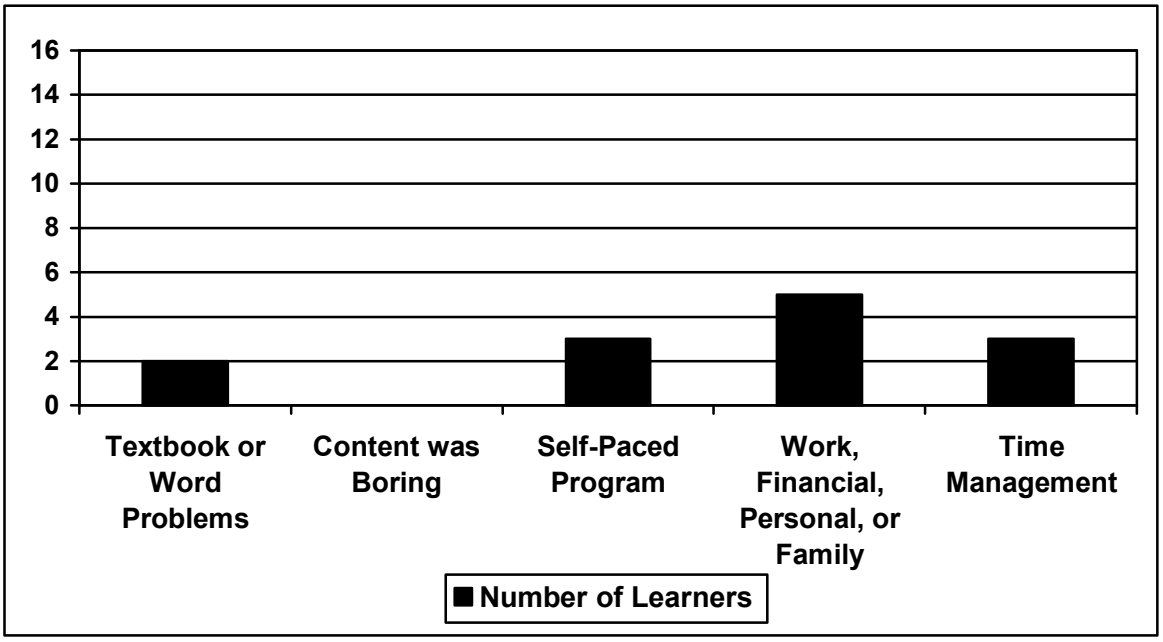

Figure 3. Factors contributing to non-completion of previous course enrolments.

The last two scaled response questions on the survey related directly to the research question. Question 6 asked participants to respond to certain factors in terms of importance to learning mathematics and Figure 4 reflects the responses. The factor "a good teacher" received the highest rating for any of the factors with 87.5% of respondents ranking it as "very important". The second most important factor contributing to learning mathematics, as rated by the respondents, concerned "learning things that you can use in your everyday life" with 75% of learners ranking it as being "very important" or "important".

The next two factors, "support from family, partner, or community members" and "working at your own pace", were more varied in their responses with the former being ranked as "important" or "very important" by approximately 69% of the respondents and the latter by only 50%. "Working at your own pace" also received the highest number of "somewhat important" ratings of all the factors.

Of note, the factor most related to the research question, "seeing the connection between math and your culture, traditions, or history", received the second lowest number of "very important" ratings and the second highest "somewhat important" ratings of all factors. As shown in Figure 4, only 50% of respondents ranked this factor as "important" or "very important".

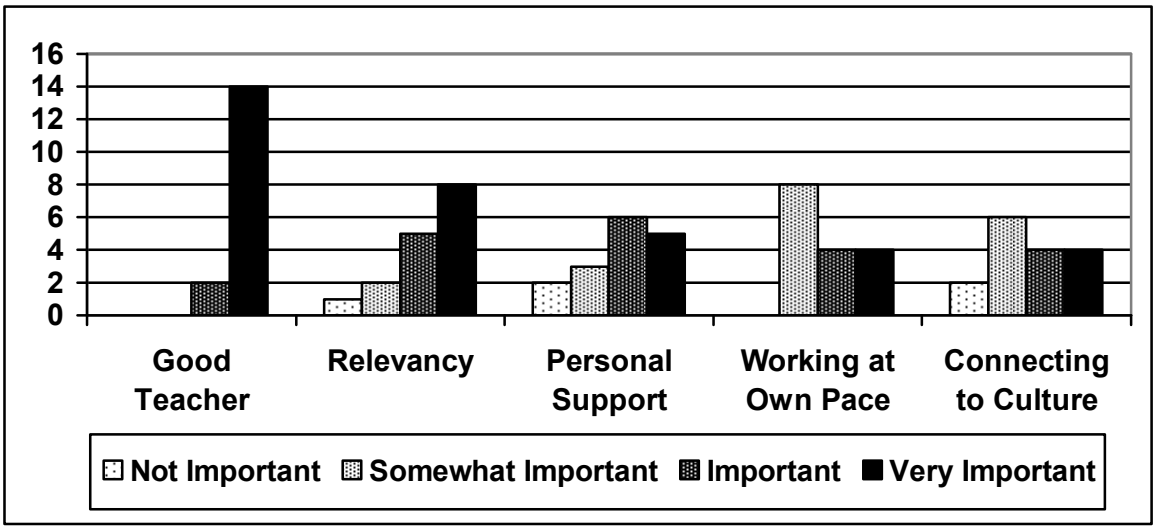

Figure 4. Factors helpful to learning mathematics.

Question 7 consisted of three sub-questions asking learners if they were interested in learning more about the connection between their culture and mathematics, the option of learning about this connection if it was offered online, and their interest in learning about this connection if it lengthened the time required to complete their course. In all three sub-questions the "somewhat interested" category was the predominant response with percentages ranging from 38% to 31%. However, the range of responses across all categories was minimal

with a difference of no more than three responses between the "not important" and "very important" categories.

The two open-ended questions asked the learners what they had learned about themselves since enrolling in mathematics academic upgrading and what they think would be most helpful in helping learners staying interested and completing the course content. The responses were analysed and grouped into three themes: barriers, instructional support, and relevancy.

Barriers

Many of the learners' responses to the survey questions related to developing confidence in their abilities and being able to transfer their successes to further education and other areas of their lives. "I'm still learning but so far I have learned that I enjoy doing math and that if I put my mind to it I can do it. Which I guess I would apply to anything else also". And in another example, a learner was able to acknowledge some of the factors that contributed to the feeling of success and confidence:

> I think I have learned a lot about myself since taking this upgrading. At first I was not sure I was willing and able to get through this work, but the people and the instructors in this program give me so much help and support. I now know that I have a chance to go on further and continue to reach my educational goal.

Learners were also able to identify some of the barriers they are facing and provided insights into their behaviours and attitudes. "My own motivation. I've lacked motivation and I think at times I'm scared to finish and move on to a college course. Failure is not an option, but at times neither is success." While the theme of avoiding mathematics but needing it for further education was mentioned by a couple of learners, "Now I realize not many like math

but it seems to be one of those things that should be done in order to move on to courses/programs that you want to take", other learners were also able to identify attitudes and strategies needed in order to work through the resistance. "You need patience, persistence, and the ability to acknowledge imperfection", along with, "Flexibility, support, someone to be there to push a little when it looks like I am losing track". Additionally, one learner commented on the connection between attendance and course completion, "That I can do it if only I could've had a better attendance in high school".

One learner in particular expressed a deep understanding or appreciation of the impact post-colonialism has had on Aboriginal peoples and how it has perhaps shaped attitudes towards formal education for some Aboriginal learners.

> I am interested in the course content; it is family/cultural obligations that interfere with my education goals. Plus First Nations people today generally don't like to touch things they don't understand if it intimidates them, they tend to procrastinate rather than attempt it. Some of this is from the "fear of being wrong" instilled in most from the harsh education of the residential school. It's not that they can't do it, it's fear of failure, as failures were condemned to a life of sin and misery taught by Residential schools. The generation that went through this transformation inadvertently taught their children to feel the same way.

Instructional support

In addition to identifying some of the barriers facing learners, the theme of having a good teacher or instructor was also consistent throughout the learners' comments. The role of the instructor in creating a supportive environment was recognized as a being a factor that learners

considered helpful to completing a mathematics course. "The course content is not really an issue for me, but rather having a good working environment and a knowledgeable instructor to make the work as clear as possible for me". As described by another learner, a good instructor was seen as being sensitive to the learning needs and styles of the students, "By having a teacher that can be patient, and by making sure that your moving along the way you learn. A good instructor that can make math fun by simply being able to tune into how a person understands/learns". Although not identified specifically, having a personal relationship with the instructor and issues of trust also appeared to be important, "I think having a connection with the instructor/teacher . . . Also having a instructor/teacher who someone is not afraid to ask questions to."

As noted in a learner's statement above, patience was another attribute that learners valued in an instructor and was referred to throughout the learners' comments, "A good teacher that has a lot of patience with me", and similarly, "I have found that with a teacher who will take the time to keep teaching me how to solve the math problem".

Relevancy

The third theme that was evident after analyzing the data was the theme of relevancy. A number of learners expressed the importance of having content that provided some meaning in their life, although this was expressed in a number of ways. A couple of learners commented on the wording and explanations given in the textbooks used, "If the explanation in the text was clearer I would succeed more at my math", and, "Problems to be easily worded and understandable". Other learners commented on the desire to have the course content more interesting, "For me, personally, if it's interesting I will work at it more", and one learner

observed that there needed to be a greater connection to everyday life, "I've learned that through time I actually like it. Still can't figure what some of has to do with everyday life though". And, as articulated by one learner, it can be surmised that the following statement is suggesting that mathematics needs to have more relevancy and a greater connection to other bodies of knowledge in order for it to have a wider appeal to learners, "Getting a content which can be found not only in our culture but in science and other interesting topics that can help mathematics have a universal appeal and not just a certain bias within the learning phase".

Study Conclusions

The research question for this study was identified as follows: Is there a need for an online cultural component to be incorporated into an intermediate mathematics course intended for a diverse Aboriginal adult learner population? This question in turn led to the development of two sub-questions: (1) Would Aboriginal adult learners value the inclusion of a cultural component – even if its inclusion extended the duration of the course; and, (2) Can the cultural component be designed to meet the cultural needs of a diverse Aboriginal population? In arriving at the study conclusions, of primary consideration is whether or not the study findings answer the research questions.

Determining the Need for an Online Cultural Component

With regard to determining the need for an online cultural component to be incorporated into an intermediate mathematics curriculum, the study findings certainly corroborate the need for a mathematics curriculum to have content that is relevant and meaningful for the learners. There was a good deal of consistency from both the interview participants and from the learner

survey in recognizing the need for increased relevancy and with learners being able to see themselves in the curriculum. These results are also very consistent with the view supported by much of the literature that for "most aboriginal students, mathematics receives superficial attention because there is no linkage between it and their cultural values, little or no relevance to their daily life, and so no connection is established" (Ezeife, 2002, p. 185). However, there were some discrepancies in the responses of the interviewees relating to the inclusion of cultural content and what constitutes cultural content.

Generally, educators were supportive of the inclusion of a cultural component using online technology. Some of those who weren't supportive at the beginning of the interviews could perceive the potential by the end of the interview given certain conditions, such as ensuring that examples used are not just isolated tokenism but part of what connects the learner to Aboriginal ways of knowing and teaching. Those who remained reluctant based some of their reservations on the perspective that it is the community's responsibility to impart cultural knowledge and teachings or that culture is such a personal matter that it needs to be separated from curriculum.

Interestingly, there was also general agreement amongst almost all the interviewees about the use of technology in many First Nations communities and the degree of comfort experienced by Aboriginal learners in using the technology. Approximately half of the interviewees could see the application of technology and how it could complement cultural curricula (Agbo, 2001), particularly as it relates to language and mathematics (Battiste, 2002; D'Ambrosio & D'Ambrosio, 1994). And although there were some concerns expressed about the functionality and sophistication of the technology to adequately present cultural content, the principal concerns seemed to centre on the ability of technology to convey an Aboriginal

perspective and respect protocols. This is a concern that is also supported in the literature, that "despite the current preoccupation with finding the most successful configuration of technologies and support services, the most demanding challenge will be to find ways to infuse educational programs with Aboriginal values and perspectives" (Davis, 2000, p. 247). The study findings suggest that there is further work to be done with the community in determining what kind of cultural content and examples would be deemed appropriate to place online. The findings also underline the critical importance of the community driving the process.

Although there were no assumptions made during the interviews that learners would have to access the online cultural component independent of an instructor or support staff, a number of interviewees felt it important to state the importance of a blended approach, especially in working with adult learners at the fundamental or intermediate levels.

Inclusion of a Cultural Component

The reluctance of some interviewees and the lack of strong interest from the learner survey to consider the inclusion of a cultural component could be attributed to how participants defined a cultural component or the indigenization of mathematics. Some participants initially viewed the cultural component as meaning to include traditional teachings that usually take place in ceremonies and are not intended to be shared with the public. As the interviewees progressed and concrete examples were provided, this perception shifted. However, for the learners who participated in the survey, there wasn't the opportunity to engage in such a dialogue and learners responded according to their interpretation of "seeing the connection between math and your culture, traditions, and history". The fact that 75% of survey respondents viewed "learning things that you can use in your everyday life" as being

"important" or "very important" speaks to the importance of having a curriculum and content that reflects the learner.

Although not directly related to the research questions, both interviewees and the learners who participated in the survey reinforced the importance of a having "a good teacher" and of the relationships that form in the classroom between instructor and learner. It was further identified through the interviews, that it is these relationships that allow learners to make the connection between their knowledge, teachings, and experience and the mathematics curriculum. In turn, this knowledge can be shared with others prompting discovery learning and inquiry arousal (Driscoll, 2002) which would provide the opportunity for other learners to create their own connections.

Meeting the Needs of a Diverse Aboriginal Population

Finally, the issue of designing a cultural component that could meet the cultural needs of a diverse Aboriginal population was examined. When working with specific communities, the findings suggest that it is important that the local territories' traditions be respected. Interview participants also reflected on the difficulty in trying to create a curriculum that can meet the diverse needs of Aboriginal learners, but a number of interviewees suggested that the use of examples based on local traditions, teachings, and socio-political issues can also prompt learners from other territories or communities to question their respective practices.

Study Recommendations

The findings generated three primary recommendations, the implications of which will be discussed further in Chapter 5. Recommendations 2 and 3 will be dependent upon the input

and direction from the community, which includes Camosun College's First Nations Education and Services department. The three recommendations are as follows:

1. Report back to community on research study findings.
2. Develop examples of both text-based and online content.
3. Work with local community to design and pilot an indigenized mathematics curriculum.

Report Back to Community on Research Study Findings

Although providing feedback and a copy of the major project's Executive Summary to interviewees was incorporated into the Ethical Review and Major Project Proposal, this recommendation proposes a more formal approach to providing feedback. Three Aboriginal communities, representation from two school boards, representation from the University of Victoria, and colleagues from Camosun College were involved in the research and the researcher would like to present the findings to promote further feedback and recommendations. Not only is this recommendation supported by the literature (Battiste, 2002; Richardson & Blanchet-Cohen, 2000; Smith, 1999), but also by many of those interviewed.

Develop Examples of Online Content

In consultation with Aboriginal educators, developing online content could be used to demonstrate how Aboriginal content could be introduced into the curriculum. This content could include local, national, and international Aboriginal examples of mathematical concepts, relevant and meaningful supplementary exercises and problems to compliment existing . . . which would be drawn from both traditional culture and contemporary social, political, and

economic Aboriginal life. Having concrete examples could help facilitate a greater discussion of the possibilities of having an indigenized mathematics curriculum as it was difficult for some interview participants to conceptualize what an online cultural component would look like. A number of interview participants, and perhaps some of the learners who participated in the survey, viewed an online cultural component as including teachings that might take place in traditional ceremonies, such as in the longhouse, which for some Coast Salish First Nations are not intended to be shared outside of the community. Having examples would provide a better framework for further discussions.

Work with Local Community to Design and Pilot an Indigenized Mathematics Curriculum.

Again, this recommendation would be dependent upon community input and on the feedback from the two prior recommendations. Camosun College has outlined a process for developing curriculum (Camosun College, 2005) and should there be support in the community for such a project, there is already a process that has been established and resources from both the community and college to draw from.

Chapter Five – Research Implications

Organizational Implementation

The three recommendations generated by the research study were as follows:

1. Report back to community on research study findings.
2. Develop examples of both text-based and online content.
3. Work with local community to design and pilot an indigenized mathematics curriculum.

Implementing all three recommendations will have implications for a number of departments at the college although, as noted in the previous section, if and how recommendations 2 and 3 are implemented will be dependent upon the outcome of the first recommendation of reporting back to the community. The departments at the college most affected by any implementation of the recommendations are First Nations Education and Services (FNES), Distributed Education, and Community Learning Partnerships.

First Nations Education and Services Department

Camosun College has a well established and innovative FNES department that has worked hard and successfully at establishing relationships and protocols with First Nations and Aboriginal communities in Southern Vancouver Island. FNES has a leadership role in terms of developing programming and courses for Aboriginal students both on-campus and in community learning centres, as well as being one of the key institutional contacts for government funding initiatives.

One of the Camosun College projects sponsored by the Aboriginal Special Projects Fund (Ministry of Advanced Education, 2007) was the development of a document entitled

Indigenizing Post-Secondary Curriculum: A Framework (Camosun College, 2005). The intent of developing this framework was to introduce the qualities of an indigenized curriculum to the college community and to guide faculty who may be interested in indigenizing curriculum. It examines the development and delivery of First Nations curriculum utilizing four phases of indigenization: consultation, collaboration, creation, and reflection/validation; and, at its core, is "the emphasis placed on ensuring that the voices, the knowledge, and the wisdom of First Nations faculty and/or community members are included throughout the process from consultation to reflection/validation" (p. 8). Consequently, this framework provides a very relevant foundation for proceeding with implementing the recommendations, and the researcher would rely on the FNES department to guide the development and delivery of any indigenized curriculum.

The first recommendation deals with reporting back to the community on the findings of the research. One of the goals of consultation in course development is to "use an appreciative process to assess what will best serve the community while building on the strengths and resources already in existence" (Camosun College, 2005, p. 8). Given the broad representation and experience of the interview participants it is anticipated that the feedback from the community will guide the process to determine if an indigenized mathematics curriculum should be developed at this time. Should there be support for the development of such a program then all four phases of the indigenization framework could be applied.

The second recommendation focuses on developing examples of online and text-based content in order to better illustrate an indigenized mathematics curriculum. Community involvement in the form of consultation and collaboration is critical in order to foster "community ownership and control of the learning resources" (McLoughlin, 2000, p. 237).

Not only can the community provide the necessary cultural perspectives, values, and beliefs but it can also contribute to the task and concept analysis for specific learning objectives or lessons (Alessi & Trollip, 2001). Again, the FNES department would be involved in facilitating this process.

Should the community support the development of a pilot indigenized mathematics curriculum, then the development process would follow all four phases identified in the framework. It will be important that attention is paid to the reflection/validation phase throughout the development process to ensure that the curriculum reflects the directions and needs of the community.

Distributed Education Department

The Distributed Education (DE) department at the college provides support and services to faulty and staff instructing online or blended courses. Although there are approximately 50 courses being offered online at Camosun College (Camosun College, 2007e), the DE department consists of only one faculty member and 1.7 support staff. While "technology-based learning is only as good as the instructional content and design provided by the teachers" (Latchem & Hanna, 2001, p. 24), the ability to successfully deliver online content is also dependent upon an organization providing the necessary resources to support both the learners and staff (p. 48). Despite the fact that expanding distributed education is targeted under the college's strategic plan (Camosun College, n.d., p. 7), the DE department is severely under-resourced. Implementing new courses will put further pressure on the DE department, especially if the courses require different hardware or software than the ones currently supported by the college.

Developing online curriculum using cultural and traditional knowledge will further challenge the DE department and the college to establish protocols concerning the placement of Aboriginal content online and to work with the FNES department and Aboriginal communities to "ensure that traditional culture and heritage is appropriately acquired and used" (Battiste, 2005, p. 11).

Community Learning Partnerships Department

As the Community Learning Partnerships (CLP) department is the primary provider of academic upgrading instruction in community settings, the task of developing an indigenized mathematics curriculum will most likely fall under its area of expertise. The department is well placed for such a task given its connection with Aboriginal learners and communities as well as with the FNES department. However, while there are opportunities for professional development and release time, the development of an indigenized course will undoubtedly add to the workload of faculty and staff, especially given the limited DE support. In addition to working with community to develop a curriculum, the department will need to liaise with other departments within the college to ensure that the learning outcomes of an indigenized mathematics curriculum are consistent with courses articulated at both the college and provincial levels. It will be critical to the success of an indigenized mathematics curriculum that learners meet the intended learning outcomes required for transitioning to on-campus courses and programs.

A further challenge will be resolving issues regarding learner access to online content. Different communities have different levels of sophistication in terms of hardware and software, and some community sites utilize course management systems that are not currently

supported by the college's DE department. Faculty will need to work closely with the individual communities and the college's technical and DE departments to ensure that the use of software and course management systems meet the technical requirements, and limitations, of individual learning communities.

Further Research

While the research study was successful in identifying a number of themes relating to the learning of mathematics by Aboriginal adult learners, the findings also support the need for further research in a number of areas. Although the literature review provided a good deal of research concerning the impact of ethno-mathematics or indigenized curriculum on learners at the kindergarten to Grade 12 level, very little research was found on the impact of introducing culturally relevant mathematics curriculum to adult learners. The need for Aboriginal post-secondary education research in BC and Canada was one of the recommendations arising from a review of Aboriginal post-secondary programs in BC (Human Capital Strategies, 2005, p. 97) and it is hoped that further research stemming from the major research project can contribute to strategies that will increase participation and completion rates for Aboriginal adult learners. Specifically, there are four areas that are recommended for additional research:

1. The use of the terms *culture* and *cultural component* in both the interviews and learner surveys resulted in varied interpretations by the research participants as to the definitions of these terms. Reframing some of the research questions based on the findings of the major research project could produce further data in determining the need for the inclusion of a cultural component into mathematics curriculum.

2. Both the literature review and the findings of the research project support the importance of local communities being involved in the development of curriculum. However, implementing an indigenized curriculum in the Camosun College catchment area of southern Vancouver Island, which encompasses eleven First Nations bands, could be very challenging and time consuming given the cultural diversity of the communities involved. One of the questions arising from this challenge is how important to the learner, in terms of participation and completion rates, would a locally developed curriculum be in contrast to a pan-indigenized curriculum. Further research could focus on the degree of cultural specificity learners need in order to recognize themselves in, and feel connected to, the curriculum.
3. Another area of future research is to examine the kind of cultural knowledge that appeals to a broad range of adult Aboriginal learners. While the community will, to a large extent, determine the cultural content integrated into a curriculum, it may be in conflict to what the learners may value or appreciate. For instance, some learners might prefer traditional or historical perspectives while other learners may appreciate more of a contemporary or social justice perspective. It would be interesting to also examine if there is a correlation between learner expectations in terms of a culturally based curriculum and their cultural background, living situation (e.g., on-reserve or off-reserve), age, and education levels.
4. Although outside the scope of this study, an issue that was identified as a result of the research concerned assessment and intake processes for learners at the fundamental and intermediate mathematics levels, with a number of the interviewees commenting on the need for better assessments at all levels of a learner's educational journey.

Currently all learners are assessed for their level of academics prior to enrolling in academic upgrading courses. There are both formal and alternate forms of assessment, with the latter generally being used for learners who did not progress far in school or where there has been a long absence from formal schooling. After the initial assessment, learners are placed according to the results.

However, motivation and goal setting also plays a significant role in course retention and completion rates, and learner motivation for taking mathematics academic upgrading was another topic that emerged. Learners articulated reasons ranging from genuine interest and enjoyment of mathematics to having to take mathematics upgrading in order to meet the pre-requisites for entry into other courses or programs. Some learners also indicated they needed mathematics in order to obtain their Grade 12 graduation.

As a subject for future research, reviewing the current assessment and intake processes at the community learning centres could identify gaps in accurately assessing learners' motivation and goal setting as well as provide insights into how to better assist learners in establishing and achieving realistic educational goals. Identified gaps could lead to the development of more appropriate screening and assessment tools which can then assist faculty and staff better meet the needs of learners by building on a learner's extrinsic or intrinsic motivation (Driscoll, 2000) and perceived self-efficacy (Bandura, 1994). Furthermore, a better understanding of learners' motivation and goal setting could be used to develop relevant academic assessments, early intervention strategies, course content, and course evaluation tools.

Chapter Six – Lessons Learned

There were many valuable lessons learned in the process of completing the major research project in terms of the research topic, project management, and personal learning style. The journey of exploration and discovery has been inspiring and rather than the major project report being the termination of the research project, it will hopefully serve as the launching point for further research.

Critical to the research was choosing a topic that was both meaningful to the researcher and had direct application to his work and the learning communities he works in. The topic chosen certainly provided both and the findings of the research project already have had an impact on instructional practice and how programs and courses designed for Aboriginal learners will be designed and implemented, at least on a personal level if not at the departmental level. Although the findings did not suggest an immediate need to develop an online cultural component to complement the mathematics curriculum, the findings definitely supported exploring the concept further and reinforced that using online technology to deliver such a component appeals to some learners, educators, and community members. The findings also provided the researcher with critical factors to consider when implementing online cultural components based on traditional knowledge and teachings using elders and community members.

The major research project highlighted some of the issues and complexities of conducting research in Aboriginal communities. The varied responses and interpretations to the interview and survey questions regarding the terms *culture* and *cultural components* underlined the need to be very specific with key terms and definitions prior to data collection. Being respectful of interview participants' time and availability was another important factor in conducting the

research. There were a number of community members and educators who were consistently identified as being individuals who should be interviewed both for their knowledge and experience as well as for their standing in the community. Their availability did not necessarily fit with the initial timelines of the major project schedule; however, being flexible allowed the researcher to gain access to these individuals and having these individuals contribute to the research project added a great deal to the researcher's personal learning and to the findings. Their contributions will also carry strategic weight when sharing the major project findings with the community to determine the next course of action.

The researcher found unexpected lessons and learning opportunities during the process of researching and writing the major research project. Narrowing the literature review to the research questions was a major challenge as the inclination was to delve deeper into the literature, especially as a great deal of the literature exposed the researcher to concepts and perspectives that had not been considered or explored prior to initial research. The literature challenged the researcher to examine his values and beliefs and well as his philosophical base concerning research methodologies, especially research involving Aboriginal participants and communities.

The literature review and the subsequent personal reflection proved to be a very valuable phase of the research as it contributed to a more open and flexible approach to the interviews where on occasions the interview process departed quite radically from the semi-structured format. While at times during certain interviews the researcher had hoped that there would be more of a focus on distributed learning and the predetermined questions, these occasions also provided the researcher with invaluable insights and lessons with respect to working with Aboriginal learners that may not have emerged had the focus been solely on following the

interview script or on the technology end of the research question. In addition to flexibility, the interview process required creating a safe environment for the interviews, being respectful of the experiences and backgrounds of the interviewees, listening with an open mind, and monitoring the inclination to want to convince the interviewees that the research question had merit.

There were also a number of lessons learned in the data analysis and report writing phases of the major project. After the initial listening to and transcription of the interviews, the data was organized into specific themes using audio clips to support the themes. However, over a period of several months the transcriptions and full interviews were reviewed numerous times, and it was interesting to discover how the researcher's perceptions about the perspectives expressed through the interviews changed over time when viewed in the context of all the data. It was a lesson in the value of revisiting the data collected and providing adequate time to reflect on the meaning gleaned from the analysis, particularly when engaged in culturally based research. It became apparent that this need for reflection was also an important component of the researcher's personal learning style and provided him with opportunities to integrate many of the concepts expressed in the literature review with the themes generated through the research.

Another lesson that was reinforced during the writing phase of the research project was the importance of providing the opportunity to participants to review quotes attributed to them that were to be used in the final report. All participants were in agreement with the usage of the quotes and a number of participants expressed how much this was appreciated. Asking participants to review their quotes also provided the opportunity for further informal discussion about the research question.

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Appendices

Appendix A – Interview Guides

Interview Questions for Community Members

1. What kind of involvement do you currently have with adult learners?

2. What do you think are the biggest challenges facing aboriginal adult learners returning to school?

3. What kind of supports can help aboriginal adult learners feel more comfortable in an educational setting?

4. How important do you think it is for adult learners to connect the learning they do in school with their culture, traditions, and history?

5. Mathematics is a subject that many learners are reluctant to take due to previous negative experiences. What do you think could help make mathematics upgrading more attractive to adult learners?

6. Some elementary and secondary schools offer mathematics courses intended for aboriginal learners. These courses provide content, examples, and exercises based on First Nations and Aboriginal culture and experiences. Do you think offering this kind of course could also benefit adult learners upgrading their mathematics skills?

7. What kind of cultural knowledge and teachings do you think should be included in such a course?

8. One of the ways being considered for the delivery of a mathematics course with aboriginal content is through the internet as an online course. What do you think of this way of delivering such a course?

Interview Questions for Educators

1. What is your current role or involvement with learners?

2. What has been your experience of working with learners taking mathematics?

3. What do you see as the major barriers to learners being successful in mathematics?

4. In your experience, what do you think would help keep learners more engaged in learning mathematics?

5. Some schools have introduced indigenized mathematics curriculum at the elementary and secondary levels in order to increase participation and completions rates.

   (a) Do you think the introduction of indigenized curriculum has increased participation and completion rates for students at this level?

   (b) Do you think the indigenization of mathematics curriculum at the adult level could also benefit adult learners returning to school?

6. If yes, what kind of cultural knowledge, teachings, and content do you think should be included in an indigenized mathematics curriculum for adult learners?

7. One of the formats being considered for the delivery of an indigenized mathematics curriculum is an online cultural component that would complement the textbook and provide supplementary and more culturally relevant content, examples, and exercises. What do you think of this format for the delivery of such a component?

8. Who do you think should be involved in the development of an indigenized mathematics curriculum, and why should they be involved?

Interview Questions for Previous Adult Basic Education (ABE) Learners

1. What are you currently doing in terms of school or work?

2. When you look back to when you were upgrading your academic skills, what was it like for you?

3. What were your biggest challenges upon returning to school as an adult?

4. What kind of supports, if any, made a difference to your upgrading experience?

5. As an adult learner returning to school, how did you feel about upgrading your mathematics skills?

6. How important do you think it is for adult learners to connect the learning they do in school with their culture, traditions, and history?

7. Would it have made a difference if the Adult Basic Education mathematics course you took had Aboriginal content in the course? If yes, how would it have made a difference?

8. What kind of cultural knowledge and teachings do you think should be included in such a course?

9. One of the ways being considered for the delivery of a mathematics course with aboriginal content is through the internet as an online course. What do you think of this way of delivering such a course?

Appendix B – Survey Questions for Current Academic Upgrading Learners

1. How far did you progress in math when you were in school as a child or teen?

   ☐ less than Grade 8
   ☐ Grade 8-9
   ☐ Grade 9-10
   ☐ Grade 10-11
   ☐ more than Grade 11

2. Which of the following statements best describes your experience of learning math when you were in school?

   ☐ I hated it.
   ☐ It was hard.
   ☐ It was something I had to take.
   ☐ It was okay.
   ☐ I really liked it.

3. Which math course have you most recently been taking?

   ☐ Math 032 – Fundamental Mathematics 1
   ☐ Math 033 - Fundamental Mathematics 2
   ☐ Math 034 - Fundamental Mathematics 3
   ☐ Math 052 – Intermediate Mathematics 1
   ☐ Math 053 - Intermediate Mathematics 2
   ☐ Math 072 – Advanced Mathematics 1

4. How many times have you registered for this course (Fundamental Mathematics 032, 033, 034, 052, or 053)?

   ☐ one (1)
   ☐ two (2)
   ☐ three (3)
   ☐ more than three (3) times

5. If you have taken this course more than once, what contributed to you not completing the course the last time you took it? (you can choose more than one)

   ☐ difficulty with the text book or word problems
   ☐ the content was boring
   ☐ the class being self-paced
   ☐ conflict with work, or financial, personal, or family problems
   ☐ time management

6. On a scale of 1 to 4, where 1 is not important and 4 is very important, how would you rate the following factors in terms of helping you learn mathematics?

   A good teacher
   ___ (1) not important ___ (2) somewhat important ___ (3) important ___ (4) very important

   Support from parents or caregivers
   ___ (1) not important ___ (2) somewhat important ___ (3) important ___ (4) very important

   Working at your own pace
   ___ (1) not important ___ (2) somewhat important ___ (3) important ___ (4) very important

   Learning things that you can use in your everyday life (e.g., how to measure ingredients for a recipe, finding out how many square feet of flooring you need, etc.)
   ___ (1) not important ___ (2) somewhat ___ (3) important ___ (4) very important

   Seeing the connection between math and your culture, traditions, or history
   ___ (1) not important ___ (2) somewhat important ___ (3) important ___ (4) very important

7. How interested would you be if you could learn more about the connection between math and your culture, tradition, and history if it was offered as part of this course?
   ___ (1) not interested ___ (2) somewhat interested ___ (3) interested ___ (4) very interested

   How interested would you be in learning more about the connection between math and your culture, traditions, and history if it was offered online?
   ___ (1) not interested ___ (2) somewhat interested ___ (3) interested ___ (4) very interested

   How interested would you be in learning more about the connection between math and your culture, traditions, and history if it lengthened the time to complete this course?
   ___ (1) not interested ___ (2) somewhat interested ___ (3) interested ___ (4) very interested

8. As an adult learner, what have you learned about yourself since taking math upgrading courses?

9. What do you think would help you the most in completing a math course and staying interested in the course content?

Appendix C -Full and Informed Consent Forms

FREE AND INFORMED CONSENT FORM FOR INTERVIEWS

Project:	Connecting Mathematics and Cultural Relevancy for Adult Aboriginal Learners
Researcher:	Marc Bissley
Academic Institution:	Royal Roads University
Academic Program:	MA in Distributed Learning Program (MADL2003)
Major Project:	This research project is part of the requirement for a Master's Degree in Distributed Learning at Royal Roads University.
Project Supervisor:	Dr. Mary Kennedy, Ed.D., Royal Roads University, may be contacted to verify the authenticity of the research project and the researcher's credentials.
Project Sponsor:	Janice Simcoe, Camosun College, Chair, First Nations Education and Services.

This document constitutes an agreement to take part in a research program, the objective of which is to determine if supplementing existing mathematics curriculum with culturally relevant content is a need, and may enhance the learning experience for adult aboriginal learners.

The research will consist of an interview to answer eight open-ended questions in a discussion format that will take approximately 90 minutes to complete. The questions and discussion will be in reference to integrating aboriginal content into existing mathematics curriculum. Information from the interview will be recorded in hand-written format or, upon permission from the interviewee, audio recorded. Information from the interview(s) will then be summarized, in anonymous format, in the body of the final report.

At no time will any specific comments be attributed to any individual. All documentation will be kept strictly confidential. Recordings and transcripts will only be accessible by the researcher and will be destroyed at the conclusion of the project. Transcripts may, upon a request from participants, be returned to them. The results of this research will be available in approximately six months and an executive summary of the findings will be sent to each interviewee. Copies of the final report will also be available by contacting the researcher. Additionally, a copy of the final report will be housed at Royal Roads University and will be publicly accessible.

Prospective research participants are not compelled to take part in this research project. Similarly, if employees or other individuals elect not to take part in this research project, this information will also be maintained in confidence. If an individual does elect to take part, she or he is free to withdraw at any time from the research project with no prejudice, and all information collected to date will be destroyed.

By signing this letter, the individual gives free and informed consent to participating in this project and permission for the eventual disposal of recordings and transcripts.

Name: (Please Print): _____

Signed: _____

Date: _____

FREE AND INFORMED CONSENT FORM FOR INTERVIEWS FOR PREVIOUS ABE LEARNERS

Project:	Connecting Mathematics and Cultural Relevancy for Adult Aboriginal Learners
Researcher:	Marc Bissley
Academic Institution:	Royal Roads University
Academic Program:	MA in Distributed Learning Program (MADL2003)
Major Project:	This research project is part of the requirement for a Master's Degree in Distributed Learning at Royal Roads University.
Project Supervisor:	Dr. Mary Kennedy, Ed.D., Royal Roads University, may be contacted to verify the authenticity of the research project and the researcher's credentials.
Project Sponsor:	Janice Simcoe, Camosun College, Chair, First Nations Education and Services.

This document constitutes an agreement to take part in a research program, the objective of which is to determine if supplementing existing mathematics curriculum with culturally relevant content is a need, and may enhance the learning experience for adult aboriginal learners.

The research will consist of an interview to answer eight open-ended questions in a discussion format that will take approximately 90 minutes to complete. The questions and discussion will be in reference to integrating aboriginal content into existing mathematics curriculum. Information from the interview will be recorded in hand-written format or, upon permission from the interviewee, audio recorded. Information from the interview(s) will then be summarized, in anonymous format, in the body of the final report.

At no time will any specific comments be attributed to any individual. All documentation will be kept strictly confidential. Recordings and transcripts will only be accessible by the researcher and will be destroyed at the conclusion of the project. Transcripts may, upon a request from participants, be returned to them. The results of this research will be available in approximately six months and an executive summary of the findings will be sent to each interviewee. Copies of the final report will also be available by contacting the researcher. Additionally, a copy of the final report will be housed at Royal Roads University and will be publicly accessible.

Prospective research participants are not compelled to take part in this research project. Similarly, if employees or other individuals elect not to take part in this research project, this information will be maintained in confidence. If Camosun College learners elect not to take part in this research project, this information will also be maintained in confidence and will have no effect upon their grades or standing. If an individual does elect to take part, she or he is free to withdraw at any time from the research project with no prejudice, and all information collected to date will be destroyed.

By signing this letter, the individual gives free and informed consent to participating in this project and permission for the eventual disposal of recordings and transcripts.

Name: (Please Print): _____

Signed: _____

Date: _____

FREE AND INFORMED CONSENT FORM FOR THE SURVEY FOR CURRENT ABE LEARNERS

Project:	Connecting Mathematics and Cultural Relevancy for Adult Aboriginal Learners
Researcher:	Marc Bissley
Academic Institution:	Royal Roads University
Academic Program:	MA in Distributed Learning Program (MADL2003)
Major Project:	This research project is part of the requirement for a Master's Degree in Distributed Learning at Royal Roads University.
Project Supervisor:	Dr. Mary Kennedy, Ed.D., Royal Roads University, may be contacted to verify the authenticity of the research project and the researcher's credentials.
Project Sponsor:	Janice Simcoe, Camosun College, Chair, First Nations Education and Services.

This document constitutes an agreement to take part in a research program, the objective of which is to determine if supplementing existing mathematics curriculum with culturally relevant content is a need, and may enhance the learning experience for adult aboriginal learners.

The research will consist of a survey that will be administered either online or as a paper document. The survey will take approximately 15 minutes to complete and will contain 11 multiple choice and short answer questions. The questions will be in reference to the participants' experience with mathematics and what factors might contribute to being successful in mathematics courses. Survey results will be summarized, in anonymous format, in the body of the final report.

If the survey is administered as a paper document, the distribution and collection of the survey will be done to ensure anonymity and confidentiality. Likewise, the act of logging-in to the survey will be construed as giving free and informed consent and participants who participate in the survey will use a generic login to preserve anonymity and confidentiality.

As the survey participants are learners with Camosun College and the researcher is an instructor who may have direct academic responsibility, all questions, information documents, and consent forms have been approved by both the project supervisor and the Director, Educational Research & Development, responsible for ethical conduct at Camosun College, to ensure that there is no perceived conflict of interest or bias.

At no time will any specific comments be attributed to any individual. All documentation will be kept strictly confidential. Raw survey data will only be accessible by the researcher and will be destroyed at the conclusion of the project. In the event that the participants' survey responses are processed and stored in the United States (e.g., SurveyMonkey), you are advised that its governments, courts, or law enforcement and regulatory agencies may be able to obtain disclosure of the data through the laws of the United States.

The results of this research will be available in approximately six months. Copies of the final report and executive summaries will be available upon request to the researcher. Additionally, a copy of the final report will be housed at Royal Roads University and will be publicly accessible.

Prospective research participants are not compelled to take part in this research project. Similarly, if Camosun College learners elect not to take part in this research project, this information will also be maintained in confidence and will have no effect upon their grades or standing. If an individual does elect to take part, she or he is free to withdraw at any time from the research project with no prejudice, and all information collected to date will be destroyed.

By signing this letter, the individual gives free and informed consent to participating in this project and permission for the eventual disposal of the survey instrument.

Name: (Please Print): _____

Signed: _____

Date: _____

Appendix D – Contact Forms

TELEPHONE CONTACT FORM FOR THE INTERVIEWS

Project:	Connecting Mathematics and Cultural Relevancy for Adult Aboriginal Learners
Researcher:	Marc Bissley
Academic Institution:	Royal Roads University
Academic Program:	MA in Distributed Learning Program (MADL2003)
Major Project:	This research project is part of the requirement for a Master's Degree in Distributed Learning at Royal Roads University.
Project Supervisor:	Dr. Mary Kennedy, Ed.D., Royal Roads University, may be contacted to verify the authenticity of the research project and the researcher's credentials.
Project Sponsor:	Janice Simcoe, Camosun College, Chair, First Nations Education and Services.

This telephone call is to request your participation in a research project, the objective of which is to determine if supplementing existing mathematics curriculum with culturally relevant content is a need, and may enhance the learning experience for adult aboriginal learners.

The research will consist of an interview to answer eight open-ended questions in a discussion format that will take approximately 90 minutes to complete. The questions and discussion will be in reference to integrating aboriginal content into existing mathematics curriculum. Information from the interview will be recorded in hand-written format or, upon permission from the interviewee, audio recorded. Information from the interview(s) will then be summarized, in anonymous format, in the body of the final report.

At no time will any specific comments be attributed to any individual. All documentation will be kept strictly confidential. Recordings and transcripts will only be accessible by the researcher and will be destroyed at the conclusion of the project. Transcripts may, upon a request from participants, be returned to them. The results of this research will be available in approximately six months and an executive summary of the findings will be sent to each interviewee. Copies of the final report will also be available by contacting me. Additionally, a copy of the final report will be housed at Royal Roads University and will be publicly accessible.

Prospective research participants are not compelled to take part in this research project. Similarly, if employees or other individuals elect not to take part in this research project, this information will also be maintained in confidence. If an individual does elect to take part, she or he is free to withdraw at any time from the research project with no prejudice, and all information collected to date will be destroyed.

If you are interested and able to participate, I will send you a Free and Informed Consent Form requesting your signature that confirms the above information and your consent to participate in this research project.

EMAIL CONTACT FORM FOR THE INTERVIEWS

Project:	Connecting Mathematics and Cultural Relevancy for Adult Aboriginal Learners
Researcher:	Marc Bissley
Academic Institution:	Royal Roads University
Academic Program:	MA in Distributed Learning Program (MADL2003)
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