Métis Traditional Environmental Knowledge and Science Education

A Thesis Submitted to the College of

Graduate Studies and Research

In partial Fulfillment of the Requirements

For the Degree of Master of Education

In the Department of Educational Foundations

University of Saskatchewan

Saskatoon

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ABSTRACT

A chasm exists between science curriculum offered within K-12 and post-secondary education systems, and the needs of national and international decision-makers with respect to the inclusion of Indigenous knowledges within processes aimed at protecting global biological diversity. World governments seek to protect biodiversity through the United Nations Convention on Biological Diversity and consideration of Indigenous knowledges has emerged in governing texts. Yet, sustaining Indigenous knowledges as global wisdom will not be possible if young people lack opportunities to learn Indigenous traditional environmental knowledge as an integral part of their education experience. Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within holistic lifelong learning.

In advancing this contention, a series of interviews were conducted with Métis traditional land users from North West Saskatchewan. The interviews provided data in 17 thematic areas including: balance, economic, environment, harmony, health, Indigenous knowledge, political, social, spirituality, values, land, language, people, self, imagination, tradition, and learning. Results were used to respond to the four primary research questions: According to traditional land users in North West Saskatchewan, what is Métis traditional environmental knowledge? How does Métis traditional environmental knowledge in North West Saskatchewan align with established theories of Aboriginal epistemology and supporting principles? What evidence and arguments exist that support the development of Métis traditional environmental knowledge as a modality of science education? How can Métis traditional environmental knowledge be developed as a modality of science education?

Findings support development of holistic education processes that comprise a broad scope of knowledge integral to understanding our environment. Métis traditional environmental knowledge requires learners engage in activities outside the classroom, participating in experiences that facilitate an understanding of holistic thinking in intellectual, physical, affective and spiritual domains. Traditional environmental knowledge and practices of Métis People can inspire learners in science education, improving their engagement, understanding and decision-making abilities concerning the natural environment.

ACKNOWLEDGEMENTS

I would like to thank Dr. Alexandria Wilson, my Thesis Advisor, for the support and wisdom offered during this journey. Your encouragement and expertise made this thesis possible. To Dr. Glen Aikenhead and Dr. Marie Lovrod, thank you so much making me think harder about important issues and for investing your time to help me realize this work. To Professors Bob Regnier and Marie Battiste, thank you for taking time to teach me what being a graduate student is all about, for the moments of levity when I needed it, and for being my friend at difficult times.

To the Métis People in North West Saskatchewan, thank you for sharing your knowledge and wisdom from the kindness of your hearts. I share your vision for Métis youth and Métis communities.

Thank you to Elders Vicki Wilson, Danny Musqua and Richard Dubois for giving me courage and knowledge that has carried me along through this river of life.

Finally, I would like to acknowledge special people who have gone on to the spirit world, but remain in my heart. Michael Vizina. Don Favel. Louis Chartier.

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The fullness of personal and collective human experience extends through multi-dimensional aspects of life nurturing, drawing from cognitive and intellectual development, emotional maturation, spiritual recognition and acknowledgement, and the manifestation of personal knowledge through action. Physically, human beings are nearly exactly the same from person to person with only small variations in genes which give rise to individual uniqueness and group similarities. Studies have illustrated the small amount of genetic differentiation among human populations (Rosenberg, et al., 2002). However, when it comes to the construction of knowledge – what we know, and how we know it, there are much deeper social variations. The knowledge systems possessed by groups help them survive and make sense of the world and their experiences.

In Canada, traditional Aboriginal knowledge systems are based on the belief that learning is holistic and encompasses all things known and unknown and all the complex relationships between them. An Elder has told me that as spiritual beings, we are born into and live an inherently spiritual life in a physical world, die and return to a non-physical state of existence. How we come to build knowledge is a complex combination of thought, feelings, beliefs and experiences in which no single element or aspect can be dismissed as irrelevant in our learning processes. Aboriginal holistic knowledge systems can assist in building a life that facilitates learning from relationships within a multi-dimensional world. These cornerstone philosophies include, and extend beyond, schools and books. Reconciling deeply spiritual and ceremonial worlds of Aboriginal beliefs and practices with contemporary urban life in Saskatchewan provides opportunities to learn from a variety of ideologies influencing each domain, bringing new understandings to personal and professional knowledge within a holistic paradigm.

My formal training as an educator specializing in the disciplines of Biology and Native Studies provided me with a unique perspective of the world, as did the time spent learning from Elders who remain my anchor to a spiritual and compassionate life. The more time I spent immersed in these different communities, the more I became aware of the disconnect between what was being taught in schools, what Elders were teaching, and what was being discussed in international forums on the environment. Most grievously, I became aware that traditional environmental knowledge from cultures and places around the world that had been carried

forward intergenerationally for thousands of years grows more frail with every passing generation.

Concerned citizens of nearly every nation have convened thousands of formal and informal gatherings at local, regional, national and international levels to share information, discuss issues, identify areas of concern, and develop action plans that will contribute to biological survival. The United Nation's Convention on Biological Diversity (CBD) facilitates hundreds of such gatherings and is a world leader in this regard. Indigenous representatives participating in CBD gatherings are not afforded the same status as nation-states, but individuals attend to advocate for consideration of traditional Indigenous perspectives around the world. The CBD currently represents 191 nation-states (Secretariat of the Convention on Biological Diversity, 2009a), but it is often the voices of Indigenous individuals and non-governmental organizations who, unfettered by political bonds, are freest to speak of the negative impact global development is having on the environment and on humanity, including the poorest people of the world, who are generally Indigenous Peoples. As a result of on-going pressure, Indigenous Peoples' concerns have resulted in Indigenous and local communities being included in the internationally adopted text of the Convention on Biological Diversity, associated Programmes of Work and supplementary documents such as the Akwe:kon Guidelines (Secretariat of the Convention on Biological Diversity, 2004a). The question remains as to whether continued negotiation and actualization of these processes can make enough difference to save life on Earth.

The United Nations respects the autonomy of nation-states to develop their own specific national processes to facilitate inclusion of Indigenous Peoples in addressing the preservation of biological diversity. In Canada, defined Aboriginal rights are a factor in the degree to which Aboriginal Peoples are included in national activities. Inclusion of First Nations, Métis or Inuit representatives in consultative processes is often dependent upon legally secured rights. Canada claims autonomy in representing everyone who lives within its borders. In United Nations processes, Canada's endorsement of international treaties cannot supersede rights recognized in national law, provincial jurisdiction on natural resources, First Nations' treaties, or any other legally secured precedent. Without nationally defined rights protected by law, Métis do not have a means of ensuring inclusion in Canada's CBD activities.

Even with invitational relationships with Canada, Métis organizations lack sufficient capacity to bring the voice of traditional land users into CBD discussions. Capacity-building requires securing adequate expertise, organizational development and systemic processes along with adequate financing which contributes to organizational and procedural stability. Organizations lacking critical foundational factors such as research and legal status are not awarded credibility in substantive national and international discussions upon which policy and legislation are built by nation-states. The lack of these capacities should not eliminate Métis perspectives from contributing to viable solutions concerning understanding the natural environment we live in. Despite similar challenges with capacity in education, Métis have demonstrated national leadership in post-secondary educational programming with such institutions as the Gabriel Dumont Institute in Saskatchewan.

Provincial and territorial governments are responsible for the jurisdiction of primary and secondary education. First Nations' Peoples primary and secondary education is under federal jurisdiction. Métis People have no primary or secondary schools under the jurisdiction of the Métis Nation or the Government of Canada. Métis children must attend public, Catholic, French-Immersion, or other such schools. Occasionally, Métis children are home-schooled. Métis-governed post-secondary institutions offer programming that includes Métis culture and history in some programming; however, the main purpose of the programming is to dovetail with provincial professional education standards. That is a different goal than having an education process capable of facilitating an integral knowledge of Métis history, culture and language inclusive of Métis traditional environmental knowledge. Consequently, the subject of Métis traditional environmental knowledge is an area that has had little academic exploration to date.

Currently, a huge chasm exists between science content offered by formal K-12 and post-secondary education systems, and the needs of national and international decision-makers with respect to the inclusion or consideration of Indigenous knowledges within processes aimed at protecting global biological diversity. Internationally, world governments are looking for solutions to protect biodiversity. Advances have been made in having consideration of Indigenous knowledge written into governing texts, but it is an incomplete process if young people have no opportunities to learn Indigenous traditional environmental knowledge as an integral part of their daily education experience or in advanced education. Learners are still

being assimilated or acculturated through legislated attendance in Western Eurocentric modeled schools that do not include Indigenous traditional environmental knowledges.

In order to address these very large challenges, the Métis community is faced with multiple tasks. There is a need to explore and define the concept of Métis traditional environmental knowledge that will require asking Métis Elders, traditional land users and community members to assist in research processes. There is a need for the Métis community to develop processes that will protect existing knowledges, perpetuate knowledges and ensure their consideration in national and international policy-making. New processes might occur through educational practices able to thrive during evolving legal parameters of Aboriginal rights.

Human population numbers make living sustainable lifestyles nearly impossible in today's world. The more we educate ourselves, the 'higher' our standard of living becomes and the more we consume. In Canada, there are almost no opportunities to live as a traditional land user. Designation of Crown Land means Aboriginal Peoples are not able to live traditional lifestyles within traditional territories. It seems a strange paradox that at the international level, at least 191 nations of the world are desperately seeking solutions to save the environment in order to sustain human life. The perspectives of Indigenous Peoples of the world may cause some governing authorities discomfort, but their perspectives are still valued in these fora. Yet, national and provincial legislation creates barriers which prevent Canadian Aboriginal individuals and communities from maintaining traditional connections to the land and most Canadian schools are bereft of any substantive teaching of traditional environmental knowledge. There are virtually no formal life-long learning processes for perpetuation of the knowledge systems of traditional land use.

Canadians need to reconnect young people with the natural world. Educational processes are needed to facilitate development of Indigenous scholars with first-hand knowledge of the land. Canada can continue to grow as a model nation in preserving biological diversity by having school systems forge meaningful and mutually beneficial relationships with Aboriginal Peoples. Education systems and Aboriginal communities can work together to support individuals who understand Aboriginal traditions and have the scholarly skills to facilitate the integration of Aboriginal epistemologies into our collective way of life. Together, these steps can contribute to looking after this planet and all the beings that dwell on it.

1. RETHINKING SCIENCE EDUCATION

Introduction and Central Hypothesis of the Study

Métis People have played a significant role in the historical development of Canada and have a continued role in future development. Métis knowledge of the land and traditional ways of life balanced conservation with economic sustainability. Indigenous Peoples' cultures and languages throughout the world have historically reflected harmonious interaction with the natural world. Indigenous traditional environmental knowledge systems based on ethics of reciprocity, respectful relationships, and interconnectedness with the natural world developed over successive generations of local communities. In contemporary times, Indigenous traditional environmental knowledge systems are dismissed by most mainstream sciences in their focus on globalization and large-scale industrial development, even though many of these processes are known to be unsustainable, for instance, through depleting the world's natural resources. Ecological crises facing humanity, such as global warming, pollution, accelerated extinction of life forms, and degraded ecosystems, are forcing nation-states to consider implications for our collective survival. Ironically, while Canadian society lives in the midst of ecological turmoil, research indicates increasing numbers of students disengaging from science education as they move from elementary to secondary education and beyond (Canadian Council on Learning, 2007b). The trend away from science education is even more apparent with Aboriginal students (Canadian Council on Learning, 2007b; Aikenhead G. , 2006). In the search for solutions to the degradation of ecosystems and to the trend away from science education, traditional environmental knowledge and practices of Aboriginal Peoples in Canada can play a significant role in connecting Métis and other learners to science education, and subsequently, to improving their understanding and decision-making abilities concerning the future of our natural environment. Métis traditional environmental knowledge requires learners to engage in hands-on activities outside the classroom, providing personalized experiences that can facilitate an individual's understanding of holistic thinking in intellectual, physical, affective and spiritual domains. **Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within holistic lifelong learning.**

1.1.1 The Métis

The Métis are Aboriginal People in Canada with mixed First Nation and European ancestry. The Constitution Act, 1982 recognizes Indian, Inuit and Métis as the Aboriginal Peoples of Canada (Government of Canada, n.d.). For the purpose of this research, references to Métis are limited to participants represented by the Métis National Council (MNC) in Saskatchewan. The MNC is a body mandated by its Governing Members in British Columbia, Alberta, Saskatchewan, Manitoba and Ontario, representing the Métis Nation in federal litigation processes on Métis rights and representing the Métis Nation internationally within the United Nations and the Organization of American States (Metis National Council, 2004).

1.1.2 Indigenous Traditional Environmental Knowledge

The term *Indigenous traditional environmental knowledge* is used to represent Earth-based wisdom-oriented philosophies and practices of Indigenous cultures. Indigenous traditional environmental knowledge has many definitions, implicit and explicit, depending on its application, but at the most general level refers to a "way of knowing" (Aikenhead G. , 2006) the environment and relationships to the environment by Indigenous Peoples worldwide. Ancestral knowledge is an integral part of traditional environmental knowledge as an influence on subsequent generations in understanding and interacting with the natural world. Gregory Cajete (1994) describes traditional education as occurring through a theology of nature (p. 86). He explains,

> For Indigenous people around the world, education in Nature is life. For Native people throughout the Americas, the paradigm of thinking, acting, and working evolved through their established relationships to Nature. The foundation, expression, and context of Indigenous education were environmental… The environment was not something separate from their lives, but was the context, the set of relationships, that connected everything. An understanding of ecology was not something apart from themselves or outside their intellectual reality, but the center and generator of self-understanding. As a center, that environmental process of education became the guiding mechanism for the ways they expressed themselves and their sense of sacredness. (pp. 87-88)

The current theoretical literature available on Indigenous traditional environmental knowledge systems stems from a few scholars worldwide. Included in this list are Gregory Cajete and Glen Aikenhead. Other scholars have written more specifically about self-determination in Aboriginal education but describe Earth-based philosophies as the foundation of

Aboriginal education (Battiste & Henderson, 2000; Smith, 1999; Hampton, 1995; Deloria Jr. & Wildcat, 2001). Scholars have illustrated differences between Indigenous forms of education and Western Eurocentric ideology governing education. Few published scholarly resources specifically describe environmental philosophies of specific Aboriginal nations in Canada.

As a graduate student who has been studying the concept of Indigenous knowledge over the course of two degree programs, it is easy to forget that traditional land users and Elders seldom, if ever, talk about knowledge using this term. Rather, it is a useful academic reference used to generalize about a vast body of cultural knowledges held by particular peoples across the world. The term Indigenous knowledge has seeped out of academia into use by some members of Aboriginal communities, but generally should be regarded as a shorthand linguistic label.

Throughout this study, the phrases 'Indigenous traditional environmental knowledge', 'Aboriginal traditional environmental knowledge' and 'Métis traditional environmental knowledge' will appear. The phrase used will depend on the source of the information or the context in which the phrase is used. I will use the term 'Indigenous traditional environmental knowledge' when referring to knowledge contexts that are non-specific to a particular Indigenous nation of people internationally. I will use the term 'Aboriginal traditional environmental knowledge' when referring to knowledge contexts within Canada but non-specific to First Nations, Métis or Inuit Peoples. I will use the term 'Métis traditional environmental knowledge' when referring specifically to Métis contexts.

1.1.3 Métis Traditional Environmental Knowledge

When specifically applied to Métis People, traditional environmental knowledge becomes contextualized to the history, culture and languages of Métis People, extending the scope beyond a hub of ecological knowledge to a holistic paradigm. Métis traditional environmental knowledge is built from community practices which form the foundation for understanding the natural world, building skills and behaviour adaptable and applicable to other facets of Métis life, maximizing use and benefit of natural resources within community accepted ethical boundaries, and contributing to personal and community spiritual, physical, intellectual and emotional health and development. While the phrase 'traditional environmental knowledge' does not mention contemporary life, the purpose of understanding Métis traditional environmental knowledge is intended for adaptation and use in everyday life.

In the case of Métis traditional environmental knowledge, I identified three scholarly resources. Carole Leclair, a Métis, completed a dissertation on Métis environmental knowledge. The dissertation was largely about issues of identity, reserving only about one-twentieth of the document for specific ecological information (Leclair, 2003). A dissertation written in 1992 by Bernard Johnston contains research about plant use among Métis in Alberta (Johnston, 1992). A thesis produced by Lawrence Stanley outlines a conceptual framework for development of a sustainability strategy for Métis of northern Saskatchewan (Stanley, 2000). The paucity of literature about Métis traditional environmental knowledge indicates additional research needs to be completed to contribute to the scholarly base of information.

1.1.4 Modalities of Science Education

The term 'modality' refers to the content and context of science education delivery. Content concerns the information, opportunities for experience and structure of the information or experience that is conveyed to learners. Context concerns the manner in which the ontology, epistemology, axiology, methodology and methods are delivered. While mainstream science is primarily taught within the confines of schools, learning foundations of science from a Métis cultural perspective requires interactive hands-on experiences with the natural world and qualitative engagement with forms of ancestral knowledge that result in subjective learning experiences. One primary difference between mainstream science and Aboriginal traditional environmental knowledge systems is the function of objectivity. Mainstream science requires the investigator consider him, or herself, an 'objective' part of the discovery. Aboriginal traditional environmental knowledge systems require full personal acknowledgement, commitment, and involvement of the investigator to make meaning from a given experience. Making meaning ranges from understanding personal impact resulting from the discovery to understanding implications of the event or discovery on other living and non-living things.

Mainstream science does not support affective and spiritual domains of knowledge. Researchers strive to eliminate affective and spiritual domains from influencing their work and understanding of the discovery. Since the seventeenth century "The Christian religion taught that the human spirit was of supernatural origin, its mental and moral faculties beyond the reach of natural law and, hence, outside the realm of science" (Bowler & Morus, 2005, p. 299). The discipline of science has not changed its position with respect to this premise over the past few

centuries. But, as human society evolves to include respect for Indigenous knowledge systems, such as the recent United Nations Declaration on the Rights of Indigenous Peoples adopted by the UN General Assembly in 2007 (United Nations, 2006), there are new opportunities to reconsider the labels attached to disciplines studying the natural world and how we can include the study of human relationships with the natural world.

A Métis modality of science education would extend beyond basic science, biology, chemistry, physics or geology (cognitive and physical) and extend into affective (emotional) and belief-based explorations (spiritual) such as ethics or cultural worldviews. Including affective and spiritual experiential opportunities is essential to achieving a holistic understanding of life from a Métis perspective. A lifelong effort is required to build and balance an understanding of cognitive, physical, affective and spiritual aspects of Métis traditional environmental knowledge.

1.1.5 Engaging Learners in Understanding Relationships with the Natural World

A foundational feature among Aboriginal Peoples' worldviews is an underlying belief in the interconnectedness of all things, seen and unseen, in existence. This belief requires that one acknowledges a "spiritual ecology" (Cajete, 2000, p. 178) within which each person builds relationships with all other things including water, Earth, air, fire, plants, animals and the spirit world.

> Native people perceived multiple realities, of which the reality experienced by our five senses was only one of many possibilities. In such a perceived multiverse, knowledge could be received directly from living and non-living entities. (Cajete, 2000, p. 178)

Building relationships and understanding relationships occurs in varying degrees of complexity over a lifetime. Allowing learners to explore these relationships in a natural environment will lead Aboriginal and non-Aboriginal learners to become engaged in activities that will provide opportunities to develop personally meaningful understandings of the natural world. An engaged learner will actively participate in experiential activities. Active participation will allow the learner to form conclusions based on personal understanding rather than only being a passive learner reading, viewing or listening to out-of-context information and regurgitating it back to the teacher to get a passing grade. Making meaning from personal experience enhances holistic learner experiences. Learners who have an opportunity to

experience activities within traditional Aboriginal activities can gain insight into the interconnectedness of all living things.

1.1.6 Importance of Developing Sustainable Lifestyles

Traditionally, Aboriginal cultures were grounded in sustainable lifestyles (Cajete, 1994, p. 86; Little Bear, 2000, p. 81; Rice, 2005, p. 25; Michell H. , 2005, p. 36). These authors describe traditional views of the interconnectedness of all things and the importance of good relationships with corporeal and non-corporeal entities. Mohawk author Brian Rice (2005) explains how Anishnawbe understand the world,

> *Kitchi Manitou* is the energy from whom all things evolve and with whom all things exist in balance. This energy keeps order in the universe. Aboriginal peoples refer to the order and harmony existing at the time of creation as the original instructions. To maintain a balanced world each aspect of creation is given instructions to follow – the sun rises in the east and sets in the west; birds migrate and constellations appear and disappear at certain times of the year; and the moon follows a monthly cycle. When one of these cycles falters the rest of creation is affected. Each segment of the universe depends on another so each element of the cosmos must play its role to avoid cataclysmic consequences. (p. 25)

Ceremonies conducted by Aboriginal Peoples honour the original instructions given by the Creator to all things in Creation. According to oral tradition of Aboriginal Peoples, human survival depends on the continuation of ceremonies. Survival also depends on extensive environmental knowledge and careful harvesting to ensure natural resources will always be available in the future. For example, when Aboriginal Peoples harvest plants for medicinal or ceremonial use, it is essential to identify areas where a particular plant grows through direct knowledge or through extrapolation and application of knowledge of the kind of habitat supporting a particular type of plant. Medicines and ceremonies require specific plants. Part of maintaining tradition is the continued use of the same items. Aboriginal Elders have shared traditional teachings with me of not harvesting too many plants from one area, leaving a good portion of the plants intact so that they re-seed for the following year, and the importance of knowing and carrying out the spiritual ceremonies that go along with harvesting before any plant or other item is taken from the natural world.

Today, few Aboriginal people have extensive environmental knowledge or the ability to apply that knowledge for broad public use in policy and practice concerning sustainable resource

use. Traditional Aboriginal environmental knowledge systems have weakened in contemporary times with the loss of access to land for traditional activities that would provide the educational context for transmitting cultural knowledge and value systems about life. Most schools include little or no Aboriginal content in science education, although recent developments in Saskatchewan Education curriculum are helping to change this absence. This is discussed further in Chapter Five. Recently, Elders in North West Saskatchewan told me that they do not believe there are any young Aboriginal people today who know the natural world well enough to survive on the land in a traditional manner. In North West Saskatchewan, natural resources including forests, diverse plants, water, minerals and fossil fuels are valuable commodities in today's global economy. Pressure from internal and external community sources to facilitate natural resource development in the interest of wealth generation and employment create situations where Aboriginal people holding traditional views feel helpless to resist the development or to assert their own cultural values and principles as cornerstones to future development.

For over 20 years, scientists have been warning of imminent global ecological disasters resulting from unsustainable human activities. In 1987, the Report of the World Commission on Environment and Development, also known as the Bruntland Commission, described the urgency of addressing deteriorating human environments and natural resources and the implications for social and economic development. In the report, the concept of sustainable development is identified as "… meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, p. 1). In 2007, the United Nations released "Global Environmental Outlook 4" another comprehensive report outlining the state of the environment around the world, a framework for necessary change and the consequences of inaction (United Nations Environment Programme, 2007). Yet, mainstream science education remains unchanged. We are left to wonder what the next United Nations report will say 20 years from now if we do not find it within ourselves to explore new ways of knowing within science education.

Sustainable development can only occur as an outcome of human lifestyle choices. These two concepts are indistinguishable from each other; separating them implies that we are not responsible for sustainable or unsustainable development impacts on the environment or

human societies. The Council of Ministers of Education, Canada (CMEC) describes sustainable development as

> …a very inclusive term, encompassing environmental, economic, and social themes such as poverty alleviation, peace, democracy, justice, human rights, gender equity, social equity, cultural diversity, rural and urban development, environmental protection, and natural resource management. (Council of Ministers of Education, Canada, 2007a, p. 4)

The way we live our lives, the choices made each day and the relationships we build, or do not build, contributes to how we address sustainability. CMEC goes on to say,

> In order to ensure that sustainable development becomes integral to societal values, education for sustainable development must be offered through lifelong learning opportunities, especially at all levels of the education system. (Council of Ministers of Education, Canada, 2007a, p. 18)

In order for learners to cultivate a sense of personal and collective responsibility toward sustainable development, there must be an opportunity to learn how to do this from an early age. Excluding values of society within science education that will lead to understanding sustainable development, infers to learners, and educators, that values do not matter within the context of industrial or other forms of development occurring within the discipline of science, as it currently exists. Building science education that is inclusive of diverse societal value systems conversely provides an opportunity to refresh value systems to include thinking about sustainable development.

Métis traditional environmental knowledge can provide a model for science education that supports sustainable development. This assertion is relevant to this study in the argument that Métis traditional environmental knowledge is important to all learners, not just Métis learners, and there is a valid and evidence-based need to rethink how science education is delivered to all students in Canada. Science education can be redesigned to include helping learners think about why we do not have sustainable lifestyles and what might be learned from traditional Métis philosophies and processes to overcome this loss of foresight.

1.1.7 A Holistic Lifelong Learning Model for Métis

In the research construction and analysis, I apply the Métis Holistic Lifelong Learning Model (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and

Higher Education Consortium, 2007) referenced in Appendix II of this thesis. The Model has been endorsed by the Métis National Council and contains the major components Métis people believe represent a holistic education supporting Métis culture. The content of the Métis Lifelong Learning Model was created in 2007 by Métis individuals in consultations hosted by the Aboriginal Learning Knowledge Centre, a research initiative funded by the Canadian Council on Learning. Before 2007, no physical model existed showing the various components important to Métis education.

Conceptualized as the *Sacred Act of Living a Good Life*, the Model illustrates a living tree that contains four branches of knowledge: self, people, land, and languages and traditions. Self is complimented by sub-branches representing Imagination; People is complimented by sub-branches representing Family; Land is complimented by sub-branches representing Traditional Practices; and Languages and Traditions are complimented by sub-branches representing knowledge of Michif and other traditional languages. The trunk of the tree is the domain of sources of knowledge and knowing. Rings of the tree represent holistic stages of learning, including mental, physical, spiritual and emotional aspects of life and holds Métis identity at the core. Just as a living tree grows and adds to its core, the rings of learning extend outward to include Learning From Family, Community & Social Relations, Early Childhood Learning, Elementary Education, Secondary & Post-Secondary Education and Adult Learning. The rings are shaded to indicate degrees of formal and informal learning. Roots of the tree are grounded in Indigenous Knowledge & Values and spread out to include Balance and Harmony, Health Care, Spirituality, Political Environment, Economic Environment, Social Environment and Physical Environment. The image of the living tree and cycles of growth comprising the model leave no doubt regarding the underlying importance of the natural world within a Métis worldview of learning.

The Model is also supported by draft literature depicting 23 domains of knowledge, 37 indicators of learning, six stages of learning and associated formal and informal indicators of learning. Designers of the Model consider it a *living draft* that will evolve over time, as more information becomes available (Canadian Council on Learning, 2007). The Model is appropriate for this research as it provides a frame of reference concerning Métis education that can be considered in the data analysis. Since the Model described is holistic, it provides an opportunity to test how it is applicable to learning Métis traditional environmental knowledge. All

components of the Model are believed to exert an influence in successful lifelong learning of Métis individuals. As a consequence of interviewing Métis traditional land users and analyzing the results in relation to the Model there should be an opportunity to identify how Métis traditional environmental knowledge could become a modality of science education that would inspire learners and augment their success in science education.

The Study

This thesis proposal consists of four components: a literature review; a formulation of a theoretical and methodological framework; and a discussion of methods, data analysis, and interpretation of results.

Purpose of Study

The purpose of this study is to argue the thesis that **Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within holistic lifelong learning**. The thesis will:

1.3.1 begin development of a body of research on Métis traditional environmental knowledge;

1.3.2 examine the current narrow scope of contemporary science education, the ideological premise of contemporary science education and the principal reasons for Métis traditional environmental knowledge not currently being a modality of science education; and

1.3.3 support the preservation of biological diversity and the perpetuation of Métis traditions.

Context

With the passage of time, fewer and fewer Métis People have access to traditional environmental knowledge as they become disconnected from the land and assimilated into mainstream society. Inclusion of Métis traditional environmental knowledge content within formal school curriculum may be minimal or non-existent because there are few published resources available on the subject. Métis children are disconnected from traditional lifestyles lived in close association with the land, and opportunities to gain, retain or expand Métis traditional environmental

knowledge within a formal school setting are few or nonexistent. Métis children now grow up disconnected from the natural world, trying to respond to a society that demands they 'get an education', and 'get a job' which most would interpret as a directive to becoming urbanized and rejecting their ancestral traditional practices since there are few, if any, alternatives.

In Canada, there are no public opportunities to receive education, training, and employment based on traditional knowledge systems and lifestyles. Yet, there is increasing demand for representation of Métis cultural perspectives in sectors such as education (Council of Ministers of Education, Canada, 2007a, pp. 47, 53; Council of Ministers of Education, Canada, 2007b, pp. 35-41) economic development, environment, law and health. It is my intention to address this disconnection. In May 2008 and March 2009, the Government of Saskatchewan and the Government of Canada hosted two-day events in Saskatoon, Saskatchewan to explore with Aboriginal Peoples the Supreme Court ruling on the 'duty to consult' and what this means in Canada. Even the decision-makers do not have foundational information needed for change.

Beginning to build a body of knowledge on Métis traditional environmental knowledge will benefit Métis communities on a number of levels. Local communities can examine research findings to compare and assess their own situations with respect to contemporary science education that may inspire additional research for specific geographic areas. Regional, provincial and national Métis authorities may utilize the research findings in the development of self-governing or intergovernmental sectoral strategic planning in such areas as environment, economic development, health and education. Public government and educational institutions may use the research to assist in the development of Métis specific content or policy development.

Analysis of Questions

The research questions are designed provide a progression matrix for analysis. In question one, interview responses are summarized and provide foundational information about Métis traditional environmental knowledge. In questions two, results from question one are analyzed in relation to theory. In question three, results from questions one and two are used to provide evidence-supporting development of Métis traditional environmental knowledge as a modality of science education. In question four, results of question one, two and three are used to provide an

orientation of how Métis traditional environmental knowledge might be developed as a modality of science education.

The interview questions were developed and used in another research study entitled Learning Indigenous Science from Place (Michell, Vizina, Augustus, & Sawyer, 2008). In that study, the questions were used to interview First Nations and Métis community members and were adapted for use in this thesis. Adaptations included making the questions more personal to allow the interviewee an opportunity to respond in the form of narrative of personal experiences and knowledge. Questions are structured to explore what it means to be a traditional land user living in North West Saskatchewan; perspectives of youth and the environment; Indigenous languages; community engagement in teaching; local practices of Métis traditional environmental knowledge; and local Métis protocols. These questions provide a context for responding to the central hypothesis of this research.

Chapter Structures

Chapter One introduces the thesis and organization of the study. It begins by advancing and fully explaining the primary contention that **Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within a framework of holistic lifelong learning**. The chapter then proceeds to identify and explain what constitutes the components of the study, reviews the purpose of the study and constructs context for it, analyzes questions for the interviews, and provides a review of how each chapter builds the thesis.

Chapter Two reviews three areas of literature to develop an understanding of why Métis traditional environmental knowledge is not currently a modality of contemporary science education, how diminishing use of Aboriginal languages parallels diminishing traditional understanding of the environment and how global movements are supporting Indigenous knowledge in the preservation of biological diversity. The first section reviews various global theories of the impact of colonization and decolonization of education in relation to Indigenous Peoples. This section also examines Métis self-determination and views of education. The second section in this chapter reviews literature on Aboriginal languages in Canada and linguistic diversity in education to define how language shapes, and is shaped by, particular

worldviews. This will include a review of the emerging field of ecosemiotics in informing perspectives of the interaction of language, culture and the environment. Finally, literature about the Michif language will provide evidence for understanding the evolution of Métis culture and worldview. The third section of this chapter will examine national and international supports for education for biological diversity and how these supports are relevant to the development of Métis traditional environmental knowledge as a modality of science education.

Chapter Three will provide the theoretical framework, methodology and methods used for the study. I will discuss Aboriginal ontology, epistemology (what we know and how we know it) and axiology (value systems) as comprising the theory of knowledge appropriate to this study and to establishing Métis traditional environmental knowledge as a modality of science education.

Chapter Four will provide the analytical framework and analysis of data in relation to the research questions. Essentially this chapter will describe the themes and coding framework, process and results.

Chapter Five will interpret the research findings for the study. The interpretation includes a discussion of the findings and conclusions. This chapter provides additional insight into the relationships between the research data and literature, lessons learned, implications for policy and practice and opportunities for future research.

The Appendices will include Appendix I: Bibliography; Appendix II: Métis Holistic Lifelong Learning Model; and Appendix III: University of Saskatchewan ethics documents used in the study.

2. LITERATURE REVIEW

2.1 Overview of Literature Review

In this research, I use a three-part review of literature to justify the need for developing Métis traditional environmental knowledge as a modality of science education. In the first area on decolonization of education, I argue that, in order to understand what science education from an Indigenous perspective can evolve to, attention must be paid to understanding what education is not. Through literature concerning decolonization of Aboriginal education (Smith, 1999; Battiste & Henderson, 2000; Battiste M. , 2000) including science education (Cajete, 1994; Cajete, 1999; Cajete, 2000; Aikenhead & Ogawa, 2007) I will examine international theories of colonization, racialization in Saskatchewan and Canada, linguistic and cognitive imperialism, motivation for revolutionizing education systems, and paradigms of Indigenous education. The collective work of these authors, combined with a review of Métis self-determination, will help establish a frame of reference to argue for Métis traditional environmental knowledge as a valid modality of science education.

Formal education in Saskatchewan has been designed by the Government of Saskatchewan to meet the needs of all learners regardless of their cultural background. "Saskatchewan's Education Sector plays a significant role in the province's present and future by establishing a foundation for lifelong learning and developing citizens who are highly literate with excellent workplace skills." (Ministry of Education, 2007, p. para 1) When the ideology driving contemporary education places labour force needs as one of its primary motivating forces, curriculum is designed accordingly. Demands from the trades and technology industrial labour market feed that ideology. Culture brings a broader set of perspectives into the education picture. Indigenous cultures, such as Métis culture, place a greater importance on good relations among people, concern for the environment, spiritual beliefs and self-development. If science education is designed to serve only the needs of industrial and technological developers at the expense of everything else, it will fail to include the impact of moral and legal ethics of its own outcomes upon human beings and the Earth systems that sustain all of us. The Métis Lifelong Learning Model described in Section 1.1.7 is based on the worldview of a mixed-heritage people who honour and respect both their European and Aboriginal ancestry. It is this fact that makes

the model ideal as a new premise for science education. The model can be a frame of reference illustrating how Métis have accepted and integrated unique ideologies of different cultures.

In the second part of this section, through a selected review of literature on linguistic diversity and ecosemiotics, I illustrate that preserving linguistic diversity is as critical to sustaining life on Earth as is biological diversity. For example, monocultures in biological systems can produce extremely lucrative crops with many benefits to commercial food production or use in industry. The same feature that makes them lucrative also makes them vulnerable to disease. There is little to mitigate the damage if disease strikes and there is insufficient diversity to arrest or recover from the event. Having only one way of thinking about Earth systems and the science we create to understand Earth's systems limits human ability to consider a variety of questions and solutions to questions.

Ancestral knowledge, worldview and key concepts for understanding the natural world are contained within the languages of Indigenous Peoples. Just as use of Métis traditional environmental knowledge is diminishing, the Michif language of the Métis is in danger of extinction with this generation. Literature on linkages between language, culture and the biological environment provide important insights in understanding human relationships with the natural world (Cajete, 2000, p. 28; Oelschlaeger, 2001). Within specific cultures, understanding how humans think and respond to the natural world, how language develops and how culture develops are preludes to understanding what happens when Indigenous languages disappear and are replaced by colonial languages.

In my lifetime, I have been exposed to several Indigenous languages including Plains Cree, Woodlands Cree and Swampy Cree, Dëne, Nakwē and Michif. I speak none of these languages fluently. Fluent speakers who are bilingual have tried to explain cultural concepts of importance but it is very difficult to understand or receive the full meaning as a monolingual English speaker. In some cases, there is no literal translation. The only way the learner can gain the information is to understand the language in which the concept exists because the concept is integrated into holistic thought such as that illustrated by the Métis Lifelong Learning Model.

The colonization of Aboriginal Peoples within Canada has resulted in the loss of many Aboriginal languages. While there were once hundreds of Aboriginal languages, there are now only about 53 in use today. Only three languages, Cree, Ojibway, and Inuktitut, are considered

to have “viable large” numbers of speakers (Statistics Canada, n.d.) Elders teach that worldview is inherent within the language of a nation. The loss of language also means the loss of integral parts of a culture’s worldview. Without the mother tongue of a nation, understanding one’s relationship to the environment within the context of traditional teachings is no longer possible. Traditional understandings are replaced with facsimile information conveyed in another language, usually English, which may appear the same on a superficial level, but is not the same information. Traditional First Nations ceremonies, for example, are nearly always conducted in original languages. English is seldom used, although occasionally Elders will use some English in a ceremony out of sensitivity to the majority of individuals who no longer have their language intact because of having attended residential schools or the intergenerational impacts of residential schools.

In the third part of this section, through a review of literature on biodiversity education I demonstrate that in Canada, academic science education is based in Western Eurocentric philosophies that are not conducive to the preservation of Indigenous traditional environmental knowledge. Western science generally dismisses Indigenous traditional environmental knowledge as myth, folktales, pseudo-science or unquantifiable knowledge.

Beginning in primary schools, mainstream science removes learners from the natural environment, relying on memorization of out-of-context data rather than understanding from experiential learning. Middle school, high school and post-secondary education systems are predominantly based in Eurocentric ideology.

> In fact, the prevailing Eurocentric concept of school “knowledge” (an accumulation of specific information, concepts, and skills within a school subject) has no direct translation into most Aboriginal languages because the Eurocentric concept of knowledge is largely foreign to most Aboriginal worldviews. The best English expression for what Aboriginal peoples learn as knowledge is “ways of living,” for which the word “learn” means “coming to knowing” (Aikenhead G. , 2006, p. 11)

Saskatchewan education policy supports inclusion of Aboriginal perspectives in the K-12 system; however, actual inclusion is dependent on the individual teacher’s personal knowledge or ability to facilitate ad hoc guests to assist in achieving this goal. Although the Saskatchewan Ministry of Education has been actively working to include First Nations and Métis perspectives in science curriculum revisions since 2005, Aboriginal knowledge within goals, outcomes and

indicators remains minimal. Additionally, few Aboriginal science resources are available compounding the inclusion problem for educators.

Using the United Nations Convention on Biological Diversity, an international treaty which validates the importance and value of traditional knowledge, I argue that an educational infrastructure different from that which currently exists must be in place to maintain the perpetuation of Métis traditional environmental knowledge and perspectives. Planning a new educational infrastructure would include adjustments to the governance of the education system, legislation and policies, community relationships, curriculum and resources, pedagogy and professional personnel. All of these components of education would require research, strategic planning and development to support the perpetuation of traditional environmental knowledge and perspectives. Failure to address a comprehensive adaptation of educational infrastructure may result, for example, in inclusion of Métis traditional environmental knowledge being left solely to the pedagogy of the classroom teacher. If this happens, meaningful inclusion will not be possible. Classroom teachers cannot be expected to know how to integrate Métis traditional environmental knowledge. Strategic planning and implementation across education and Aboriginal community-based systems are necessary to develop the means to include Métis traditional environmental knowledge in science education and to create a support network for learners, educators and Aboriginal community members.

2.2 Decolonization

During the colonization of Canada, Métis emerged as a mixed-blood people embodying a diversity of European paternal lineage and maternal Indigenous lineage. Despite having European ancestry, most Métis suffered the same oppressive treatment First Nations Peoples experienced because of colonial strategies to claim land by devaluing and eliminating Aboriginal cultures and knowledge systems. By the end of the fur trade era, violent and systematic removal of Métis from land they occupied, coupled with subsequent generations of racism and persecution, resulted in the destabilization of Métis self-governing structures, interruption of intergenerational traditional knowledge transmission, and oppression of Métis language, culture and epistemology. Métis People have endured. They continue to thrive in the twenty-first century. Métis identity and traditional environmental knowledge have survived, but few individuals are left who can pass onto another generation skills and knowledge of life on the land

gained from ancestral and community knowledge. The fragile state of Métis traditional environmental knowledge reflects the continued impact of colonization through the protection of colonial ideology within education systems to the detriment of human ability to know the land upon which they live.

> For Indigenous peoples' continued existence - throughout the world - land is a prerequisite. It is essential because Indigenous peoples are inextricably related to land: it sustains our spirits and bodies; it determines how our societies develop and operate based on available environmental and natural resources; and our socialization and governance flow from this intimate relationship. Because of that intimate relationship, the land is rendered inalienable: it is a natural right, a right essential for the continued vitality of the physical, spiritual, socio-economic and political life and survival of the Indigenous peoples for generations to come. (Chartier, 1993)

Land was the primary curriculum for learning and living. Historically, to misuse land or inflict irreversible damage to land systems was unthinkable since all people understood that their survival depended on a healthy and bountiful Earth.

Public education and the educators who deliver it are not apolitical. Cathryn McConaghy identifies that "Western knowledges are treated as the products of a depoliticized process of intellectual refinement, while the Indigenous knowledges are treated as the product of a local politics of 'the tribes'" (McConaghy, 2000, p. 11). Western science has been established as a dominant modality in education that dismisses other ways of understanding, reinforcing the hegemony, or adopted dominance, protecting its status as bringing the 'only' truth. Marie Battiste says,

> …the most serious problem with the current system of education lies not in its failure to liberate the human potential among Aboriginal peoples but in its quest to limit thought to cognitive imperialistic policies and practices. This quest denies Aboriginal people access to and participation in the formulation of government policy, constrains the use and development of Aboriginal cultures in schools, and confines education to a narrow scientific view of the world that threatens the global future. (Battiste M. , 2000, p. 194)

Decolonization and self-determination for Aboriginal Peoples are inextricably linked, requiring establishment of education parameters that support, rather than destroy, modes of learning Aboriginal traditional knowledges. Challenging assumptions of modern society that European worldviews are superior, universal, normative and ideal is part of maintaining Aboriginal identity, language, and culture in modern society (Battiste M. , 2000, pp. 192-193).

2.2.1 Theories of Colonialism

Most discussions of colonization describe the impact of that history on Indigenous Peoples throughout the world. Characterized by violent suppression of Indigenous cultures and languages, and imposed foreign ideologies, colonization occurred at great cost to Indigenous humanity. In the aftermath, Indigenous Peoples of the world have struggled to regain strength, in spite of grievously weakened structures of self-determination, and work toward emancipation from oppressive social and economic systems.

In the same manner that religious and political systems express the interests of dominant groups of people, scientific knowledge is also an expression of the values of those who create it (Bowler & Morus, 2005, p. 14). Seventeenth century British philosopher Thomas Hobbs believed that harmonious existence among people was not possible naturally. He believed that people who existed in the *state of nature* such as "the savage people in many places of America" were led by desires and passions that created distrust and universal enmity, and where nothing was unjust (Henderson, 2000, p. 16). Hobbs believed that in the state of nature there were no notions of right and wrong, justice or injustice, no common power and no law. Hobbs theory permeated Eurocentric thinking, influencing government and politics (Henderson, 2000). The justification to dominate and enforce European worldviews became entrenched in processes of colonization.

The European practice of colonization spread throughout the world. John Warnock (2004) explains that imperial countries carried out *total war* against the Indigenous Peoples of North America. He cites Michael Stevenson (1992) in that total war lays waste to a people and destroys their culture in order to undermine the integrity of their existence and appropriate their riches. Total war requires the devastation of the material and spiritual economy, a continuous recreation of its mechanisms of justification, and a resulting structure of collective feeling, way of thought and language that facilitates its continuity from generation to generation (Warnock, 2004). Colonization is often considered a historic event, something that happened in the past, and we fail to recognize it as an ongoing process.

Métis People were not considered or treated greatly different from other Aboriginal Peoples during the fur trade era, and were identified with other colonized peoples. Ron Bourgeault (1988) relates a segment of a letter Louis Riel, Métis leader, wrote to the *Irish World*,

which was published five days after he was hanged. In the letter Riel said,

> Our lands have since been torn from us, and given to landgrabbers who never saw the country...The riches which these lands produce are drained out of the country and sent over to England to be consumed by a people that fatten on a system that pauperizes us. The result is extermination or slavery. Against this monstrous tyranny we have been forced to rebel... The behavior of the English is not singular. Follow those pirates the world over, and you will find that everywhere, and at all times, they adopt the same tactics, and operate on the same thievish lines. Ireland, Indian, the Highlands of Scotland, Australia, and the Isles of the Indian Ocean - all these countries are the sad evidences, and their native populations are the witnesses to England's land robberies. (Warnock, 2004)

Indigenous Peoples all over the world controlled their own lands and territories prior to colonial dispossession. Since then, some Indigenous Peoples have been able to regain a land base and some measure of self-government or autonomy. Having sufficient lands and natural resources returned will enable the Métis to survive as a distinct people and retain their culture, traditions, customs, livelihood, languages and dignity (Chartier, 1993).

The process of colonization is complex and involves a broad effort in determining its success. More than a physical process of land occupation, colonization requires a replacement of Indigenous spiritual belief systems, intellectual reprogramming with new ideologies and defeat of the will to resist. Virgilio and Laenui describe colonization as including "*Denial and Withdrawal*" where Indigenous culture is dismissed as being without value or merit, and the people judged by the colonizer's moral values; "*Destruction / Eradication*" to eliminate artifacts and physical representations of Indigenous culture; "*Denigration / Belittlement / Insult*" where new colonial systems such as religion, healthcare, and law reject all forms of Indigenous systems and new concepts of evil are imported which are paralleled to Indigenous beliefs; "*Surface Accommodation / Tokenism*" is a method of the colonizer to appear lenient toward continuing ignorance of the natives; and "*Transformation / Exploitation*" where facets of colonial religion, art and music incorporate some elements of traditional Indigenous culture and language that have not been able to be eliminated thereby further exploiting the culture (Laenui, 2000, pp. 150-152). The concepts described by Virgilio and Laenui are not believed to occur in steps one after the other, but concurrently and in various combinations. Indigenous methods of understanding the natural and supernatural world are part of what has been lost in the process of colonization.

Cathryn McConaghy (n.d.) brings together six key processes she believes were

successfully used in the process of racialization and colonization in Australia. The six processes include "*naturalism*" (JanMohamed, 1985) describing that which rationalizes the belief that oppression and suffering of Indigenous Australians is natural and a result of the superiority of whites over blacks as is male over female. "*Patriarchy and the cults of domesticity*" (McClintock, 1995) and (Sennett, 1993) describe the process of society modeled on a metaphor of paternal love and dominance in order to institutionalize the male as head of the home, the workplace and the state, and then to transfer that model to Indigenous homes, missions, schools and reserves. "*Scientific Culturalism*" is a term McConaghy uses to describe the approaches of applying scientific concepts and methodological processes to analyze Indigenous cultures. She believes that scientific culturalism is central to creating the hierarchies and values in colonial disciplinary knowledge contexts. McConaghy believes scientific culturalism is the birthplace of a two-race binary that establishes the power relations and quest to address 'problems' with Indigenous existence. "*Nationalism*" (Hodge & Mishra, 1991) describes the creation of new identities that negate existing identities based on the myth of *terra nullius* applied to land vacancy, symbolic and epistemological realms asserting white supremacy. In "*transnational capitalism and global imperialism*", McConaghy cites several authors (Stoler & Cooper, 1997; Pybus, 1997; Said, 1978) in describing complex social and economic combinations that, despite all the attention focused on impacts by Western culture, required a real desire in the colonies for materialism and wealth generation. In order to achieve this state of affairs to the maximum benefit of the colonizers, racialization in the form of social programming had to be devised to undermine and denigrate Indigenous Peoples in order to avoid any possibility of Indigenous successes or competition. Finally, McConaghy lists "*colonial desires*" a term used to describe the contradictory acts of degradation and desire contributing to domination, seduction and conquest by the colonizer. Colonial desires connect political, moral, economic, scientific, and sexual interests of the colonizer creating the social foundations of colonization (McConaghy, n.d., pp. 1-7). McConaghy refers to these six processes as '*othering*' (Mama, 1995) establishing a two-race binary. Although Aikenhead and Ogawa (2007) point out there is a fallacy in binary opposites, a need to be sensitive to the incommensurability of treating Indigenous knowledge systems and Eurocentric sciences as parallel equivalent systems, and a need to value Indigenous knowledge on its own merit (p. 552), the elements illustrated by Leinui and McConaghy continue to influence the status of Indigenous knowledge in science education today.

Tove Skutnabb-Kangas (2000) explains that in order to understand and critically reflect on the messages of hegemonic control, it is necessary to understand the messages in the language through which they are delivered, and through one's own language. This process is necessary to constructing counter hegemonies. Issues of power, control and cost related to linguistic diversity are articulated by Skutnabb-Kangas in that,

> Instead of or in addition to colonizing the land, water, and natural resources of the dominated, as under colonialism, and instead of directly colonizing the bodies of the dominated, as under slavery, the modern version of domination is increasingly colonizing minds, because this also enables a more covert (re)colonisation of both bodies and lands. (Skutnabb-Kangas, 2000)

As with other Aboriginal Nations within Canada, and other Indigenous Nations around the world, Métis People share common pressures in preserving their historic language and with it a unique ontology and epistemology.

Outlining the components of colonization imposed by a dominant culture is a means of understanding colonization, but does not counter with ideologies of the colonized. Linda Tuhiwai Smith explains,

> In a decolonizing framework, deconstruction is part of a much larger intent. Taking apart the story, revealing underlying texts, and giving voice to things that are often known intuitively does not help people to improve their current conditions (Smith, 1999, p. 3).

She believes, for Indigenous communities living in either developing or developed countries, the realities of political and social conditions create situations in which simple human survival becomes the most urgent priority and; in which overturning oppressive colonial systems can feel impossible. In spite of this, resistance and hope are essential. In Smith's view,

> The problem is that constant efforts by governments, states, societies and institutions to deny the historical formations of such conditions have simultaneously denied our claims to humanity, to having a history, and to all sense of hope. To acquiesce is to lose ourselves entirely and implicitly agree with all that has been said about us. To resist is to retrench in the margins, retrieve what we were and remake ourselves. (Smith, 1999, p. 4)

Decolonization and re-establishment of self-determination involves looking at the conditions that gave rise to the past, the opportunities and needs of the present and what can be imagined for the future. McConaghy proposes exploring discourses that move outside the binary to build new assumptions about the complexity of society, moving beyond simple essentialisms that construct

black and white, re-theorizing issues of agency, resistance and national identity formation, while recognizing the fragility of post-colonial identities, structures and processes (McConaghy, n.d., p. 8). It is essential that Indigenous Peoples lead processes of decolonization and self-determination.

Inaccurate work done in the past by non-Indigenous researchers has contributed to hardships on Indigenous communities. Increasing numbers of Indigenous scholars are taking on issues of decolonization in an effort to represent Indigenous perspectives accurately in research. It is in spaces of resistance and hope "that increasing numbers of indigenous academics and researchers have begun to address social issues within the wider framework of self-determination, decolonization and social justice" (Smith, 1999, p. 4) Strategies for decolonization must include *unpacking* aspects of colonization in order to educate global societies to the harm that is being done and to the benefits of decolonization. In the context of contemporary colonial society, and Western scientific traditions, evidence is required to evoke a paradigm shift. Indigenous voices may have been silenced or dismissed for centuries but the failing health of the Earth is clear evidence that Western science cannot provide all solutions. There is a need to develop and implement a better science paradigm for the future.

2.2.2 Racialization in Canada and Saskatchewan

Definitions of race have evolved from genetic classification systems to socio-economic status designations. There is no agreement on what race is or if it even exists; what remains is the concept that one group of people is superior and another group of people are inferior. This is commonly referred to as racialization (Warnock, 2004, pp. 156-161). Power relations between Indigenous and non-Indigenous peoples are based in land and control of land by the processes of colonization described earlier. The British came to the 'new world' solely because of the commercial value of land and natural resources, and suppression of the Irish had already provided the experience and model required for international conquests (pp. 163-167). Though mixed heritage, Métis People found themselves cast as obstacles to colonial expansion and were treated as other Indigenous Peoples subjected to colonization tactics. The process of racialization attacks the very essence of a people.

Saskatchewan's declaration as a province within Confederation in 1905 was a necessary step in extending colonial authority west. John Warnock (2004) explains the provincial birth as

"part of the commercial and political plan of Canada's political and business leaders to create a national economy based on the production and export of wheat" (p. 176). In order to accomplish the National Policy, governing authorities needed to ensure Aboriginal Peoples did not interfere. Warnock says, "The National Policy and the wheat economy were founded on the removal of the indigenous people from their land and its transfer by the Canadian government to European settlers who acquired the land to begin commercial farming" (p. 151). Treaties were signed with First Nations Peoples after starvation and disease destroyed any possibility of resistance. Scrip Commissions were sent out to displace Métis People, followed by the Canadian militia when the Commissions and the land speculators did not achieve acceptable results.

From a time before Canada existed as a country or Saskatchewan was a province, the Métis Nation flag depicted the infinity symbol, symbolizing the joining of two cultures and the existence of a people forever (Barkwell, n.d.). Even though viable Métis self-government incorporating values of Aboriginal and non-Aboriginal ancestral cultures was established and in practice during the fur trade, history shows a violent oppression of Métis People when they made efforts to peacefully join Canadian Confederation. Métis People experienced racism, denial of class mobility, restrictive education and employment policies, seizure of occupied lands, persecution and murder. Métis self-determination was unwelcome in Canada then and continues to require legal defense to secure rights into this millennium.

2.2.3 Language, Cognitive Assimilation and Colonization

Identity, history, worldview, cultural practices, values and norms are encapsulated within a language. It is through language that we understand our own cultural heritage, maintain epistemologies and transmit cultural ideologies. In the colonization process, it is imperative to destroy Indigenous languages by forcing the adoption of the colonizer's language to ensure colonization of the Indigenous mind.

Aboriginal Peoples were not without unique cultural literacies before colonization. Marie Battiste (1986) identifies tribal epistemology as having two knowledge sources, one being from the physical world of experience and the other from the spiritual world of experience (p. 25). Literacies extend beyond reading and writing alphanumeric characters to include dances, songs, stories, symbolic representations, sewing styles, hunting skills and other "non-scriptist literacies that are necessary to live in particular places…" (Chambers, 2008, p. 113) The 2008 research

project by Chambers, Balanoff, Kudlak and Koadloak in Ulukhaktok, North West Territories on literacies of the Kangiryuarmuit resulted in a heritage exhibit which provides “an interpretation of the skills people learned on the land as literacies” (Chambers, 2008, p. 122).

During early years of the fur trade, missionaries brought new knowledge systems to what would become Eastern Canada. Micmac resistance to *cognitive assimilation* was grounded in a resolute belief in the value of their own Algonkian literacies. Since the basic teachings found within Christianity and Micmac cultures are not dissimilar, Micmac People could accept them (Battiste M. , 1986, pp. 32-33). What they did not do, was adopt the colonizer’s language and culture as their own. They enhanced, rather than replaced, the literacy they already possessed. In doing so, the Micmac became a threat to colonization because they were armed with an understanding of colonial ideologies and had the ability to resist. Battiste explains it was not until the 1930's that residential boarding schools became the colonial weapon of choice designed to annihilate Micmac literacy and culture. Federal education policy and Catholic residential schools combined forces to carry out an assimilation policy. She says,

> Inherent in this policy was the destruction of tribal identity and values along with the tribal soul. This educational process is called cognitive imperialism, the last stage of imperialism wherein the imperialist seeks to whitewash the tribal mind and soul and to create doubt. (p.36-37)

Métis People constructed the Michif language as a merger of Aboriginal and European languages. Originally, there would have been a required understanding of at least two distinct worldviews in those possessing this language. The linguistic and cultural merger resulted in the expression of a new Aboriginal language embodying the worldview of Métis People and culminating in a similar context of Métis resistance to colonial domination.

2.2.4 Revolutionizing an Education System

In the current climate of globalization, international trade, technology and transnational capitalism, competition for nations of the world to flourish is unprecedented. To excel in world economies, nations depend on having human resources who are scientifically and mathematically literate, are innovative and can creatively engage economic vicissitudes. Canadian formal education systems are intended to prepare learners to live within this context. With our large land mass and relatively small population, Canada has a unique opportunity to take a divergent approach to competition. Rather than try to compete with production giants such as China, India

or the USA, “Canada must focus on fostering innovation and a commitment to the quality of output rather than cost containment as our measures of productivity” (Knox & Schmidt, 2006). Bill Buxton, a Canadian, musician and Principal Researcher at Microsoft Corporation describes the importance of renaissance teams who, like symphonies of innovation and design, bring together a collection of unique expertise and perspective and have the ability to influence society with resulting accomplishments (Buxton, 2002). But, how are our formal education systems responding to our context of increasing Aboriginal populations in Canada?

Data from the 2006 OECD Programme for International Student Assessment (PISA) identifies Canadian 15-year-olds ranking second only to Finland in science education proficiency (OECD 2008, 2008, p. 9). Aboriginal youth, however, are lower than other Canadian students are in PISA statistics and, according to Statistics Canada, are not choosing science-based careers. The Canadian Council on Learning believes this is a result of,

> A cultural mismatch, between the values and philosophy of Western science (particularly as these are typically exemplified in the classroom) and the values and philosophy held by many Aboriginal people and communities, makes the issue of increasing Aboriginal participation in science and technology a particularly thorny one. (Canadian Council on Learning, 2007b, p. 2)

Battiste (2000) believes the real justification for including Aboriginal knowledge in the modern curriculum is not so that Aboriginal students can compete with non-Aboriginal students but because society badly needs what Aboriginal knowledge has to offer. At the same time, Battiste strongly believes that Indigenous knowledges must remain under the guidance and leadership of Indigenous Peoples and caution must be exercised that it is not claimed by professionals seeking a better alternative to current Western science, or administrations that would seek to regulate and control it (Battiste M. , 2000, p. 201). Revolutionizing education means challenging mainstream ideologies and supporting systems that benefit all citizens and fit into the dynamics of a connected global society.

The subjective nature of learning is a cornerstone of Aboriginal epistemology “which focuses on exploring subjective inner spaces in order to arrive at insights into existence rather than on external knowledge and information” (Hebert, 2000, p. 71). This may explain why Aboriginal cultures continue to maintain holistic worldviews rather than attempt to deconstruct their lived experiences into disciplinary fields of study. Métis describe learning as ‘The Sacred Act of Living a Good Life’ in the Métis Holistic Lifelong Learning Model (Aboriginal Education

Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007). Western Eurocentric education, on the other hand, relies on specialized knowledge that often results in experts with conflicting knowledge about the same phenomenon. Western science, in particular, often uses the guise of objectivity as a means of convincing the public that it reveals the only truth. Sandra Harding explains objectivity has no single definition and is used in at least four different ways. For example, individuals or groups of people who are believed to be emotional, less impartial, or political are believed to be 'less objective'; knowledge claims that have more evidence than competing knowledge claims are considered 'objective' or 'more objective'; methods or procedures that are thought to be fair such as statistical or experimental are considered 'objective'; and the structure of certain kinds of knowledge-seeking communities that thrive in competitive conditions is attributed to 'objectivity' (Harding, 1998, pp. 127-128). Application of the claim of objectivity is often used to marginalize other ways of knowing without regard as to how the claim of objectivity was arrived at within those power relations.

2.2.5 Indigenous Education

In describing the difference between Aboriginal and Western epistemologies, Willie Ermine explains,

> Those people who seek knowledge on the physical plane objectively find their answers through exploration of the outer space, solely on the corporeal level. Those who seek to understand the reality of existence and harmony with the environment by turning inward have a different incorporeal knowledge paradigm that might be termed 'Aboriginal epistemology'...The inner space is that universe of being within each person that is synonymous with the soul, the spirit, the self, or the being. (Ermine, 1995, p. 103)

Indigenous Peoples do not seek understanding, nor convey cultural teachings within the group through 'objective' processes. Indigenous knowledge is the sum of individual knowledges gathered over time, accepted by the community and synthesized into collective knowledge as necessary for survival. Traditional teachings are provided for the learner to integrate intangible elements of self within the comprehension process. Teaching and learning is a process of cultural breathing. Knowledge is drawn in, internalized and expressed by individuals and by collectives. Individual and collective kinship patterns, experiences, relationships, interpretations of community practices, spirituality and history are all aspects of cultural epistemology.

The traditional knowledge of Indigenous Peoples differs from region to region, and is

grounded in the particular environment and culture from which it has emerged. Traditional knowledge has emerged over time and changes over time. Battiste and Henderson explain,

> From the beginning, the forces of the ecologies in which we live have taught Indigenous peoples a proper kinship order and have taught us how to have nourishing relationships with our ecosystems. The ecologies in which we live are more to us than settings or places; they are more than homelands or promised homelands. These ecologies do not surround Indigenous peoples; we are an integral part of them and we inherently belong to them. The ecologies are alive with the enduring processes of creation itself. As Indigenous peoples, we invest the ecologies with deep respect, and from them we unfold our structure of Indigenous life and thought. (Battiste & Henderson, 2000, p.9)

Defining traditional knowledge for use in Western scientific paradigms is difficult. The oral nature, intangible aspects and holistic views of traditional knowledge are not easily understood, or accepted, within foreign scientific paradigms. Western scientific paradigms demand tangible evidence, 'objectivity', definitions and non-contradictory qualities. Without these elements, Western scientific paradigms cannot accept or process other kinds of information. This results in the need for an alternative paradigm for understanding traditional knowledge in relation to Western scientific knowledge.

In 2006, the Canadian Council on Learning, the First Nations and Adult Higher Education Consortium based in the Treaty Seven area of Alberta and the Aboriginal Education Research Centre at the University of Saskatchewan undertook research resulting in three holistic lifelong learning models representing how First Nations, Métis and Inuit believe their respective education processes exist from a cultural perspective. Each model is unique reflecting a link between lifelong learning and community well-being as well as providing a reference for educators and Aboriginal community members to assist in rethinking what constitutes a holistic education and how successful First Nations, Métis or Inuit education might be measured. In the case of the Métis, the model indicates

> The Métis understand learning in the context of the Sacred Act of Living a Good Life, a perspective that incorporates learning experienced in the physical world and acquired by 'doing', and a distinct form of knowledge—sacred laws governing relationships within the community and the world at large—that comes from the Creator. To symbolize these forms of knowledge and their dynamic processes, the *Métis Holistic Lifelong Learning Model* uses a stylistic graphic of a living tree. (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007)

In the Model, concentric rings within the trunk of the tree illustrate formation of a person's Métis identity at the core of lifelong learning, extending out to encompass learning first experienced

informally within intergenerational contexts of family, community and social relations, then more formally in early childhood learning, elementary education, secondary and post-secondary education and adult learning. Within the core Métis identity a holistic balance of spiritual, emotional, physical and mental dimensions exist reflecting the complexity of natural conditions that give rise to optimum growth of the healthy Métis learner from the development of self through all other stages of learning. Branches of the tree represent sources of knowledge and knowing such as are found within self, people, land and languages and traditions. The leaves clustered around each branch can be thought of as domains of knowledge, varying in intensity of colour depending on an individual's understanding in a particular domain. As with a living tree, leaves naturally fall to the Earth creating a cycle of knowledge transmission beneficial to the foundations of learning and generation of new knowledge. Stabilizing and balancing the tree are the roots of Métis health and well-being anchored in Indigenous knowledge and values found within particular conditions of social, physical, economic and political environments, spirituality, health care, and balance and harmony (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007). The Métis Holistic Lifelong Learning Model is a paradigm representing a natural order believed to constitute the parts and relationships necessary to a successful Métis learning process. Use of the symbolic living tree is a metaphor for each learner within a forest of learners indicating not only the importance of lifelong learning, but also the significant impact the natural world has on the Métis soul.

Governments and science communities recognize that irreversible environmental damage has placed continued human existence at risk. Western science has been powerless to avert pending disaster by providing sufficient solutions based on its own paradigms. In 2002, Simon Brascoupé, Director of the Aboriginal Affairs Directorate of Environment Canada, explained,

> Science and technology are fundamentally limited in their scope and ability to solve the current environmental crisis. Their linear approach is juxtaposed to the holistic interpretations of Indigenous Peoples who seek to maintain a delicate balance between the physical, emotional, mental, and spiritual. Consumerism, which is the soul that feeds present day neo-liberal regimes, contrasts with the spiritual connection to the land that is at the heart of Indigenous People's philosophies and traditional practices. For the industrial world, there are many obstacles that cloud sustainable development and sustainable decisions. (Brascoupe, 2002, p. 29)

Gregory Cajete (1994, 1999) provides perspectives on ecology, personal spiritual development,

traditional philosophies, mythology, artistic visioning, relationships, and curricula to help explain the complexities of Indigenous ecological education and within which he formulates a framework for educators to work. Cajete (1994) conveys methodologies for transformational education, drawing on Tewa teachings and similar philosophies from other Indigenous Nations. Cajete says,

> This transformation is a dynamic creative process that brings anything but peace of mind, tranquility, and harmonious adaptation. The exploration of self, and relationships to inner and outer entities, require a tearing apart to create a new order and higher level of consciousness. (p. 210)

Personal transformation through spiritual development is necessary to achieve completeness in life. The educational pedagogies employed to facilitate personal transformation need to be grounded in ecological awareness and connection. In this regard Cajete (1994) also believes "…a contemporary application of Indian education must integrate the orientation of economic survival and ecological sustainability if it is to serve the needs of Indian people living in contemporary times" (p.216).

Eber Hampton (1995), describes a redefinition of Indian education in terms of a six-directional framework, incorporating traditional teachings of power in the four cardinal directions of north, south, east, west, and also that above the Earth - spirit, and that below the sky - Earth. Combined, the framework is intended to demonstrate a pattern for organizing thought about how we exist in the universe. Hampton believes it is important to recognize that each direction's set of complex meanings, feelings, relationships and movements are dynamic, as is Indian education.

Understanding how equilibrium is maintained within the systems of the Earth requires an understanding of complex relationships of reciprocity found within traditional knowledge. An individual's actions affect their environment, resulting in a tremendous responsibility carried by the individual, and the community, that must be considered carefully before carrying out a particular action. This responsibility is not only to the physical world or to others in the community, but is also a responsibility to the spiritual world and the future.

Aboriginal philosophy of Plains Indians holds that all things are animate, have spirit, are in constant motion, and that interrelationships between entities are of paramount importance (Little Bear, 2000, p. 77). This philosophy provides the foundation for values and customs such

as the acceptance of wholeness or totality, strength, independence and respect, noninterference for others' wholeness, totality and knowledge, sharing, humour, honesty and kindness. These values function to maintain the relationships that hold creation together (pp. 79-80). Teaching and learning the complexities of respect are part of a lifelong effort to achieve different levels and layers of understanding. Learning is not a linear process; rather, one acquires spiritual and intellectual growth through dynamic interaction with other beings sharing their environment, often by cyclical or repetitive experience.

Métis People need to remain in contact with their cultural environments, and retain contact with traditional teachers, in order to ingrain experience and internalize traditional teachings. Continuity of contact with cultural teachers contributes to the retention and synthesis of traditional knowledge critical for the holistic development of Métis children. Researchers, educators and learners working to have traditional knowledge respected for what it is and how it exists must also do so in an ethical manner consistent with the nature of traditional knowledge in its holism and sacredness. Internalizing traditional knowledge, for Métis and for others, facilitates the revitalization of self, the collective and the natural world.

In examining human-environment relationships, Russell, Bell and Fawcett (2000) describe one of the most contentious definitions of equating 'environment' with 'resources'. People living in modern, industrialized societies generally imagine humanity to be different from, and superior to, all other life resulting in the notion that the environment is to be controlled and used solely for our benefit. Alternatively, Indigenous knowledges hold a radically different premise that humans are part of, not separate from, environmental processes. David W. Orr (1992) believes,

> It is a mistake to think that all we need is better technology, not an ecologically literate and caring public willing to help reduce the scale of problems by reducing its demands on the environment and to accept (even demand) public policies that require sacrifices. It all comes down to whether the public understands the relation between its well-being and the health of the natural systems. (p. 90)

Challenging attitudes of limitless consumption requires seeking out developed theories and practices promoting ecological literacy.

Cajete explores traditional universal concepts found in various Indigenous cultures such as wholeness, self-knowledge, spiritual development and the wisdom needed to accept our

interconnectedness with the Earth and cosmos. Cajete (1994) believes "a contemporary application of Indian education must creatively integrate the orientation of economic survival and ecological sustainability if it is to serve the needs of Indian people living in contemporary times" (p. 216). Cajete's work provides a theoretical framework for achieving personal transformation, centeredness and lifelong learning processes supporting traditional values and practices.

In later work, Cajete (1999) provides a culturally responsive science curriculum he has been using for 25 years at the Institute of Indian Arts in Santa Fe, New Mexico. This curriculum integrates Native American traditional values, teaching principles and concepts of nature with those of Western science (p. 9). Cajete (1999) cites Peat (1996) in coming to a description of Indigenous science, in that

> …it is a broad category that includes everything from metaphysics to philosophy to various practical technologies practiced by Indigenous peoples both past and present. At its most inclusive definition "Indigenous science" may be said to include practically all of human invention before the advent of Cartesian-mechanistic science. These include areas such as astronomy, healing, agriculture, study of plants, animals and natural phenomena. Yet Indigenous science extends beyond these areas to also include a focus on spirituality, community, creativity, appropriate technology which sustains environments and other essential aspects of human life. (p. 81)

Cajete goes on to say,

> Indigenous science includes exploration of basic questions such as the nature of language, thought and perception, the movement of time, the nature of human feeling, the nature of human knowing, the nature of proper human relationship to the cosmos and a host of other questions about natural reality. Indigenous science is the collective inheritance of human experience with the natural world. It is a map of reality drawn from the experiences of thousands of human generations which gave rise to a diversity of technologies for hunting, fishing, gathering, making art, building, communicating, visioning, healing and being. (p. 81)

Building curricula for ecological education involves getting out of the classroom into nature and extending the support network of educators to include other community members knowledgeable about local traditions. Opportunities for Métis traditional knowledge holders to interact with school educators will result in a broadening of experiences for students, stronger relationships between Métis community members and schools, and an expanded base of experience for educators.

2.2.6 Métis Self-Determination

Historically, the Métis struggle to protect the land and their way of life from oppressive government policies and practices culminated in battles with the Canadian military in Saskatchewan in 1885. In the aftermath, Louis Riel, Métis leader, was condemned by an all-white jury and executed in Regina on November 16, 1885. The subsequent social persecution of anyone identifying as Métis was devastating to Métis people. Payment (1986) explains that in the areas around Batoche, Saskatchewan, tensions between immigrant groups and the Métis were already high and reflected 'white' prejudices in general toward Aboriginal Peoples. Many Métis left the area, and others learned to hide their identity over the next several generations. Even today, many will not self-identify publicly as Métis because of the historic shame ingrained within their families and compounded by racism in general within society.

Residential schools financed by the federal government, consumed First Nations, Métis and Inuit children in the generations to follow. In a Statement of Reconciliation put forward by the Government of Canada in 1998 and subsequent formal apology in 2007, Canada acknowledged attitudes of racial and cultural superiority and that federal legislation did lead to a suppression of Aboriginal culture, values and languages, erosion of political, economic and social systems, as well as dispossession of traditional territory (Government of Canada, n.d.b). The magnitude of cultural genocide is captured in the statement,

> Two primary objectives of the Residential Schools system were to remove and isolate children from the influence of their homes, families, traditions and cultures, and to assimilate them into the dominant culture. These objectives were based on the assumption Aboriginal cultures and spiritual beliefs were inferior and unequal. (Government of Canada, 2008)

As early as 1909, Métis in Manitoba had begun to gather and form new political structures that would revitalize the Métis Nation and its communities; Métis in Alberta and Saskatchewan activated in the years following. The Saskatchewan Métis Society (now the Métis Nation - Saskatchewan) was formed in 1938. Broader national Métis political activity began to emerge in the 1950s gaining momentum until Métis were finally recognized as one of the three Aboriginal groups of Canada in the Constitution Act, 1982. It was at this time the Métis National Council was formed as a means of representing Métis-specific issues in Canada's constitutional talks (Métis National Council, 2001).

The Métis National Council is the representative body for five Governing Members who

are the: Métis Provincial Council of British Columbia, Métis Nation of Alberta, Métis Nation - Saskatchewan, Manitoba Métis Federation and Métis Nation of Ontario. The Governing Members each have an elected body of representatives and are led by a provincial President. The five provincial Presidents and their Councils elect a National President to lead the Métis National Council. Hence, the Métis National Council Board of Governors is made up of five provincial Presidents and one National President. Individually, each Governing Member organization is autonomous, carrying out the best interests of the Métis People within their respective province according to their own processes and priorities. Collectively, the Board of Governors addresses national political and sectoral issues that affect Métis People.

Métis want to be involved with formal K – 12 education processes to ensure the needs of Métis learners are met. In the *Métis Education Report: A Special Report of Métis Education Prepared by the Métis National Council for the Summit on Aboriginal Education* the five Governing Members comprising the Métis National Council stated

> Métis believe that this can be accomplished in part through establishing specific Métis curriculum, developing Métis authorities, respecting and instilling Métis knowledge, values and skills, creating pedagogical environments that respect this authority, and developing the capacity of the Métis community to engage in long-term strategies and visions. (Gabriel Dumont Institute of Native Studies and Applied Research, 2009, p. 2)

The Métis National Council believes meeting the needs of Métis learners might be possible through the creation of a "Métis Education Active Measures Program" (p. 2) to assist Métis provincial education commissions to work in collaboration with provincial education authorities, public, separate and private school boards.

The Métis National Council has also voiced serious concern that "Métis have been excluded from the post-secondary supports and services otherwise provided for First Nations and Inuit learners, thus limiting university access and achievement rates of the Métis (p. 2). Developing a culturally appropriate science education paradigm is not an argument for a return to a hunter/gatherer lifestyle, but rather an argument to augment Métis identity with advanced education and vice versa. Critically, the Métis Nation believes that "distinct and targeted program and policy development must occur under a multilateral approach that respects Métis jurisdiction and control for Métis education rather an on a pan-Aboriginal off-reserve basis" (p. 1).

In order for society to evoke a *paradigm* shift within educational systems, there is a need to understand the issues and potential solutions to a science paradigm based on a Métis self-determined model of lifelong learning. Thomas Kuhn's theory of paradigm shifts describes how we understand changing views of the natural order of the world. Kuhn believed that societies accept certain assumptions, theories, principles and doctrines as paradigms until new thought, in the form of a new paradigm, emerges to supplant the old. A paradigm shift happens when scientists can more fully explain events with the new model. Henderson (2000) explains in law and social sciences the term *context* is used to describe paradigms of thought. Roberto Unger's description of 'natural' and 'artificial' contexts explains, "If a context allows people to move within it to discover everything about the world that they can discover, then it is a "natural" context. If the context does not allow such natural movement, then it is an "artificial" context derived from selected assumptions" (Henderson, 2000, p.12). In this thesis, I am arguing that allowing science education to evolve to something more inclusive requires a paradigm shift away from the exclusivity of a western Eurocentric perspective of understanding our environment to a holistic paradigm that can accommodate multiple ways of knowing.

2.2.7 Science Education in Saskatchewan

The original form of education in this land emerged with Aboriginal Peoples and was based on particular Aboriginal knowledges and ethics of reciprocity. Taking what was needed for survival from the environment was carried out thoughtfully, respectfully and purposefully with decisions based on experience, intergenerational and inter-tribal knowledge learned over many centuries. The healthy environmental conditions and abundance of the land described by explorers and fur traders initiated an accelerated colonization by European settlers.

Over time, with increasing pressure from foreign and domestic governing authorities to remove First Nations and Métis Peoples from the land, treaties and scrip processes were devised to ensure land was available as an enticement for European immigrants. Residential schools were established across Canada during 1870 to 1910 for the purpose of assimilating Aboriginal children. By 1920, attendance was compulsory for Aboriginal children seven to fifteen years old and families who did not comply had their children taken forcibly by government representatives, police or members of the clergy. By 1930, there were 80 residential schools across Canada. The last federally run residential school, at Gordon First Nation in

Saskatchewan, closed in 1996 (Assembly of First Nations, 2010). Métis were also affected during the residential school era and although some individuals who attended these schools look to the past with forgiveness and even appreciation for the good experiences they had, there are many who suffered unimaginably and carried those wounds for the rest of their lives. Some did not survive residential schools.

> All of the personal accounts and histories of course are not stories that ended with the closing of these schools. The intergenerational impacts of these schools affect all generations of Métis today. Credit is due to the generation of people who stepped forward and had the courage to tell their stories about their experiences as a Métis Survivor. Carving out a unique niche in the legacy of the residential school system will help the future generations of Métis who still want to know. (Aboriginal Healing Foundation, 2006, p. 2)

Loss of cultural knowledge, languages, disconnection from families and communities and disillusionment with religious and educational systems were only some of the results of residential schools. It is important to acknowledge and recognize the historical impact residential schools had on Aboriginal Peoples because the imposed education system created enormous negative impacts on individuals, families and communities across Canada that still exist today.

In many ways, the ideology of contemporary education has remained unchanged since the residential school era. Métis children are still required to comply with curriculum based on colonial models, which ultimately is still designed to facilitate assimilation. Though the methods may be gentler today than in the past, for the most part there remains an absence of opportunity within formal education processes for Métis children to learn cultural traditions as an integral part of their lives. Though some arguments might be made to the contrary, evidence to support my claim is apparent in the diminishing use of Aboriginal languages, loss of traditional knowledge associated with traditional land use, attrition rate of Aboriginal students from formal education systems, low achievement rates or disengagement in Western Eurocentric science disciplines across Canada, and consequently, the fragility of Indigenous participation and input to the United Nations Convention on Biological Diversity processes together, or apart, from Canada.

Canada devolves responsibility for education between Kindergarten and Grade 12 to provincial and territorial jurisdictions. As such, Canada as a federal authority does not have a

lead role in determining or monitoring education, with the exception of Indian and Northern Affairs Canada (INAC) who assume responsibility for First Nations education. Within Saskatchewan, the department responsible for all public education is the Saskatchewan Ministry of Education.

The Ministry has been active in addressing educational needs of First Nations and Métis Peoples recognizing demographic shifts project that by the year 2016 approximately 45% of all children entering kindergarten will be First Nations or Métis; that currently only 30% of First Nations and Métis learners aged 15-24 have completed high school; that with an aging labour force in Saskatchewan "First Nations and Métis children and youth is potentially Saskatchewan's greatest asset in meeting the challenges associated with an aging workforce" (Ministry of Education, 2010, p. para 4); and that existing Aboriginal and treaty rights of First Nations and Métis Peoples of Canada denotes a responsibility for federal and provincial governments to work in partnership with First Nations and Métis Peoples to achieve equitable outcomes in education (Ministry of Education, 2010, p. para 5). To directly address these challenges the First Nations, Métis and Community Education Branch assists with development of policy and curriculum which infuses First Nations and Métis ways of knowing, partners with school divisions in planning processes, develops partnerships with First Nations and Métis organizations, supports Indigenous languages and cultures programs, addresses representative workforces, develops equitable resources and conducts research to discover promising practices (Ministry of Education, 2010).

The following is adapted from the Learning Indigenous Science from Place (Michell, Vizina, Augustus, & Sawyer, 2008) report:

> Since 1982, the Government of Saskatchewan has taken steps to encourage positive change for First Nations and Métis education by activating a Native Curriculum Review Committee, later known as the Indian and Métis Education Advisory Committee (IMEAC) and currently named the Aboriginal Education Provincial Advisory Committee (AEPAC). Their responsibility was to find ways of including Aboriginal content and perspectives in provincial curricula and report in the form of action plans. In 1981, the Saskatchewan Minister of education had mandated a review of the K-12 education system which resulted in the document *Directions* (Saskatchewan Education, 1984) that provided a foundation for

the *Core Curriculum* (Saskatchewan Education, 2000b) in emphasizing the importance of, and commitment to, the inclusion of Aboriginal content and perspectives in all curricula. AEPAC spoke to the importance of the Core Curriculum saying,

> The Core Curriculum is recognized as a central feature of the provincial education system. It is a curriculum that creates spaces for Aboriginal voices, well beyond the Native Studies program. Integrating Aboriginal content and perspectives across the curriculum, within all subject areas is the goal for all students. (Saskatchewan Education, 2005, p. 4)

A *Five-Year Action Plan for Native Curriculum Development* (Saskatchewan Education, 1984b) was also developed by the Native Curriculum Review Committee and included a series of recommendations including the need for policy development, continuity for an Aboriginal education advisory committee, inclusion of the north, as well as Aboriginal content and perspectives in curricula. Those recommendations remained priorities from 1984 through 2005. In 1995, the Indian and Métis Education Advisory Committee identifying five areas of importance developed an Indian and Métis Action Plan including evaluation, governance, teachers and administrators, external relationships and communication (St. Denis, Bouvier, & Battiste, 1998, p. 70).

An important policy document developed by the Government of Saskatchewan was the *Indian and Métis Educational Policy from Kindergarten to Grade 12* (Saskatchewan Education, 1995c). Guided by the Five-Year Action Plan for Native Curriculum Development from 1984 and subsequent iterations including the Indian and Métis Action Plan of 1995 (Saskatchewan Education, 1995b) the new policy outlined three major curriculum objectives:

- The inclusion of Indian and Métis content in all core curricula for all students in the province;
- The development and implementation of programs for and about Indian and Métis students, for example: Native Studies and Indian Languages programs;
- The development, identification and coordinated distribution of instructional resources and locally produced materials for core and other curricula. (Saskatchewan Education, 1995c, p. 4)

The policy section *Appendix B: Principles and Guidelines for Indian and Métis Curriculum Development* offered recommendations for curriculum development and stated

"Improvements to the education of Indian and Métis students are dependent upon the changes in the processes of development, the instructional approaches taken, and the presentation and representation of curricula and materials" (p. 9) Three areas in particular were highlighted: Involvement of Indian and Métis Peoples, sustainability of instructional approaches, and adequacy of curriculum. In the attempt to make curricula adequate, curricula and materials will "concentrate on positive images" and "reinforce and complement the beliefs and values of Indian, Métis, and Inuit peoples", as well as "include historical and contemporary issues", emphasize "Indian/Métis Studies, Indian languages, and English language development", and "reflect the legal, cultural, historical, political, social, economic and regional diversity of Indian, Métis, and Inuit Peoples" (p. 10). The policy also asserted, "knowledge within Indian and Métis communities and institutions will be utilized in the development of Indian and Métis content" (p. 9).

In 2000, AEPAC submitted *Action Plan, 2000-05*, which shifted its focus from organizational development to student and community. In their Plan, AEPAC said, "Now that the groundwork and structures are in place, we would like to shift our attention to actualization of Aboriginal content and perspectives in Saskatchewan schools – all schools, and not only those that have a significant population of Aboriginal students" (Saskatchewan Education, 2000a, p. 2). The province defines actualization as "effective implementation and ongoing renewal" and notes that, "the awareness is still lacking that *all students* in the province stand to benefit if the recommendations of [AEPAC] and its predecessors are actualized" (p. 2).

In 2003, *Building Partnerships* was released as a policy framework for Pre-kindergarten to Grade 12, outlining how the province would strengthen partnerships at the policy level through such activities as including First Nations and Métis people in policy discussions, having adequate First Nations and Métis representation on advisory and reference committees, and the use of effective processes for seeking and receiving policy advice (Saskatchewan Learning, 2003, p. 36). Later, in 2005, *Learning Community in Aboriginal Education 2004-2007, Priorities Report* was released by AEPAC for the province. The document was an assessment of the 2000-2005 Action Plan and a review of priorities for 2005-2007. The five principles were reaffirmed with six new opportunities identified (Saskatchewan Education, 2005, pp. 12-13).

In recent years, Saskatchewan's Ministry of Education has been renewing science curriculum for elementary and secondary grades. The first effort was the Science 10 Curriculum Guide (Saskatchewan Learning, 2005). The revised curriculum includes a declaration of the province's commitment to the inclusion of First Nations and Métis content and perspectives within the curriculum. In the section on Core Curriculum Components and Initiatives, an orientation is provided for educators to help them understand the directive on how to think about Indian and Métis Content and Perspectives. Specifically,

> It is an expectation that Indian and Métis content and perspectives be integrated into all programs related to the education of kindergarten to grade 12 students in Saskatchewan, whether or not there are Indian and Métis students in a particular classroom. All students benefit from knowledge about the Indian and Métis peoples of Saskatchewan. It is through such knowledge that misconceptions and bias can be eliminated. (p. 6)

The guide goes on to explain that teachers must find multiple methods of integrating First Nations and Métis content and perspectives because,

> This approach begins with understanding and respecting ***Indigenous knowledge and ways of knowing***. Indigenous knowledge and ways of knowing often seem at odds with contemporary, scientific views of knowing. Thus, teachers and students may question why these ways of knowing should be incorporated into and addressed in science courses. An inclusive science curriculum respects the variety of worldviews that various cultures use to understand and explain their relationships with the natural world. Indigenous perspectives are holistic, and focus on understanding concepts at a macro level, and then looking for specific examples that incorporate that knowledge. Inherent in these perspectives is an understanding of the relationships between the living and non-living, and a need to respect cultural values when exploring nature. Contemporary scientific approaches are generally characterized as reductionist, focusing first on the micro level of understanding, then progressing to the major macro concepts and connections. This dichotomy in worldviews creates a challenge for teachers of classes that contain a mix of students of various heritages. (p. 6)

To accomplish inclusion of Indigenous knowledge and ways of knowing, educators are asked to:

- concentrate on positive and accurate images
- reinforce and complement beliefs and values
- include historical and contemporary insights
- reflect the legal, political, social, economic, and regional diversity of Indian and Métis peoples; and
- affirm life experiences and provide opportunity for expression of feelings. (p. 6)

The curriculum suggests using *Diverse Voices: Selecting Equitable Resources for Indian and Métis Education* as a guide for appropriate resources to support curriculum (Saskatchewan Education, 1992). In addition, a database bibliography provides internet links to resources for educators. Unfortunately, there is a notable shortage of published resources appropriate for Saskatchewan First Nations and Métis content and perspectives. This important area needs development and support.

The purpose of this lengthy explanation of Saskatchewan educational policy is to acknowledge and review the efforts that have been made to create the policies that have been provided for First Nations and Métis content and perspectives within science curriculum. Over the past three decades, a variety of Aboriginal advisory committees have assisted provincial policy-makers and curriculum writers with inclusion of First Nations and Métis content and perspectives within Saskatchewan's educational policies resulting in broader inclusion within most school subject areas, with the notable exception of science education. In late 2005, a volunteer group of academics from the University of Saskatchewan and the First Nations University of Canada, teachers from public, Catholic and First Nations school divisions, political representatives and First Nations and Métis community members worked together in support of further specific exploration of the role of Indigenous knowledge within science education. The result was *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008); a research report intended to provide information about Indigenous knowledge and how it might be animated within formal and informal educational settings. During this same time, the Ministry of Education held consultations with educators and Aboriginal Elders and commissioned a new school science textbook for middle year's students, which included some First Nations and Métis content.

In 2009, Saskatchewan revised Science 6 through 9 drawing on academic experts, teachers, administrators and others to assist in the curriculum revisions. The curriculum guides provide professional contextual orientation for educators along with a series of Outcomes and Indicators targeted for specific grade levels, rather than the page-by-page unit and lesson plan format used in the previous versions of the curriculum. This provides educators with more flexibility in finding creative and innovative ways of including First Nations and Métis content

and perspectives within their daily teaching. For example, target Outcome EU9.3 of the Science 9 Curriculum states "Examine how various cultures, past and present, including First Nations and Métis, understand and represent astronomical phenomenon" (Ministry of Education, 2009, p. 40). The Indicators that would show the students have achieved the Outcome are listed as

> a. Describe First Nations and Métis perspectives on the origin of the solar system and the universe; b. Identify how worldviews related to astronomical phenomenon are expressed through First Nations and Métis stories and oral traditions; c. Explain the importance many individuals and cultures place or have placed on the summer and winter solstices and vernal and autumnal equinoxes; and d. Identify common characteristics of stories, past and present, describing the origin of the world from various cultures and those in fantasy literature. (Ministry of Education, 2009, p. 40)

While this thesis is not intended to be a discourse analysis of provincial curriculum, I will mention that of the 15 Outcomes targeted in Science 9 only one of them (provided in the example earlier) is specifically written for First Nations and Métis content and perspectives, with the other 14 based on Western Eurocentric science. An educator might also be led to believe that the Indicators provided in the example above somehow relate First Nations and Métis perspectives of the solar system and the universe itself with science-fiction fantasy, or at least classify them in the same group. Instead, learners should be encouraged to understand Indigenous Peoples throughout the world have extremely complex understandings of the cosmos that have provided human understanding of relationships that go beyond intellectual and physical processes that researchers, for example in the discipline of physics, are only beginning to try to understand in such areas as the entanglement of atomic particles, multiple universes, and the search for a unified theory that unites quantum physics with Einstein's theory of relativity. Holistic knowledge systems, understanding interconnectedness and the importance of relationships are part of many worldviews that, in Indigenous cultures have many layers and levels of complexity. Just as in formal public education processes, grade levels are provided to build learners with an expanding knowledge base, Indigenous knowledge also has processes of achieving and acquiring knowledge but that format differs from formal education in that knowledge shared is anchored in processes such as trust, respect for sacred knowledge and personal integrity. Sharing knowledge across cultures and disciplines is possible but it requires a shared respect and appreciation for what can be, or is, learned from each other as well as acknowledgement that no one group of people have all the answers to life's mysteries.

Educators have an enormous challenge in meeting the goals of provincial curriculum and bringing age appropriate and culturally appropriate knowledge into their pedagogy. Having been a small part of some of the provincial consultations on revising the science curriculum for Grades 6 through 9, I also understand the challenge faced by curriculum writers and policy-makers with time constraints, financial limitations and pressure from individuals who do not support the inclusion of First Nations and Métis perspectives in public curriculum. Even in overcoming these obstacles, there remains the challenge of finding a continuum of age appropriate First Nations and Métis content and perspectives for use in public curriculum and respecting that Indigenous knowledge belongs within the domain of Indigenous Peoples and must not be appropriated. These challenges require that educators gain skills in First Nations and Métis community ethical protocols in order to build relationships with community members to help guide educational practices and ensure that educators not attempt to teach what may be considered sacred knowledge themselves in the classroom. This process is different from the autonomy most teachers are used to having with respect to their pedagogy, but can be personally and professionally fulfilling for educators of any background, and rewarding for students and First Nations and Métis community members.

Educators and school divisions should also be held to the highest standards in their efforts to collect or publish traditional environmental knowledge to ensure that the intellectual property remains with the community sharing the knowledge. This could be accomplished by collaborating with political and academic institutions that are experienced with these issues and supports the role of holistic learning and relationship building to obtain mutual goals. Post-secondary institutions undertaking research involving humans are required to comply with institutional ethics processes, including ethical standards found in the 1998 Tri-Council Policy Statement (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 1998 (with 2000, 2002 and 2005 amendments)) or the new Revised Draft 2nd Edition Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (2009) (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 2009). Both documents provide specific sections on working with Aboriginal Peoples and are intended to assist in facilitating research

that is not harmful to Aboriginal communities. Additionally, local First Nations or Métis communities have their own ethical processes that may, or may not, be written down.

In Eastern Canada, the Mi'kmaw established the Research Principles and Protocols – Mi'kmaw Ethics Watch hosted at Unama'ki College of Cape Breton.

> Mi'kmaq Ethics Committee has been appointed by the Sante' Mawio'mi (Grand Council) to establish a set of principles and protocols that will protect the integrity and cultural knowledge of the Mi'kmaw people. These principles and protocols are intended to guide research and studies in a manner that will guarantee that the right of ownership rests with the various Mi'kmaw communities. These principles and protocols will guarantee only the highest standards of research. Interpretation and conclusions drawn from the research will be subject to approval to ensure accuracy and cultural sensitivity. (Mi'kmaq Ethics Committee, 1999)

Most Aboriginal communities have not taken the kinds of steps to protect their cultural knowledge that the Mi'kmaw have taken; however, this does not mean that communities do not expect that anyone seeking traditional knowledge would abide by the local community protocols of that place.

The goals of education are part of the consideration of what, and how, science education entails in terms of content and how it is taught. Goals of education are developed in concert with what societies deem important goals for itself. Within Canada, increasing demands for a skilled labour force in all sectors is seen as a driving force in provincial and post-secondary education. First Nations and Métis communities also place a high value on employment and career goals for young people as well as retention of cultural knowledge and original languages. In acknowledgement of this, provincial Ministers of education comprising the Council of Ministers of Education, Canada (CMEC), in 2004

> declared Aboriginal education to be a priority issue deserving targeted activity. This commitment was reaffirmed in Learn Canada 2020, the framework that the ministers are using to enhance Canada's educational systems, in which Aboriginal education was identified as one of the specific activity areas.
>
> In establishing Aboriginal education as a priority, ministers have acknowledged the need to find new and varied ways of working together and in partnership with Aboriginal leaders and communities, as well as with the federal government, to improve outcomes for Aboriginal students at all levels of education. Ultimately, with Learn Canada 2020 as their framework, ministers responsible for education in all jurisdictions have committed to eliminating the gap in academic achievement and graduation rates between Aboriginal and non-Aboriginal students. (The Council of Ministers of Education, Canada, n.d.)

CMEC indicates, “The long-term goals of the plan include more positive Aboriginal learning experiences, improved student well-being, increased success for Aboriginal students, and improved labour-market integration for Aboriginal peoples” (The Council of Ministers of Education, Canada, n.d.).

Additionally, education Ministers from the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan have worked together on regionally relevant partnerships within the Western and Northern Canadian Protocol which resulted in, among other initiatives, the creation of The Common Curriculum Framework for Aboriginal Language and Culture Programs Kindergarten to Grade 12 which is,

> intended to be a support document for schools or regions within the Western provinces and the territories wishing to develop curricula, learning resources or strategies dealing with Aboriginal languages. It is a framework that reflects the universal values and beliefs inherent in Aboriginal cultures. The outcomes provided are to be interpreted and specified by local developers based on the strength of their language, the availability of cultural resources and the expressed language goals of their community. (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000, p. 1)

Linkages between languages and cultural practices are required for full and contextually appropriate understanding and fluency. While statements made by the Council of Ministers of Education, Canada and the Ministerial members of the Western and Northern Canadian Protocol are intended as a guide for all formal education processes within their respective jurisdictions, the discipline of science education has made little progress in allowing its scope to evolve more holistic foundations. Three challenges that emerge in literature point to the need for education systems to ensure that First Nations, Métis and Inuit cultures are valued and have an equitable place in formal education, that labour force needs within Canada are met, and that Aboriginal youth find greater engagement and success in all facets of formal education, including science education. These challenges cannot be met with minimal efforts to infuse Indigenous knowledge within provincial curricula. It will result in continued failure of educational systems to respond to the challenges put forward by greater society. Indigenous knowledge, in its holistic scope, must be available to Aboriginal community members, including youth, as an integral part of their lives. In this thesis, it is my wish to examine reasons for the disconnection of Indigenous voices from international discussions on the preservation of global biological

diversity and what can be done locally within educational processes to ensure Aboriginal Peoples, in particular Métis People, have an opportunity to find success in formal education without relinquishing their traditional knowledge. In my view, this can only happen with radical change to the way we approach education in Saskatchewan. The Métis Holistic Lifelong Learning Model is the beginning of work on a paradigm of learning suitable for Métis and may be the Model that can be adapted as the basis for rethinking science education.

2.3 Aboriginal Languages and Ecosemiotics

> The preservation and enhancement of Aboriginal languages is a matter of national pride and honour. Language retention is also critical to the ongoing existence of the distinct cultures of Aboriginal peoples. In many areas of Western Canada, Aboriginal languages are in danger of being lost. Unlike other languages, the Aboriginal languages cannot be revitalized or supported in other countries. The source of traditional knowledge and teaching is dying with the Elders. These languages belong in Canada. It is imperative that immediate action be taken. (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000, p. 2).

Part of the motivation of including this section on Aboriginal Languages and Ecosemiotics is to illustrate the importance of seeing Indigenous languages beyond political and social concerns and raise the issue that communication manifests in the human and non-human worlds. Language is the modality of human beings to express their understanding of that communication. Indigenous languages are linked to spiritual beliefs that include spiritual ceremonies and spiritual communication as part of Indigenous epistemology.

2.3.1 Ecosemiotics

When examining issues of colonization and decolonization, perspectives of sovereignty, justice, cultural preservation and rights, it is tempting to see arguments simply for linguistic preservation in the same regard. The diversity of knowledge that arises from a specific place is learned and interpreted through language by the people inhabiting the local area and becomes part of the people. The relationships between human cultures and linguistic expression are complex and rich in variation among Earth's cultures. Studies presented by linguists, sociologists, anthropologists, and others represent scientific perspectives of these relationships rooted in the knowledge of their disciplines. We engage in, and perpetuate, dialogue among disciplines that have at least some concept of what each of us brings to the discussion. We try to advance knowledge based on what we know and can learn from others integrating new knowledge into

that which forms the basis of our own worldview. However, interdisciplinary studies and interpretation of knowledge between social sciences and other types of sciences tend to be difficult escalating, at times, to acrimonious. One example is the historical legacy of debates between religious and Western scientific scholars. Vigorously defended fields of belief and study within disciplines that currently have no ability, or desire, to remain open to new knowledge have left little room for collaborative exploration of questions related to the ways in which communication occurs among individuals and systems, whether they be human or non-human. Learning, in both traditional Indigenous communities and Western scientific thought both support the idea of lifelong learning, so at least there is a starting point for sharing and building a new community of learners for the purpose of understanding the world around us.

Epistemological questions regarding how we know and understand life, and how we respond, are rooted in the diverse worldviews we hold individually, linguistically and culturally. Recognizing parts of the natural world as animate or inanimate and the role of supernatural existence are part of unique belief systems that, among Indigenous cultures and Western scientific disciplines, are usually at odds with each other and seem ontologically irreconcilable. In this section, I introduce some literature on the concepts of semiotics and eco-semiotics, in an effort to expand the argument that the knowledge inherent in diverse languages, and the importance of understanding methodologies of communication, has a role in science that has barely begun to be explored. Kull, Emmeche & Favareau (2008) look at a new paradigm, a semiotic approach to life science, and provide a view of how this differs from non-semiotic biology where higher-order understandings do not have a conceptual place within the paradigm.

Semiosis is considered *sign* activity that occurs within processes of self-organization and reflects, "The ability to create and take part in meaning-generating processes – is the one of the distinguishing marks of a system that is *alive*" (Kull, Emmeche, & Favareau, 2008, p. 42). Biosemiotics is defined as the study of qualitative diversity found in and by living systems and is related to what is described as "*Umwelten* – the experiential worlds within which organisms live and must choose their actions – are qualitative by their very nature" (p. 45). A major question in the study of biosemiotics asks how the world within which any individual organism finds itself appears to that organism. Western scientific investigation would consider this question unanswerable by way of reductionist biology, but biosemioticians believe phenomenological experiences are accessible and that one of the primary reasons questions regarding an organisms'

subjective experience have been perceived to be unscientific is because " "the scientific method" has been prematurely codified (and perhaps has subsequently become petrified) in a too narrow and restricted sense, reflecting its origins in seventeenth and eighteen century mechanistic reductionism" (pp. 43-44). Through semiosis, and the qualitative study of cognitive-semiotic mechanisms, it becomes possible to explore biological functions that might include "recognition, action choice, memory, code relations, categorization, and communication" as well as issues of intentionality (p. 46). So what does all this have to do with Indigenous languages? I believe it is part of the responsibility of looking beyond what our own knowledge and set of assumptions about the role and importance of language to see how it manifests in the broader, or more holistic, context recognizing that communication is about more than spoken language, strings of letters, or words, and truly does represent unique perceptions of the world and processes of understanding what is perceived.

Kull, et al. helps orient our thinking about communication by raising questions about the nature of interpretation of signs and communication at the molecular level "How can anything (e.g., molecule x) that initially does not have a function, obtain a function?" to communicative interactions that extend spatially and temporally, and what physiological, ecological and communicational processes and structures are involved (p. 47)? Biosemiotics involves a relational approach to investigating life processes, examining the communicative aspects of living organization, within and between organisms and the development of a principled method for capturing and accounting for the translatability between sign systems among different species. This relatively new field of research has yielded a number of case studies over the past ten years that are applying biosemiotics and advancing human understanding in new ways. They include: The biosemiotics of animal communication, biosemiotic processes in ecosystems, the biosemiotics of the immune system, the biosemiotics of signal transduction in cellular studies, neurosemiotics, a biosemiotic model of the genetic information system of the cell, a biosemiotic taxonomy of systematic, compositional, sign-dependent relations in the living realm, application of a semiosic matrix in reinterpreting the process of oocyte-to-embryo transition in development, comparative studies of sensorimotor interactions and inner representations in vertebrates and invertebrates, studies of vegetative semiosis, and the role of sign types at various biosemiotic levels for the emergence of the human linguistic animal and differences and similarities between human language and animal communication (pp. 48-51). Kull et al. acknowledge that even the

fields of genetics and cellular and molecular biology have seen an increase in efforts toward more systematic and holistic understanding than in the past. Although the examples of biosemiotics provided above are provided in Western scientific terms, these concepts comprise part of Aboriginal ontology.

Contemporary global ecological crises have inspired more attention to the study of ecology and its interdisciplinary applications. A variety of fields of study within ecology have risen and helped shape new thinking about the place of humanity within the natural world. The study of semiotics has also seen the emergence of a branch known as ecosemiotics described as "the study of the semiotic interrelations between organisms and their environment" and is based on the assumption of any organism, not necessarily a human, at the centre of interest (Noth, 1998, p. 333). There are varying approaches to ecosemiotics; one is known as cultural ecosemiotics, in that nature is interpreted through cultural perspectives. Another approach, biological ecosemiotics, treats the sign processes in nature as phenomena in their own right (Maran, 2007, pp. 274-275). Biological ecosemiotics is similar to biosemiotics, in that the field of interest involves the sign relationships between organisms and their environment, whereas cultural ecosemiotics must involve the influence of culture but is also bound by the limitations of human language and cultural systems in understanding sign relationships (p. 279).

The different approaches to ecosemiotics have provided debate among scholars, but more importantly, they have provided varying perspectives that contribute to advancing human understanding of the sign and communicative processes within our bodies and the world we are part of, as well as how culture allows us to interpret and understand the world around us and how language helps us express what we have interpreted and understand. Maran cites Keskpaik (2004) in the belief that it is necessary to bring biological ecosemiotics and cultural ecosemiotics together in order to have a transcendent view that overcomes the linear dichotomous logic of having two separate approaches. Further, Keskpaik (2004) believes that if this can be achieved, ecosemiotics can advance its most significant task which is "to help diminish communication problems between human and nature, because from that viewpoint it becomes possible to speak about nature, as it seems to us in culture, and to speak with nature, because of its ability of speech has been restored" (Maran, 2007, p. 279). The study of ecosemiotics is relatively new, and much of the literature is emerging in non-English speaking countries of Eastern Europe. There is much that has yet to be learned and understood about the world around us, whether it is

from a western scientific perspective or Indigenous perspective or some more holistically based combination. The questions related to identifying self-organizing systems and how we can identify them on Earth or elsewhere; how a molecule exhibits consistent behaviour or how traditional healers awaken plant medicines are mysteries to which we cannot claim full knowledge. Some of this knowledge may never be accessible, but it would appear that maintaining a rich diversity of cultures, languages and our ability to share and exchange knowledge across them will help expand our understanding of semiotics, the world around us and ourselves.

2.3.2 Michif Language

Michif is the language of the Métis People that emerged during the era of the fur trade. By some explanations, the term 'Michif' is a derivative of old French words 'méstif' and 'métis', and has come to refer to the mixed language spoken by Métis People of French and Cree heritage (Paquin & Préfontaine, 2003). Métis Elder, Bruce Flamont, says, "Michif identifies you and allows you to identify yourself. Michif demands that you think, feel and thus react in a Michif way. Michif allows for a psychological independence. Michif is the language the Creator gave us as a People" (Flamont, 2003, p. 15).

Linguist Peter Bakker describes some of the unusual characteristics of the Michif language. He describes it as syncretic, in that it combines different beliefs and principles. As such, it is not classifiable to one language family. Michif can be said to belong to two language families at the same time, in that it is just as much Algonquian as an Indo-European language. Bakker explains, **"**Michif has grammatical and lexical features from the two languages in roughly equal numbers, which may very well make it unique among the languages of the world" (Metis National Council, 2000, p. iv). Bakker rationalizes this statement based on the Michif distribution of elements of the two source languages and the fact that no other known mixed language show nouns from one language and verbs from another.

Michif is a language fading into history. Today, it is only spoken in a few Métis communities within Canada, as well as a few within the United States. It is believed that there are fewer than 1,000 remaining Michif speakers (Bakker, 1997). It is apparent that the challenge of preserving the Michif language is at a critical moment in time.

As with other Aboriginal languages within Canada, the Michif language faces its greatest

issue in collective usage. Languages that are not used become extinct along with the history and worldview they represent. New forms of communication surface to replace the old and harmonize with new ways of life. Aboriginal languages, rich with historical meaning and words imbued with spiritual energy and power, are closely associated with particular cultures of place. Use of original Aboriginal languages in ceremony continues in contemporary times because ceremonies are accepted as sacred. Colonization and the residential school era have resulted in suppression of the belief that everyday life, and every word spoken, is sacred. In Aboriginal communities, loss of ability to speak the language of your ancestors is often associated with a loss, or change, of culture and identity. While certain elements of culture and identity are lost or changed, it is important to note that declining or extinction of Indigenous languages around the world is evidence of continued impacts of colonization, racialization and globalization.

Tove Skutnabb-Kangas explains a prevailing myth of monolingualism, which promotes the idea that having only one language is efficient and economical, and leads to being a rich and powerful society. She explains that part of this myth is promotion of the idea that individuals are better off learning the dominant language well, that learning another language diminishes the individual's proficiency, and that it is somehow disloyal to speak another language other than the dominant language. In her argument against monolingualism, Skutnabb-Kangas provides counter-evidence that it is, in fact, inefficient and uneconomic to prevent people from getting their education, understanding important messages, and participating in the discourse needed for democracy in a language they know. She says proficient multilinguals show better test results in areas such as general intelligence, cognitive flexibility, divergent thinking, creativity, sensitivity to and capacity to interpret feedback cues, sensitivity to and interpretation of non-verbal cues and meaning, metalinguistic awareness, and efficiency in learning additional languages faster and better (Skutnabb-Kangas, 2000).

In describing theoretical foundations of imperialism**,** Phillipson (1992) cites Johan Galtung's explanation that imperialism is a type of relationship in which one society is able to dominate another. Galtung believes that there are six interlocking types of imperialism: economic, political, military, communicative, cultural and social. Phillipson believes that linguistic imperialism warrants its own distinction because it is manifested within all the other types of imperialism as the method of transmitting ideas both in the form of the language and the content of the ideas (Phillipson, 1992). This is significant for Métis because public education

systems maintain dominant ideologies and English linguistic imperialism contributes to accelerated loss of Aboriginal ancestral languages.

Some researchers claim that ceasing intergenerational language transmission has been a deliberate choice by parents based on careful cost-benefit analysis. This claim is refuted by Skutnabb-Kangas. She explains that, with respect to Indigenous languages, choice was never there, and that most Indigenous parents do want mother-tongue education, they are just never asked. Instead, there is an introduced shame of their language, embedded within dominant ideologies that a high English language competency is desirable and not compatible with a dominated language. She goes on to say that, parents supporting non-Indigenous language education do not have sufficient information about the long-term consequences for their children and grandchildren, nor for the fate of the languages themselves (Tove Skutnabb-Kangas, 2000). National consultations with Aboriginal Peoples in Canada revealed a broad belief in the importance of language and culture. In 1991, Canada established The Royal Commission on Aboriginal Peoples (RCAP) to examine relationships between Aboriginal and non-Aboriginal people and restore justice within those relationships by proposing practical solutions to difficult problems (Indian and Northern Affairs Canada, 2010).

Volume 3 Gathering Strength: Chapter 5 Education, of the RCAP final report, contains information which specifically addresses linkages between language and culture, issues of cognitive imperialism, processes of moral communication, conceptions of language education and a series of recommendations to address language concerns (Royal Commission on Aboriginal Peoples, 1996a, pp. Vol 3, Ch 5). Volume 3 Gathering Strength: Chapter 6 Arts and Heritage recommends,

> Federal, provincial and territorial governments recognize promptly that determining Aboriginal language status and use is a core power in Aboriginal self-government, and that these governments affirm and support Aboriginal nations and their communities in using and promoting their languages and declaring them official languages within their nations, territories and communities where they choose to do so. (Royal Commission on Aboriginal Peoples, 1996b, pp. Vol 3, Ch 6, Sec 3.6.8)

RCAP Chapter six also includes a series of recommendations in Sec. 3.6.9 that each Aboriginal nation should undertake in working to establish priorities and policies for Aboriginal language conservation, revitalization and documentation.

Volume 4 Perspectives and Realities: Chapter 5 Métis Perspectives provides specific

information regarding Métis history and issues. Appendix A of this Volume provides a series of recommendations by RCAP in Sec. 4.5.5 and Sec. 4.5.6 that directly address educational issues as well as the Michif language (Royal Commission on Aboriginal Peoples, 1996c, pp. Vol 4, Ch 5).

Following the RCAP research, The Métis National Council increased efforts to support the Michif language. The document "Taanishi Kiya" a Michif Revival Strategy 2000 - 2002 and Beyond was developed describing Métis political responsibility to language programming, a Michif revitalization plan, strategic directions, national direction coordination and leadership, promotion strategies for the Michif language, goals and objectives for curriculum development and teaching aids, community learning opportunities, issues regarding standardization of the language and for officially adopting Michif as the official language of the Métis (Metis National Council, 2000).

In carrying out the Michif Revival Strategy, a number of major initiatives have been accomplished. The Michif language was declared an official historic language of the Métis Nation at the Métis National Council Annual General Assembly in July 2000 (Manitoba Metis Federation, n.d.). The Métis Resource Center's website provides information and audio lessons on the Michif language (Metis Culture and Heritage Resource Centre Inc., 2002). The Virtual Museum of Métis History and Culture provides academic papers, interviews, print stories and audio and video recordings. Some of the material is in English, and other material is in the Michif language (Gabriel Dumont Institute of Native Studies and Applied Research, 2003).

In addition to Métis Nation efforts, The Keewatin Career Development Corporation in northern Saskatchewan hosts a website that includes information on the Michif language, teacher lesson plans, stories, legends, and arts education material. This material was designed for use in the Rossignol School in Ile-a-la-Crosse, a historic Métis community in Saskatchewan (Keewatin Career Development Corporation, n.d.). In the United States, a Yale University research program on endangered languages is supporting an initiative called the Camperville Michif Master-Apprentice Program (Yale University, 2003).

Mrs. Erica-Irene Daes, Special Rapporteur for the United Nations Sub-Commission on Prevention of Discrimination and Protection of Minorities of the Commission on Human Rights, Economic and Social Council, submitted a report on the Protection of the Heritage of Indigenous

Peoples in 1994 that proposed sixty principles and guidelines to achieve the goal inherent to the title of the report. The following articles help to contextualize the arguments presented in this thesis:

> 7. To protect their heritage, indigenous peoples must control their own means of cultural transmission and education. This includes their right to the continued use and, wherever necessary, the restoration of their own languages and orthographies.
>
> 14. Indigenous peoples' heritage should continue to be learned by the means customarily employed by its traditional owners for teaching, and each indigenous people's rules and practices for the transmission of heritage and sharing of its use should be incorporated in the national legal system.
>
> 16. Governments, international organizations and private institutions should support the development of educational, research, and training centres which are controlled by indigenous communities, and strengthen these communities' capacity to document, protect, teach and apply all aspects of their heritage. (United Nations Economic and Social Council, 1994, pp. 280-281)

Métis learners can be provided with Michif language programming if the systems are developed and made available. Continued involvement of Métis youth in Michif language acquisition is of critical importance to intergenerational language transmission. Submersed in popular culture, Métis youth are acculturated into dominant ideologies believing Aboriginal languages are not valuable and would stigmatize them within society. Dominant society is unlikely to convince Métis youth that the Michif language is important to learn, or provide them with reasons of protecting language diversity. These values must come from within Métis families, and be sufficiently supported by formal Canadian education systems. Métis youth of colonial society have to be taught the value of culture and language, and internalize it as a benefit to themselves and to others.

The need for diversity exists not just in ecological systems but in human systems as well. Viewing the world from different cultural perspectives gives human beings an opportunity to consider our existence in a variety of manners. When solutions to problems are needed, most consider it common sense that 'two heads are better than one', yet have difficulty accepting the idea that language diversity also provides an increase in human ability for divergent thinking and creative problem solving. At this time, where could it be more important to have creative problem solving than in mitigating the impact of over six billion people on Earth's systems with approximately 8000 languages in use worldwide? What we can learn from each other may determine our ability to survive as a species as global population numbers continue to increase

exponentially and natural ecological systems become more fragile.

Dan Moonhawk Alford (2001) provided insight into how powerful having an understanding of multiple perspectives can be when he explained his understanding of the intersection of western science, Aboriginal spirituality and language in that "when quantum physicists say the word *quantum*, it's like when Indians say *Spirit*, and when linguists say *meaning*" (Alford, 2001). Alford's involvement in dialogues between quantum physicists, Elders, linguists and other intellectuals described a fertile ground for exciting cross-cultural discussion that are an inspiration. For the Métis, Michif language training in formal education systems is a means of providing Métis People with tools to participate more fully in interdisciplinary fora and global dialogue processes. As well, Métis need to nurture the Michif language in informal contexts within homes, extended families and community events to ensure that connections to traditional teachings and epistemologies are not lost.

Having a well-researched long-term plan for Michif language revitalization will ensure ineffective language-programming methods are not used, conserving capacity to support more robust and effective Aboriginal language programming. Varieties of language programs are available but most will not produce fluent Michif language speakers. Capturing deeper epistemological understandings of language requires everyday use in context of secular and sacred parts of life. In order to accomplish this, more Michif language speakers and immersion programming are needed in education. Programming limited to one or two hours per week of study do not produce fluent language speakers.

The Common Curriculum Framework for Aboriginal Language and Culture Programs Kindergarten to Grade 12, developed as a result of the *Western Canadian Protocol for Collaboration in Basic Education* is intended as "a support document for schools or regions within Western Canada for developing curricula, learning resources or strategies for dealing with Aboriginal languages" (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000, p. 1).

A number of Aboriginal people were involved in the development of the Framework, which covers broad range of topical themes including Cultural Outcomes, First Language Outcomes, Second Language Outcomes, Language and Culture Program Development and a guide for Incorporating Specific Cultural Content. The theme of Language and Culture Program

Development provides an overview of the need for community support, identification of cultural authority, identification of language status and options for programming. (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000).

First language programming is designed for students who have an Aboriginal language as their first language. This is not generally the case with Métis learners. Second language programming is designed for learners who do not have an Aboriginal language as their first language, but is offered only as a subject of study, usually once a week learning from a workbook, with all the limitations that entails. Bilingual programs are 'partial immersion' programs that are "designed to meet the needs of first language speakers or as intensive second language program" (p. 116). Aboriginal languages are used to teach some subject matter such as language arts. While this is a preferable choice to second language programming, bilingual programs still place primary emphasis on academic content rather than cultural content (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000).

Interestingly, in the Preface of the document, Burnaby (1996) is cited in explaining that only

> In rare exceptions, bilingual or immersion programs are established, usually in schools where the majority of students speak an Aboriginal language as their first language. Largely, in the remote or "frontier" schools, the programs are focused on bridging students into instruction in English by the middle years. (p. Preface)

Yet, the Preface goes on to cite Burnaby (1996), Krausse (1996), Crawford (1995) Mackay and Myles (1995) and the Assembly of First Nations (1990) in acknowledging that even despite all the efforts of language retention that are occurring, the number of fluent Aboriginal language speakers has continued to decline, and Aboriginal Elders and leaders are concerned about problems faced by young people without identity in either Aboriginal or mainstream culture (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000).

Preserving Aboriginal languages and culture requires full-scale immersion language programming. Children can learn both formally and informally within the context of their cultures, families and languages and still build the additional skills, knowledges and languages

necessary to compete in colonial society.

In a report by Marie Battiste (2004), prepared for the Aboriginal Language Task Force of the Department of Canadian Heritage, entitled *Evaluation Measures for Aboriginal Language and Culture Project: A Literature Review*, Hinton (2001) is cited as in explaining that,

> Today, full immersion programming is perceived as the successful model, increasingly being used throughout Canada and other countries. All instruction in the classroom is carried out in the endangered Aboriginal language from preschool, through high school and into college. Significant successes have been observed among the Maori in New Zealand who initiated this model, and have successfully relayed their successes and processes to other programs elsewhere, including their sister model in Hawaii with the Punana Leo Hawaiian language programs. (Battiste, 2004, p.40)

Immersing students into such a model does require other supports. Families, communities and political organizations must remain involved in the process to ensure that linguistic continuity is maintained through the student's academic life and outside of formal schooling processes. Achieving sufficient numbers of Michif speakers will require supporting efforts of schools, families and other institutions but even more importantly it will require the ability to imagine that it is possible to achieve and will benefit Métis and others wishing to learn the Michif language.

A Michif language plan would also have to take into consideration the wide geographic regions inhabited by Métis People. Urban, rural and northern Métis communities would require adequate Michif language programming to increase numbers of fluent Michif speakers and this would require Michif immersion schools. Piloting Michif immersion schools in selected areas would provide an opportunity to develop useful curriculum resources in a local context, and gain valuable experience that would assist other Métis communities with establishing similar schools. As a secondary benefit, curriculum resources developed should be made widely available to the broader Métis community, as well as public education systems.

2.4 Preserving Biological Diversity through Indigenous Science Education

This research was inspired because of the Convention on Biological Diversity (CBD), the declaration by UNESCO on the UN Decade on Education for Sustainable Development and the need to develop Métis perspectives on CBD issues. While Canada does seek some advice from Métis, First Nations and Inuit Peoples on CBD issues, these Indigenous Peoples often find it difficult to engage in discussion of the issues as a result of human resource capacity factors.

A major factor contributing to disengagement is the currently insufficient numbers of Métis individuals with a Western Eurocentric science background who can facilitate greater understanding of CBD issues within United Nations fora and within Métis communities. Linking international issues to local science education systems is a necessary step toward developing an improved modality of science education. While political issues such as capacity play a significant role in determining what problems can be taken up within the Métis community, the underlying issue of public education's inability to generate a body of Métis academics with the skills to address biological diversity issues from an Indigenous perspective is a more fundamental problem.

Currently, in Canada, academic science education is a process based in Western Eurocentric philosophies and ideologies that are not conducive to the preservation of traditional knowledges. In order for Métis People to adequately engage in CBD issues it is important that provincial education authorities respond to the global need for traditional knowledge and perspectives regarding biodiversity and assist in the creation of appropriate educational infrastructure to support the perpetuation of that knowledge. There is a clear need to bring international, national, provincial and local science education processes into alignment, which can be met by developing Indigenous science education programming.

2.4.1 Biodiversity

The term *biological diversity* refers to the number and varieties of all living organisms found on Earth. Specifically, it is defined in terms of genes, species and ecosystems that human beings depend on for survival. At this time, approximately 1.7 million species have been identified, but exact numbers are unknown. Estimates range from five to 100 million total existing species (Interim Secretariat on the CBD, 1994).

Canada is one of the largest countries on the Earth, with approximately 13 million square kilometres of land and water. Almost 20 percent of the Earth's wilderness, 24 percent of wetlands, 20 percent of freshwater, and 10 percent of all forests are found within this country. The Earth's ecosystems, species and genetic resources support human life ecologically, spiritually and culturally (Minister of Supply and Services Canada 1995, 1995).

Human life is dependent upon a healthy global environment. All aspects of the Earth are interrelated and need to be considered in ensuring that diverse biological life forms thrive.

Growing human populations increase pressure on our natural world, making it critically important to place sustainable development as a key area of concern for all nations of the world.

2.4.2 The Convention on Biological Diversity

The Convention on Biological Diversity exists because of the committed nations of the world's willingness and ability to address issues regarding the continued existence of Earth's biological diversity. Concerns being raised within the United Nations about the need to address issues of biodiversity prompted the United Nations Environment Programme (UNEP) to convene a series of meetings in 1988 to begin discussions on the possibility of creating an international convention on biological diversity. By May 1992, an Intergovernmental Negotiating Committee agreed on the text of the Convention. The Convention on Biological Diversity opened for signature June 5, 1992, and entered into force on December 29, 1993 (Secretariat on the Convention on Biological Diversity, n.d.a).

> Signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognizes that biological diversity is about more than plants, animals and micro organisms and their ecosystems - it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. (Secretariat of the Convention on Biological Diversity, 2009d)

The 42 Articles and Annexes of the Convention on Biological Diversity are grounded in the three primary objectives laid out in Article 1 which are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (Secretariat of the Convention on Biological Diversity, 2003, p. 4).

The CBD is a global instrument, created to benefit all people. The relevance of including the CBD in this research is important because from its inception,

> The international community has recognized the close and traditional dependence of many indigenous and local communities on biological resources, notably in the preamble to the Convention on Biological Diversity. There is also a broad recognition of the contribution that traditional knowledge can make to both the conservation and the sustainable use of biological diversity, two fundamental objectives of the Convention. (Secretariat of the Convention on Biological Diversity, 2009c).

Although all of the articles, clauses and programmes of work of the CBD affect Indigenous Peoples, Article 8(j) In-situ Conservation directly addresses inclusion of Indigenous Peoples in

CBD related processes subject to the national legislation of the signing Party. This signals a desire by the collective 192 Parties of the Convention to include Indigenous perspectives, but allows each Party to determine how this might, or might not, be done. An extensive review of the intersections of biological and cultural diversity in Canada, international environmental and human rights, and legal issues on environment and self-government can be found in Peigi Wilson's work entitled Interconnections: The Symbiosis of Human Rights and Environmental Protection: An Argument for First Nation Environmental Governance (Wilson P. , 2009).

Canada led the world in 1992 in signing the CBD; a proud moment in our history, but the extent to which Métis are included in subsequent CBD work may also be limited to strict interpretations of Canadian and international law depending on the politics of our national government of the day. Conserving the biological diversity of the Earth needs to rise above the rhetoric of partisan politics to be supported by all the best possible efforts humanity can put forward. Our future may depend on it.

Formally and informally, directly and indirectly, the Convention on Biological Diversity does animate thousands of processes around the world intended to assist in meeting the objectives of the Convention. Combined with other international agreements and conventions addressing environmental issues, cultural diversity, human rights, as well as Indigenous rights specifically, international efforts to address global environmental issues have come to the fore of public awareness and need to become part of an evolving curriculum of science education that is not dismissive of Indigenous traditional environmental knowledge.

2.4.3 Canada and the CBD

Canada was the first developed country to ratify the Convention in 1992. This show of leadership helped to encourage others to support the Convention, with 192 Nations having ratified the Convention by 2009 (Secretariat of the Convention on Biological Diversity, 2009a). As a part of Canada's commitment to the Convention on Biological Diversity, the Minister of Supply and Services Canada developed the Canadian Biodiversity Strategy in 1995. Goal 2 Ecological Management provides information and strategic direction regarding the inclusion of traditional knowledge (Minister of Supply and Services Canada 1995, 1995, pp. 47-49), a guide to Indigenous Community Implementation (pp. 70-71), and general commentary on Spiritual Importance and National Identity issues of biodiversity for all Canadians (p. 11).

Since signing onto the United Nations Convention on Biological Diversity, Canada has worked to develop and carry out action plans across the country in support of its national biodiversity commitments but recognizes

> The capacity to determine how biodiversity is managed is not limited to governments. Local and indigenous communities, businesses and industries, conservation groups, research and educational institutions, and individuals must be involved in the implementation of the Strategy. Success will require a coordinated approach based on cross-sectoral cooperation and partnerships among all orders of government, non-government organizations, private sector interests and individuals. (p. 67)

Young Aboriginal learners growing up within colonial society, required by law to attend schools premised on colonial ideology at the expense of their own culture and language have no opportunity to learn traditional practices and values. Canada endorses a collaborative cooperative approach to make positive change in managing biological diversity but requires innovative approaches to changing systems that have been entrenched for generations.

In 2003, government Ministers developed a draft biodiversity science agenda addressing governance, a science community with enhanced capacity and focus, research issues and a biodiversity information network. Although all parts of the draft science agenda are relevant to Aboriginal Peoples, one strategic direction specifically addresses the need to

> Build linkages between scientific information and traditional knowledge, with a special focus on the wider application, subject to prior informed consent, of the knowledge, innovations and practices of local and indigenous communities relevant for the conservation and sustainable use of biodiversity. (Environment Canada, 2009)

With so much effort generated internationally and nationally by CBD processes, the evidence exists to provide Canadians with incentive to review how we view school science curriculum and pedagogy in elementary and secondary schools. Issues of prior informed consent in forging research relationships are also a key concern in building linkages and harvesting traditional knowledge for adaptation and use whether by school systems or governments.

2.4.4 Indigenous Peoples and the CBD

Indigenous Peoples of the world are deeply concerned with the deteriorating state of the natural world. As such, Indigenous representatives from diverse cultures and geographic areas participate in CBD forums worldwide. Bringing Indigenous perspectives to human and environmental issues contributes to the decision-making processes within the CBD. Within the

Convention text itself there are key areas where the Conference of the Parties acknowledges the need for consideration of Indigenous Peoples, including a specific reference in the Preamble which states,

> *Recognizing* the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components. (Secretariat on the Convention on Biological Diversity, n.d.a, p. 2)

As well, Article 8(j) of the Convention states that,

> Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices. (Secretariat on the Convention on Biological Diversity, n.d.a, p. 9)

In support of Article 8(j), the Secretariat of the CBD established a special Working Group, which meets to discuss the implementation of Article 8(j) and reports their recommendations back to the Conference of the Parties governing the CBD.

All text and processes of the CBD affect Indigenous Peoples of the world. It is important to note that although certain CBD clauses specifically refer to Indigenous Peoples and traditional knowledge, Indigenous Peoples' are also involved with, or impacted by, all other Articles of the CBD including jurisdictional limitations, identification and monitoring processes, in-situ and ex-situ conservation efforts, protected areas, research, and training and public education and awareness campaigns. Conversely, actions by Indigenous Peoples worldwide affect local, national and global CBD activities.

Indigenous Peoples of the world comprise a multitude of distinctive cultural and linguistic groups and bring both unique and common concerns forward in efforts to address the preservation of biodiversity. Since the inception of the CBD processes, Indigenous Peoples have raised serious concerns regarding particular issues. In Canada, issues of concern raised within CBD forums are the same as those that would affect development of an improved modality of science education within school systems that included traditional environmental knowledge. For example, some areas of concern might include consideration of national legislation concerning

First Nations, Métis and Inuit Peoples such as treaties and Aboriginal rights, lack of national legislation regarding protection of Indigenous knowledge, such as with access and benefit-sharing agreements or subsequent legal processes for Aboriginal Peoples who wish to decline requests for access to traditional knowledge, and issues of prior informed consent and intellectual property. All of these areas are currently in discussion to greater or lesser degrees nationally by world governments and internationally by such organizations as the World Intellectual Property Organization (World Intellectual Property Organization, 2009) and the World Trade Organization (World Trade Organization, 2009).

In the case of the World Intellectual Property Organization, their 2004 report entitled "Revised Draft Provisions for the Protection of Traditional Knowledge: Policy Objectives and Core Principles" describes policy objectives that recognize value, promote respect, meet the actual needs of traditional knowledge holders, promote conservation and preservation of traditional knowledge, empower holders of traditional knowledge and acknowledge the distinctive nature of traditional knowledge systems, support traditional knowledge systems, contribute to safeguarding traditional knowledge, repress unfair and inequitable uses, concord with relevant international agreements and processes, promote innovation and creativity, ensure prior informed consent and exchanges based on mutually agreed terms, promote equitable benefit-sharing, promote community development and legitimate trading activities, preclude the grant of improper intellectual property rights to unauthorized parties, enhance transparency and mutual confidence, and complement protection of traditional cultural expressions (p. 1). This is only a single example of the kinds of issues being discussed internationally regarding the use of traditional knowledge. If Canadian school systems are to move in the direction of developing improved modalities of science education involving traditional environmental knowledge, there are significant areas of caution, such as those mentioned above, that educators need to be cognizant of in extracting any type of traditional knowledge from Aboriginal communities. Currently, there is little to no guidance for educators with respect to these issues, or issues related to Indigenous community protocols, which can be even more complex and diverse. Issues of concern raised in this section should not be seen as a deterrent in the development of science education, but as incentive for inclusion as part of the learning process.

The concerns of Indigenous Peoples are varied and no single document will ever capture all concerns or nuances of each issue. While the purpose of the CBD, and other agreements, are

noble and provide a method for positive change concerning the natural world, they are not without their challenges and imperfections. In spite of the political and legal issues they raise, the future of human life may depend on our ability to resolve the issues collaboratively. Sustaining a complex ecological global environment will require diverse perspectives from the human life that is a part of it.

2.4.5 Métis People and the CBD

Métis People believe that the celebration and preservation of Métis society, culture, identity, language, history and traditional knowledge are at the heart of all work towards creation of a model of educational change which reflects the wishes of the Métis Nation (Hodgson-Smith, 2005, p. 9). Métis recognize and value their Aboriginal ancestors who have lived on the land over many hundreds of generations, who came to share their knowledge with new settlers, and who passed on knowledge and a connection to the land, which endures within the Métis People to present day.

> This connection to the land has provided Métis with an extensive body of knowledge, values, beliefs and practices that is often referred to as traditional knowledge. This knowledge, which has been passed down orally and through land-based experience, is the foundation of Métis identity and survival. Métis Traditional Knowledge (MTK) continues to have relevance in current times and draws its' strength from being used, adapted and continuously updated to take into consideration new knowledge. Métis, as a mixed culture, have a traditional knowledge set that is unique from other aboriginal groups. Métis hold this knowledge in trust for future generations in the belief that this knowledge is of benefit to Métis and to non-aboriginal society. Métis believe the best way to ensure the survival of MTK is to continue to use it and share it in a matter that respects this knowledge and our knowledge holders. (Metis Nation British Columbia, 2009, p. 11)

Today, the representative body of the Métis People in Canada, the Métis National Council, has had only limited involvement in the work of the Convention on Biological Diversity (CBD). Canada, through Environment Canada's Biodiversity Convention Office has offered some support for participation of the Métis Nation at major CBD meetings, but generally, the Métis lack the financial capacity to build an infrastructure that would ensure adequate expertise to review and analyze some of the hundreds of documents generated by the CBD processes in order to contribute Métis perspectives. Capacity issues mean Métis are greatly challenged in their ability to engage in CBD processes in a meaningful way.

For generations, Métis People have had negative experiences with Canadian educational

systems because of racism, exclusion or marginalization, and residential school experiences. While things have improved to some degree for Métis students as a result of increased Aboriginal awareness within the non-Aboriginal population, there is still a need to increase numbers of Métis individuals in the professional workforce. The Métis have no treaties in Canada. Financial support for post-secondary education, if available, is largely relegated to programs 52 weeks or less (Metis National Council, 2004b, p. 11). For most Métis individuals interested in pursuing academic careers in university sciences, financial burdens and lack of other supports are simply too great to overcome.

Métis People living today find themselves no longer able to access the traditional lands of their ancestors, and for most, not able to access an advanced academic education. Yet, the opportunity, and need, to contribute perspectives on Métis traditional knowledge in Canadian sectors such as law, health, education and environment is very real. The dilemma of responding to this opportunity may be resolved within the education sector, which provides root experience to all other sectors. The urgent need to address environmental issues, such as the preservation of biological diversity, may be the catalyst required to inspire a new modality of science education in educational programming based on traditional knowledge and which can help bring new understanding to mainstream environmental sciences, concepts and practices with a holistic inclusive approach, rather than the positivistic exclusionary approach currently dominating Western scientific thought.

The potential impact of the CBD on Métis People is serious, providing impetus for Métis involvement. CBD discussions and decisions made regarding thematic areas, programmes of work and expert groups influence Canadian activity, policy and legislation. To respond effectively, the Métis need to be adequately prepared and involved. Issues of capacity building must be addressed nationally, especially considering certain terms of the CBD prefaced with the clause “subject to national legislation” (Secretariat of the Convention on Biological Diversity, 2003, p. 8). While the CBD provides useful guidance on a global scale, the Métis are caught in a situation where national legislation concerning Métis rights is insufficient to address equitable involvement. In this regard, Métis People share a situation similar to other Indigenous Peoples of the world. Insufficient capacity, coupled with a lack of recognition of Métis rights, create major impediments to Métis involvement in CBD processes.

While legal challenges by the Métis continue within Canada, issues of education are, perhaps, more immediate factors in future participation. Canadian education systems are failing Métis learners. The process of indoctrinating Métis People, and others, into Western Eurocentric mainstream education systems has not been effective, resulting in a widening gap between educational achievements of mainstream Canada and Aboriginal learners in general. In the case of First Nations' on-reserve education in Canada, Canadian Auditor General Sheila Fraser released information in the November 2004 Auditor General's report commenting that in spite of Canada spending a billion dollars on Native education, fewer Aboriginals are graduating from high school than non-Aboriginals. Fraser also commented that current statistics show it could take as much as 28 years for Native graduation rates to catch up (CBC/Radio-Canada, 2004; Her Majesty the Queen in Right of Canada, 2003, 2004). The Métis Nation does not receive this primary and secondary educational funding from Indian and Northern Affairs Canada, but the educational attrition of First Nations youth is a tragic indicator of the failure of Canadian education systems to meet the needs of all Aboriginal students.

Unfulfilling education coupled with the systematic removal of Métis People from traditional land use over several generations' results in a combination of forces lethal to the perpetuation of Métis traditional cultural practices. Indigenous inclusion in CBD processes today requires the provision of traditional perspectives concerning biodiversity. The inability of Métis People to access traditional lands freely and lack of educational processes supportive of perpetuating Métis traditional knowledge creates a serious participatory challenge in Métis efforts to collaborate with national and international fora on the preservation of global biodiversity.

2.4.6 Traditional Knowledge and the CBD

Traditional knowledges held by Indigenous Nations and local communities have been accepted by 192 countries as important factors within the United Nation's Convention on Biological Diversity and associated processes. In preparing for 2010, which has been deemed the International Year of Biodiversity by the United Nations, CBD Executive Director Ahmed Djoghlaf stated, "I firmly believe that the survival of species and the survival of traditional knowledge and of the holders of this knowledge are inextricably linked" (Secretariat of the Convention on Biological Diversity, 2009c, p. 1). Recognizing the vast body of biodiversity-

related knowledge held by Indigenous and local communities in managing the environment, the CBD commented in a 2009 press release that "The refined body of knowledge that indigenous and local communities have handed down orally from generation to generation are not only of direct value to these societies but also of considerable value to humankind as a whole" (Secretariat of the Convention on Biological Diversity, 2009c, p. 1) Djoghlaf believes a specific vision and target are required "to meet the unprecedented multiple crises facing humanity compounded by climate change" and that to do this "we will need to learn and be inspired by the wisdom of our ancestors and the vision of today's guardians of the traditional knowledge of mankind" (Secretariat of the Convention on Biological Diversity, 2009c, p. 2).

There are many interpretations of the meaning of traditional knowledge, one of which has been made by the Secretariat of the Convention on Biological Diversity. It has been agreed that,

> Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, and forestry. (Secretariat on the Convention on Biological Diversity, n.d.b)

Catherine Beaudoin (2001) explains that over the past two decades, Indigenous People's traditional knowledge has become recognized internationally for its importance to sustainable development, environmental protection, resource management, conservation of protected areas, biodiversity, social development and environmental ethics. While there is no universally accepted definition of traditional knowledge, common characteristics do exist. Beaudoin (2001) cites Brockman (n.d.), Lambrou (1996, 1997), and RCAP (1996) in saying

> TK emerges from Aboriginal Peoples' relationship to the natural world. It is holistic and permeates all activities, approaches and understandings and has spiritual and practical aspects. Spiritual refers to value based cosmological and ethical beliefs of Indigenous societies. Practical includes an understanding of the physical aspects of the environment and explanations of environmental phenomena based on cumulative, collective experience, tested over centuries by people who required a sophisticated and practical knowledge of the land on which they depended for every aspect of life. TK is knowledge of the land that has been passed through generation, orally in a dynamic evolving way. (Beaudoin, 2001, p. 3)

Understanding the concepts and scope of traditional knowledge across Indigenous cultures would be a difficult, if not impossible, undertaking. The diversity of knowledges and contextual application of these knowledges are complex systems that extend beyond scientific analysis or literary review. Beaudoin (2001) cites Brockman in suggesting reasons for the erosion of traditional knowledge in Canada include the loss of Aboriginal languages; lack of TK in the curriculum of 'Western' schools; and reduction in wildlife stocks and traditional economies because of Westernization and industrial activities, which results in loss of traditional lifestyle and TK (Beaudoin, 2001, p. 3).

Métis traditional knowledge exists with remaining generations of individuals who have been able to retain some connection to traditional land use. As with other Indigenous groups, it is usually held by elderly generations who still speak their mother tongue, and have grown up in non-urban environments. The loss of elderly members of the Métis community and lack of access to meaningful traditional education for younger generations means fewer and fewer Métis have access to ancestral traditional environmental knowledge processes that rightfully belong to them. Without the basis of ancestral knowledge, contemporary colonial school curriculum offering only a Eurocentric science curriculum effectively ends the cycle of perpetuating traditional knowledge by continuing the process of assimilation in Canada. This is not only a tremendous loss to the Métis Nation, but to global collaboration on the conservation of biodiversity.

2.4.7 Terminology Used for Traditional Knowledge

As the concept of traditional knowledge is explored, efforts are being made by a variety of individuals, groups and organizations to define it for a variety of purposes. It is difficult, if not impossible, to label and define traditional knowledge, but in the interest of advancing discussion, a number of terms have become commonly used by both Indigenous Peoples, and non-Indigenous people, when referring to traditional knowledge, or to forms of traditional knowledge. In 2002, The World Intellectual Property Organization published a *List of Various Terms Given to Traditional Knowledge* that has emerged to date.

The list includes terms such as Traditional Knowledge (TK), Indigenous knowledge, Community Knowledge, Traditional Ecological Knowledge, Local Knowledge, Traditional Environmental Knowledge, Aboriginal Tradition, Cultural Patrimony, Folklore, Expressions of

Folklore, Cultural Heritage, Traditional Medicine, Cultural Property, Indigenous Heritage (Rights), Indigenous Cultural and Intellectual Property (Rights), Indigenous Intellectual Property, Customary Heritage Rights, Traditional Knowledge, Innovations and Practices, Popular Culture, and Intangible Component (World Intellectual Property Organization, 2002, p. 8).

While this list is not exhaustive, it is helpful to understanding that the term 'traditional knowledge' is not used in a standard manner. Utilization of the term 'traditional knowledge' to describe a pan-Indigenous knowledge set, or epistemology is somewhat comparable to using the term 'Indigenous' to describe a portion of the human race. While these terms have some functionality, they convey an abstract message that is difficult to define further. Some organizations and researchers, however, have made an effort to conceptualize traditional knowledge within specific contexts and for specific purposes.

2.4.8 Defining and Applied Frameworks of Traditional Knowledge

Significant problems arise when attempting to define traditional knowledge within Eurocentric frameworks. Mr. Capotorti, Special Rapporteur for the United Nations, provided insight in this regard in a 1991 publication entitled *Study on the Rights of Persons Belonging to Ethnic, Religious and Linguistic Minorities*. He said "Precise universal definition, while of philosophical interest, would be nearly impossible to attain in the current state of global realities, and would in any event not contribute perceptibly to the practical aspects of defending groups from abuse" (Battiste & Henderson, 2000, p. 35).

Battiste and Henderson (2000) expand this thought by identifying three primary problems with defining Indigenous knowledge. They explain that Indigenous Peoples do not carry similar concepts of 'culture' in keeping with Eurocentric concepts of 'culture'; Indigenous knowledge is not a uniform concept among all Indigenous Peoples, it is diverse and exists in varying layers and often those who possess it cannot categorize it into Eurocentric categories because the knowledge does not exist in this manner; and that the knowledge held by individuals, clans, bands or communities cannot easily be separated from the user as it is part of their existence and normal usage (p. 36).

Dr. Erica-Irene Daes, Chairperson-Rapporteur of the UN Working Group on Indigenous Populations, explained in a 1994 report on the protection of the heritage of Indigenous Peoples,

that Indigenous knowledge is "a complete knowledge system with its own concepts of epistemology, philosophy, and scientific and logical validity" (p. 41). She says also that any Indigenous knowledge system "can only be fully learned or understood by means of the pedagogy traditionally employed by these peoples themselves, including apprenticeship, ceremonies and practice" (p. 41). In addition, she places emphasis on the fact that the "central and indispensable classroom" (p. 41) of Indigenous knowledge systems is found in the land and ecology. Dr. Daes explains that one does not learn Indigenous perspectives from literature, but rather, one must employ a different method of research which involves direct learning from Indigenous Elders of each language group, taking responsibility for the knowledge that is learned and employing it in ones daily life in order to renew the knowledge (p. 41).

Battiste and Henderson (2000) provide further insights on the Traditional Ecological Knowledge of Indigenous Peoples of North America, saying traditional knowledge,

> ...is scientific, in the sense that it is empirical, experimental, and systematic. It differs in two important respects from Western science, however: traditional ecological knowledge is highly localized and it is social. Its focus is the web of relationships between humans, animals, plants, natural forces, spirits, and land forms in a particular locality, as opposed to the discovery of universal "laws". It is the original knowledge of Indigenous peoples. Indigenous peoples have accumulated extraordinarily complex models of species interactions over centuries within very small geographical areas, and they are reluctant to generalize beyond their direct fields of experience. Western scientists, by contract, concentrate on speculating about and then testing global generalizations, with the result that they know relatively little about the complexities of specific local ecosystems. As a consequence of these different levels of analysis, the Indigenous people who have traditionally lived within particular ecosystems can make better predictions about the consequences of any physical changes or stresses that they have previously experienced than scientists who base their forecasts on generalized models and data or indicators from relatively short-term field observations. (Battiste & Henderson, 2000, p. 44)

2.4.8.1 The World Intellectual Property Organization

A working definition of traditional knowledge was created by WIPO for exploratory work done in 1998-1999. For that purpose they said,

> 'traditional knowledge'...refer[s] to tradition-based literacy, artistic or scientific works; performances; inventions; scientific discoveries; designs; marks, names and symbols; undisclosed information; and all other tradition-based innovations and creations resulting from intellectual activity in the industrial, scientific, literary or artistic fields. "Tradition-based" refers to knowledge systems, creations, innovations and cultural expressions which: have generally been transmitted from generation to generation; are generally regarded as pertaining to a particular people or its territory; and, are constantly evolving in response to

> a changing environment. Categories of traditional knowledge could include: agricultural knowledge; scientific knowledge; technical knowledge; ecological knowledge; medicinal knowledge, including related medicines and remedies; biodiversity-related knowledge; "traditional cultural expressions" ("expressions of folklore") in the form of music, dance, song, handicrafts, designs, stories and artwork; elements of languages, such as names, geographical indications and symbols; and, movable cultural properties. Excluded from this description of Traditional knowledge would be items not resulting from intellectual activity in the industrial, scientific, literary or artistic fields, such as human remains, languages in general, and other similar elements of "heritage" in the broad sense". (World Intellectual Property Organization, n.d., p. 3)

It is unlikely that any Indigenous Nation would attempt to define traditional knowledge comprehensively. Literary efforts become an onerous situation of trying to fit round concepts into square words. Defining traditional knowledge will never be accomplished adequately, but existing efforts do serve some useful purposes. Broad generalizations of traditional knowledge or perspectives offered by certain Indigenous Nations can be used as stepping-stones for Indigenous Peoples or local communities without literal interpretations of their traditional knowledge. Caution, however, must be exercised in avoiding universal assumptions that do not adequately capture distinctive differences between local manifestations of traditional knowledge.

Indigenous Nations, including the Métis Nation, must have the capacity to undertake internal discussions on the subject of traditional knowledge, including traditional environmental knowledge, in order to address the issues contributing to declining use of the knowledge. Long-term plans leading to effective solutions for the perpetuation of traditional knowledge must be community-based solutions. In the absence of comprehensive discussions, Métis People cannot respond to national or international organizations who wish to ensure traditional knowledge has a place of value in conserving the Earth's biodiversity.

2.4.8.2 The Convention on Biological Diversity: Articles 1, 15, 8(j), and 13

The United Nations effort to include Indigenous perspectives in CBD processes is an important step in encouraging global nations to see intrinsic value in preserving and perpetuating traditional knowledge regarding biodiversity. The following selected portions of the Convention on Biological Diversity are key areas in Canada's future environmental and educational sectoral policy developments.

Article 1: Objectives of the CBD

Article 1 provides the orientation for all CBD work. The three objectives identify conservation, sustainability and sharing as key concepts, all of which are compatible with traditional environmental knowledge. Specifically, Article 1 says,

> The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding. (Secretariat on the Convention on Biological Diversity, n.d.a, p. 4)

Article 15: Access to Genetic Resources

Access to Genetic Resources is part of a larger discussion on Access and Benefit-Sharing which includes references to portions of the Preamble of the CBD, Articles 1, 8(j), 15, 16, 17, 18, 19, 20 and 21 of the CBD, and subsequent programme developments all concerned with facilitating access to biological genetic resources and ensuring resulting benefits are shared equitably. This is relevant to issues of Indigenous traditional knowledge since genetic resources from plants, animals (excluding humans) and microorganisms are in demand for research and potential development and commercialization. Indigenous traditional knowledge gathered by educators and published for use in school systems could potentially compromise Indigenous Peoples right to benefit sharing from that knowledge. This may initially seem like a deterrent, but resolution of issues related to access to genetic resources is intended to assist in facilitating access legally rather than allow acts of piracy. Clause one of the Article sets out the CBD position "Recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation" (Secretariat on the Convention on Biological Diversity, n.d.a, p. 13).

In 2002, the Bonn Guidelines on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising out of their Utilization were adopted by the COP (Secretariat of the Convention on Biological Diversity, 2002). While the Bonn Guidelines are not legally binding, they provide a good orientation to the issues involved with ABS, including ethical responsibilities of negotiating parties. At the seventh Conference of the Parties held in 2004, it was decided to proceed with the negotiation of an international regime to implement Article 15 Access to Genetic Resources and Article 8(j) concerning traditional knowledge, as well as the three objectives of the Convention mentioned earlier. This work is targeted for completion in 2010 (Secretariat on the Convention on Biological Diversity, 2009e).

The Métis, although recognized in the *Constitution Act, 1982* as one of the Aboriginal Peoples of Canada, have few recognized legal rights and no land base. The Métis National Council requires adequate capacity to participate effectively in critical discussions on Access and Benefit-Sharing (ABS), which ultimately affect upon all Métis in Canada. National jurisdictional issues leave significant gaps in capacity creating barriers to collaborative discussion and inclusion of Métis perspectives on issues of Access and Benefit-Sharing and the determination of future direction regarding the preservation of Métis traditional knowledge. For example, access and benefit sharing for the Métis could include compensation for educational programming supportive of the perpetuation of Métis traditional environmental knowledge that contributes to the preservation of biodiversity as well as Métis culture and language.

Article 8(j) and Related Provisions

Article 8: In-Situ Conservation contains references in clause (j) to traditional knowledge, innovations and practices. Specifically Article 8(j) says,

> "Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;" (Secretariat on the Convention on Biological Diversity, n.d.a, p. 9)

With respect to Métis interests, the application of the Convention on Biological Diversity rests in the determination and implementation of appropriate national legislation. The Métis cannot be adequately, or equitably, involved in CBD processes nationally as long as there is insufficient national legislation regarding the protection and preservation of Métis traditional knowledge, innovations and practices.

The international community recognizes the interdependence of Indigenous Peoples and biodiversity and a result of the adoption of the CBD,

> Many Governments are now in the process of implementing Article 8(j) of the Convention through their national biodiversity action plans, strategies and programmes. A number of Governments have adopted specific laws, policies and administrative arrangements for protecting traditional knowledge, emphasizing that the prior informed consent of knowledge-holders must be attained before their knowledge can be used by others. (Secretariat on the Convention on Biological Diversity, 2004e)

The Canadian Biodiversity Strategy also recognizes the value of traditional knowledge in the conservation and sustainable use of biological diversity. Canada says, "Traditional knowledge can provide an excellent basis for developing conservation and sustainable use policies and programs. All too often, however, traditional knowledge is inappropriately used or disregarded by policy-makers, scientists, resource planners and managers" (Minister of Supply and Services Canada 1995, 1995).

Canada recognizes the reluctance traditional knowledge holders may have in sharing information out of concern that it will be used inappropriately or without permission. In light of these concerns, Canada committed in Strategic Direction 2.3 to "Identify mechanisms to use traditional knowledge, innovations and practices with the involvement of the holders of such knowledge, innovations and practices, and encourage the equitable sharing of benefits arising from the utilization of such knowledge, innovations and practices" (Minister of Supply and Services Canada 1995, 1995). Identifying mechanisms will require collaboration between Canada and the Métis Nation to ensure culturally relevant processes are developed and respected.

Article 13: Public Education and Awareness

Article 13 of the Convention on Biological Diversity contains two clauses addressing the need for public education and awareness on the conservation of biological diversity. The clauses say the Parties shall:

> (a) Promote and encourage understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes; and
>
> (b) cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity. (Secretariat on the Convention on Biological Diversity, n.d.a, p. 11)

The need to raise awareness on the importance of conserving biological diversity exists not only within the Canadian public at large, but also within educational institutions. Empowering younger generations of Canadian citizens is a key factor in ensuring sustainable development and conservation remains embedded in the consciousness of individuals regardless of the sector within which they choose to work. Environmental issues affect all life on Earth, and must become cornerstones of thought in the diverse areas within which we live and work.

The United Nations Educational, Scientific and Cultural Organizations (UNESCO) declared 2005 - 2014 to be the UN Decade on Education for Sustainable Development. In launching this initiative, UNESCO Director General Koïchiro Matsuura declared,

> We no longer have a choice, either humanity adapts its behavior to support sustainable development, meaning it ceases to pollute the environment, allows the renewal of natural resources and contributes to improve everybody's well-being, or it signs its own, more or less imminent, death sentence. Education plays a crucial role in training citizens. However, it is not always suited to the needs of future societies, both in developed and in developing countries. Environmental and cultural heritage education, for instance, does not always have the place it deserves in school curricula, and the links between culture and the sciences are not adequately emphasized. (United Nations Educational, Scientific and Cultural Organization, 2005)

These words by the UNESCO Director General emphasize the very real nature of our environmental crises and the need for all people to support a dramatic change the way we use the gifts of the natural world to sustain our lives. In a further course of action, UNESCO coordinated the development of the International Implementation Scheme for the UN Decade of Education for Sustainable Development designed to integrate ideas of sustainable development into educational, and other, systems (United Nations Education, Scientific and Cultural Organization, 2005b). The report draws from the four major thrusts of Agenda 21, which includes improving access to basic education, developing public understanding and awareness of sustainability, reorienting existing education programmes and providing training. Explicating the reorientation of existing education programmes, the report warns,

> More basic education as it is currently taught will not create more sustainable societies. The conundrum remains, that it is educated nations that leave the deepest ecological footprints, using large amounts of resources and energy to support their lifestyles. Creating a more sustainable future will not occur simply by increasing the amount of education; instead, it is an issue of content and relevance. Questioning, rethinking, and revising education from pre-school through university to include more principles, knowledge, skills, perspectives and values related to sustainability in each of the three realms – environment, society, and economy – is important to our current and future societies. This should be done in a holistic and interdisciplinary context, engaging society at large, but carried out by individual nations in a locally relevant and culturally appropriate manner. (United Nations Educational, Scientific and Cultural Organization, 2005c, pp. Annex II - Page 4)

As well, the CBD global initiative on Communication, Education, and Public Awareness (CEPA) works to promote understanding within the public on biodiversity and the measures required for the conservation of biodiversity.

Raising awareness within the Métis community on biodiversity issues can be partially achieved within the context of public initiatives, but long-term initiatives specifically designed for Métis People will be key to effective long-term engagement of the Métis community that goes beyond awareness-raising to practical action.

2.4.8.3 The 2010 Biodiversity Target

At the sixth Conference of the Parties to the Convention on Biological Diversity, involved Parties committed "to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth" (Secretariat of the Convention on Biological Diversity, 2004b). Progress and evaluation of achievements within the context of the CBD will be measured within a framework of the following focal areas:

> (a) Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems; (ii) species and populations; and (iii) genetic diversity;
>
> (b) Promoting sustainable use of biodiversity;
>
> (c) Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change.
>
> (d) Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;
>
> (e) Protecting traditional knowledge, innovations and practices;
>
> (f) Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources; and
>
> (g) Mobilizing financial and technical resources, especially for developing countries, in particular least developed countries and small island developing States among them, and countries with economies in transition, for implementing the Convention and the Strategic Plan. (Secretariat on the Convention on Biological Diversity, 2004d)

Over the past several years, the Conference of the Parties and a variety of consultative groups has worked diligently to develop CBD processes at an international level. National governments are also working to develop practical and acceptable methods of meeting CBD goals and 2010 biodiversity targets. CBD discussions are ongoing, and will continue to grow with new information and participation by global society. The CBD Goals and the 2010 Biodiversity Targets should not be seen as something locked in time, but as a milestone that will give rise to a continued effort post-2010. Outside CBD fora, it is critical that all Canadian citizens have an opportunity to learn about the processes, and make decisions about our personal

and collective roles in conserving the Earth's biodiversity.

As a political organization, the Métis National Council is working toward national recognition of Métis rights and creating opportunities for improving the lives of Métis Nation citizens. This work includes addressing serious socio-economic issues in several sectors. Although the Métis National Council has an Environment portfolio, participation in biodiversity conservation initiatives may not be seen as a priority for Métis citizens dispossessed from ancestral lands and facing personal daily hardships in contemporary life. A forced reconciliation of responding to global environmental issues with fragile traditional environmental knowledge processes at a local level may be impossible without support.

Instead, an opportunity exists for federal, provincial and Métis authorities to address the inclusion of Métis People in future biodiversity conservation efforts by increasing environmental protection and awareness through strategic planning in foundational ecological education. This would require building a strategic plan capable of addressing new educational programming with research ethics respecting relationships and needs of Métis communities.

2.4.8.4 Research Ethics and Traditional Knowledge

Any research activity involving Indigenous traditional knowledge ethically requires observance of Indigenous community protocols, just as ethical academic research processes guide researchers. In the case of research on Indigenous traditional knowledge involved parties are then governed by at least two sets of ethics.

Internationally, the CBD's Seventh Conference of the Parties Decision VII/16, published in The 2010 Biodiversity Target: A Framework for Implementation (2004), regarding Article 8(j) and Related Provisions contains the *Annex: Elements of a Plan of Action for the Retention of Traditional Knowledge, Innovations and Practices of Indigenous and Local Communities Embodying Traditional Lifestyles Relevant for the Conservation and Sustainable Use of Biological Diversity* (p. 199). The Annex outlines a series of recommendations including section *C. Research Ethics* and section *D. Research on and implementation of mechanisms and measures to address the underlying causes of the decline of traditional knowledge, innovations and practices*. As well, the Annex outlines key educational points in *E. Capacity-building, education and training* (Secretariat on the Convention on Biological Diversity, 2004c, pp. 199-202).

Section C. Research Ethics of the Annex encourages reviewing codes of ethics and conduct already in use by Indigenous Peoples, researchers or businesses and the use of them to guide further research or to develop codes where none exist (p. 200). Section D of the Annex encourages research on new and existing threats to the use and retention of traditional knowledge as well as guiding recommendations on the need for cooperative mechanisms, recognition of Indigenous land tenure, resolution of land claims, management of protected areas, legislation to protect traditional knowledge, mitigation of perverse incentives, knowledge exchange on incentives, and mobilization of financial and technical resources in support of traditional knowledge (pp. 200-201). Knowing how to conduct ethical research and knowing what types of issues require additional research naturally leads to thought on what can be practically done with such information. Section E of the Annex lays out recommendations for CBD Parties which is described in Section 2.4.8.5.

The ethics of writing about, or recording, traditional knowledge, including traditional environmental knowledge, is a major subject of discussion within local, national and international forums. Even in efforts to define it, traditional knowledge has been given a variety of implicit and explicit definitions, depending upon the particular forum within which it is being used. There has been a significant amount of literature generated on the general topic of traditional knowledge, providing a variety of insights into understanding what traditional knowledge is and how it should be treated. Having literature generated on traditional knowledge is helpful in having it valued by global societies, but it is important to critique such literature carefully. In examining published commentary on traditional knowledge, or in bringing the subject of traditional knowledge into a specific discussion impacting a particular Indigenous group, it is important to consider under what research ethic the literature was generated, and by whom, who is participating in the discussion, what parameters for traditional knowledge are inferred or defined, what expertise is being drawn upon within the discussion and for what purpose the discussion is occurring. Establishing a framework for thinking about traditional knowledge using some guidelines is an important first step in establishing the validity of a publication or discussion, and bringing critical analysis and evaluation to any resulting dialogue.

The importance of working from some form of guide is useful because any type of generalized discussion on traditional knowledge may easily become superficial since traditional knowledge does not truly exist in a generalized manner. ‘Traditional knowledge’ is simply an

English language term that has been invented and used to name a set of complex and unique knowledge systems held by Indigenous Peoples of the world. Though the knowledge systems may share some common characteristics, there is no one comprehensive definition or explanation of traditional knowledge. The lack of a comprehensive definition or explanation of traditional knowledge is consistent with the variable nature of traditional knowledge across cultures, language groups and specific subject matter.

The active and dynamic debate currently existing in forums regarding the use of Indigenous traditional knowledge in environmental, health, economic and other sectors has sparked a number of research projects and publications among those seeking to build a public knowledge base on the subject. With some exceptions, two steams of information are available on the concept of traditional knowledge. One stream of information has been generated by non-Indigenous people, the other generated by Indigenous Peoples themselves. Streams of literature available are quite different in both the manner it is presented, and the purpose for which it has been constructed. On one hand, information generated by non-Indigenous people on the subject of traditional knowledge tends to seek specific definitions, attempt direct comparisons with Western-style knowledge paradigms and have harnessing traditional knowledge for commercial purposes as a goal. On the other hand, information about traditional knowledge generated by Indigenous Peoples generally does not seek specific definitions, nor attempt direct comparisons with Western-style knowledge paradigms and tends to be provided as an educational tool for learning how to respect traditional knowledge and traditional knowledge holders for the purpose of sustaining life on Earth. The dichotomy of thought and commentary is quite apparent, with a spectrum of attitudes found within the literature ranging from demanding and uninformed to spiritual and respectful. There is some literature that does cross over or does not fall into one stream or another specifically.

Indigenous writers such as Marie Battiste, James (Sa'ke'j) Youngblood Henderson, Willie Ermine, Linda Tuhiwai Smith, Graham Smith, Leroy Little Bear, Bonnie and Eduardo Duran and many others have written extensively about concepts of traditional knowledge, impacts of colonization, rebuilding Indigenous Nations and research issues which are helpful to understanding the realm of traditional knowledge. Authors such as these have studied particular traditional knowledge systems and know the many obstacles faced by Indigenous Peoples over generations in retaining their knowledge, and some of the challenges they will face in the future.

One of the biggest challenges at this time is keeping Indigenous traditional knowledge Indigenous.

Work done by Indigenous Nations and their allies to advance goals and objectives concerning the protection of traditional knowledge has occurred out of concern for the preservation of the integrity of forms of traditional knowledge. Continuing efforts by national governments must employ methodologies and ethical frameworks that will systemically facilitate and advance legitimate discussion on traditional knowledge.

Contemporary communication technology and increased numbers of researchers have generated a significant amount of literature readily available to the public. Yet few, if any, controls exist to screen research and commentary on traditional knowledge. The increased demand for Indigenous knowledge by governments and scientific research institutions has generated so many 'researchers' and consultation fora, a colloquial term has emerged known as *consultation fatigue* used to describe what many Indigenous Peoples experience. Many Indigenous Peoples feel that they are being 'studied to death'; with little or no benefit resulting for their communities in terms of capacity building or product. Some researchers who do not, or cannot, interface first-hand with traditional knowledge holders simply develop positions on the subject and publish as they wish. Other researchers have published inaccurate information to the detriment of Indigenous communities and scholarly communities, which has given rise to Indigenous communities speaking out against this type of activity. Bonnie Duran and Eduardo Duran chastise comment,

> As we move into the next millennium, we should not be tolerant of the neocolonialism that runs unchecked through our knowledge-generating systems. We must ensure that journals, media, and other avenues for the dissemination of thought have "gatekeepers" who understand the effects of colonialism and are committed to fighting any perceived act of hegemony over our communities". (Duran & Duran, 2000, p. 88)

A review of the amount of information currently available to the public now on the subject of traditional knowledge reveals an ominous absence of materials available from within Indigenous Nations themselves. While the subject of traditional knowledge has reached the highest levels of national and international governing bodies, many Indigenous Nations are still not able to engage in those discussions. Position papers, or statements, on traditional knowledge emerging from specialized groups or individuals provide some value to initiate discussion, but does not negate the need for broader discussions, research and publication by Indigenous Nations.

Accomplishing broader discussions and research would serve two very important purposes. First, it would provide an avenue within specific Nations for disseminating information and stimulating discussion on current activity concerning traditional knowledge research. Second, it would provide an opportunity for formal position statements by specific Nations regarding traditional knowledge. Without adequate participatory processes, discussions on traditional knowledge will remain outside the control of Indigenous Nations, which is undesirable and unethical.

Within Indigenous Nations, the subject of traditional knowledge is not up for debate, deconstruction or exploitation. Some Indigenous Nations have put forward an opportunity to share facets of their traditional knowledge, but expect that both they and the knowledge shared would receive the same respect and treatment in which the knowledge exists. If governing nation-states, their representatives, researchers or expert advisors do not have the ability to learn and demonstrate this respect, there is little chance that the traditional knowledge shared will be utilized in an appropriate manner.

Dr. Kelly Bannister, University of Victoria, has examined a number of legal and ethical issues with respect to ownership and control of traditional knowledge, including those arising from the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans adopted in 1998 by the Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council (SSHRC) and the Canadian Institutes of Health Research (CIHR) and which governs research at institutions to which they provide financing. Dr. Bannister raises questions regarding the lack of explicit policy in research ethics on ownership and control of knowledge, given that research involving traditional knowledge can be a means of establishing proprietary rights in the knowledge. She examines internal processes of technology transfer used by the universities studied, and highlights the copyright and patent policies employed by each as well as the legal and ethical dilemmas this could present for both the universities and researchers with respect to the study of traditional knowledge. Part of these potential dilemmas concern the use of published research by third parties. In the case of her research done with the Secwepemc First Nations, the completed dissertation was placed in restricted access, remaining unpublished and uncatalogued in the national library system (Bannister, 2003). Although Dr. Bannister's concerns are targeted at ethical research guidelines and intellectual property ownership policies at universities in British Columbia, it is unlikely that

the issues are dissimilar in other research facilities across Canada.

In the Spring of 2004, the Interagency Advisory Panel on Research Ethics, mandated by NSERC, SSHRC and CIHR, partnered with the Indigenous Peoples' Health Research Centre (IPHRC) to provide a review of key issues regarding ethical research involving Aboriginal Peoples in keeping with Section 6 of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. The research team, comprised of both Indigenous and non-Indigenous people, produced a report in July 2004 entitled *The Ethics of Research Involving Aboriginal Peoples* in which they reviewed issues raised in literature since the mid 1990s (Indigenous Peoples' Health Research Centre, 2004). The report makes several recommendations but all are rooted in the key recommendation that the Tri-Council acknowledge jurisdiction of Indigenous Peoples over their cultures and knowledges. All research would result from mutually agreed relationships and negotiated terms of reference. The recommendations contained in the report can help to establish a new paradigm for research work involving Aboriginal Peoples.

The IPHRC report provides a theoretical framework, analysis of the issues of divergence, trends, analysis of gaps in the Tri-Council Policy Statement, thoughts on convergence and recommendations. Though the scope of the report is limited to the needs of those administering the Tri-Council Policy Statement, it provides a model that should be considered by Indigenous Nations when undertaking internal policy development processes. The report does not explicitly address how research information, contained in either the IPHRC report or the Tri-Council Policy Statement, would be shared with Indigenous Nations, or if this would be a matter left to a case-by-case basis within the defined scope described as the "Ethical Space" (p. 19) within the IPHRC report. The usefulness of the IPHRC report and the Tri-Council Policy Statement will be limited to researcher needs only if Indigenous Nations do not have the capacity to access the information and analyze it in terms of community applicability. Additionally, Indigenous Nations require the capacity to implement any potential interface with a research project bound by terms of the Tri-Council Policy Statement.

Concern with intellectual property rights and research ethics have largely been propelled because of potential commercial value that might arise from certain forms of traditional knowledge such as botanical knowledge. However, studies on the ontology and epistemology of

traditional knowledge should also be treated with the same ethic to protect the foundation on which holistic traditional knowledge exists and grows.

Collaborative research involving Métis People must emerge as a consensual project that meets not only the researcher's needs, but also the needs of the community. Reaching mutually beneficial goals is attainable, but requires lengthier interaction between the researcher and the community to develop an understanding of the implications of the proposed research.

2.4.8.5 Indigenous Science Education

The Convention on Biological Diversity is an important tool to inspire examination of traditional knowledge as a preferred foundation for Métis traditional environmental knowledge as a modality of science education. *The 2010 Biodiversity Target: A Framework for Implementation* (2004c), regarding Article 8(j) and Related Provisions contains the *Annex: Elements of a Plan of Action for the Retention of Traditional Knowledge, Innovations and Practices of Indigenous and Local Communities Embodying Traditional Lifestyles Relevant for the Conservation and Sustainable Use of Biological Diversity* (p. 199). Section *E. Capacity-building, education and training* of the Annex requests that the 192 Parties to the CBD, including Canada, "facilitate strengthening existing indigenous organizational structures"; build capacity of Indigenous women; and "where appropriate, traditional knowledge, innovations and practices should be integrated into formal, local, subnational or national systems of education, which are directed towards local or indigenous communities". Further, that "Education and training should be offered to indigenous and local communities with special attention to the future role of young people so as to enable sustainable development, while being compatible with their traditions". The Section concludes with a recommendation that CBD Parties and other stakeholders should be encouraged to learn about traditional knowledge (Secretariat on the Convention on Biological Diversity, 2004c, pp. 201-202).

The Conference of the Parties Decision VII/24 *Education and Public Awareness (Article 13)* is desirous of supporting the Global Initiative on Communication, Education and Public Awareness,

> *Noting further* that communication, education and public awareness are essential elements for the successful and effective implementation of the programmes of work of the Convention on Biological Diversity and also for facilitating the process of mainstreaming

biodiversity into national sectoral policies and programmes. (Secretariat on the Convention on Biological Diversity, 2004c, p. 281)

Encouraging CBD Parties to increase public education and awareness on biodiversity issues may take many forms. Use of mass media and electronic technology to disseminate information can be helpful in reaching some audiences. However, within the Métis community, many may not have access to these forms of communication. Youth generally have greater access to mass communication through existing school systems, but long-term change in thinking about our environment requires educational change on a greater scale, and must involve whole communities. A more holistic approach is needed to provide young learners and adults with access to the same information and take up science education collectively and in context.

Canadian educational systems can support traditional epistemologies, as well as practices. Researching and creating better paradigms within which human being can thrive and the environment can be sustained is not optional. We face a challenge of being able to see the value in traditional knowledge and practices and incorporate it into our contemporary lives. In order to integrate traditional environmental knowledge, education systems must increase their understanding of Aboriginal epistemologies and pedagogies, and support new Indigenous science education systems as equitable and beneficial processes for all.

2.4.8.6 Developing and Integrating a Holistic Framework for Indigenous Science Education

A holistic paradigm reflecting Métis culture, language and way of life need not be thought of as a model for segregation excluding other learners, but as a symbolic representation of the ontology of Métis People and useful as an inclusive model. The component parts of the model contribute to the whole, as all parts of life contribute to, and are necessary for, holistic education of a lifelong learner. The Métis Holistic Lifelong Learning Model (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007) described in Section 1.1.7 can accommodate the needs of Métis People in reclaiming traditional knowledge and practices through education and serve multiple purposes including supporting the participation of more Métis People in national and international fora concerning the environment.

Application of a Métis paradigm makes sense when working toward goals put forward within the Convention on Biological Diversity texts and processes. The process of building an

Indigenous science curriculum based on a Métis paradigm could become part of the interface for teaching and learning about traditional environmental knowledge as well as CBD issues, developing and applying local ethical protocols, and the other domains of knowledge indicated on the Métis Holistic Lifelong Learning Model. In relation to CBD issues, outcomes and indicators could be developed that meet community needs and are responsive to the CBD issues on a global scale.

3. THEORETICAL AND METHODOLOGICAL FRAMEWORK

Métis oral tradition teaches us that we are never entirely "other," that our social and spiritual identities have always overlapped with those of our tribal relatives, other entities, and our European relations, in shifting patterns of creative necessity. Métis who remember bush ways remain connected with our first teacher, the land. In this way, we enact an Aboriginal ecology, which adapts to, rather than assimilating within the larger common culture (Leclair, 2003).

3.1 Identifying the Research Paradigm

Determining an appropriate theoretical and methodological framework to address Métis traditional environmental knowledge poses the unique dilemma of choosing a research paradigm that will fit a study of people of mixed Aboriginal and European heritage. Western Eurocentric positivistic models are inadequate for research on Aboriginal traditional environmental knowledge, lacking the ability to accommodate intangible aspects of knowledge such as spiritual influences and holistic perspectives (Smith, 1999, p. 42; Battiste & Henderson, 2000, p. 44; Cajete, 1999, p. 37). Other theoretical and methodological frameworks deemed to be Aboriginal are rooted in tribal epistemologies which, if applied, force an assumption that Métis perspectives exist in this manner even though Métis People do not identify as tribal. Métis honour and acknowledge their tribal ancestors, in the same manner that they honour and acknowledge their non-Indigenous ancestors. A research paradigm appropriate for Métis should be able to accommodate the worldview that emerges from this cultural phenomenon. Currently, researchers lack a methodology that can accommodate a non-tribal Aboriginal worldview. This creates an opportunity to explore the application and adaptation of a theoretical framework useful for understanding of Métis traditional environmental knowledge from a Métis perspective.

Shawn Wilson (2008) describes a research paradigm as requiring four entities: ontology, epistemology, axiology and methodology. Wilson believes a synthesis of the four entities create a paradigm that is greater than the sum of its parts and reflects relationships essential to the formation of a mutual reality (pp. 70-71). Silverman (2005) describes the process of establishing research as beginning with a selected paradigm, or model, inclusive of the ontology and epistemology applicable to the research. Silverman (2005) explains theory is a set of concepts, and plausible relationships among concepts, to define and explain some phenomenon. Citing Jay Gubrium, Silverman describes theory as providing "a framework for critically understanding phenomena and a basis for considering how what is unknown might be organized" (p. 99). The

unknown factors that provide the impetus for research and "As living entities, they [theories] are also developed and modified by good research" (pp. 97-99). A concept is derived from within the paradigm by the researcher in order to provide a way of looking at the world. In this case, the concept is *post-modernism* which serves to deconstruct the concepts of the *subject* and the *field* in order to define the research problem (p. 98).

Creswell (2003) cites Rossman and Rallis (1998) in describing how critical and post-modern perspectives challenge objectivist assumptions and norms in the conduct of research. Four interrelated factors have been identified in support of these challenges, including,

> (a) Research fundamentally involves issues of power; (b) the research report is not transparent but rather it is authored by a raced, gendered, classed, and politically oriented individual; (c) race, class, and gender are crucial for understanding experience; and (d) historic, traditional research has silenced members of oppressed and marginalized groups (pp. 131-132).

Indigenous researchers from many areas of the world are working toward development of appropriate paradigms that satisfy conditions for representation of their lived identity and worldview. In the case of the Mäori in Aotearoa / New Zealand, Bishop (1996) describes the impact of Western research traditions of objectivity, neutrality and distancing as criteria for separating Mäori from the construction, validation, and legitimation of knowledge. Mäori concerns with who ultimately benefits from the research are increasing, as past research approaches have been established to serve the best interests of the researcher (p. 145). As a result of Mäori concerns, and research disruptions to Mäori life, "an indigenous approach to research has emerged in New Zealand" (p. 146). Globally, until appropriate research paradigms become developed in concert with Indigenous communities and researchers, it is still necessary to go through a process of discovery when interacting with particular Indigenous communities such as Métis communities.

Contemporary qualitative research can provide a theoretical orientation in which "theory becomes an *end point* for a study" (Creswell, 2003, p. 132). In the case of grounded theory, based in inductive process, researchers look for discovery of a theory that is grounded in information provided by participants (p. 133). In the case of this research project involving Métis traditional environmental knowledge, the paucity of literature and previously formulated theories will require flexibility to allow for the emergence of new theoretical possibilities or adaptation of existing theory.

In this study, the Indigenous research paradigm applied draws from theories of holistic learning coupled with grounded theory based in Aboriginal ontology and Aboriginal epistemology. Interpretations of holism vary, depending on the context within which the term is used. Indigenous researchers will bring their own particular area of expertise, such as ecological knowledge, psychology, or cosmology to "reintegrate human integrity in all its dimensions within a changing socio-ecological context" (Kenny, 2004, p. 15). Holism, in its purest form, is inclusive of all things and all relationships. This study is concerned with Métis perspectives and relationships to science education.

One of the primary differences between a holistic paradigm and other paradigms, particularly Western scientific paradigms, is that a holistic paradigm is not based in the study of anomalies. In non-holistic theorizing, the researcher examines the data within a paradigm that can explain the data. Data that does not fit into the paradigm is considered an anomalous. When there are too many anomalies, a new paradigm is required to explain the data (Deloria Jr. & Wildcat, 2001, p. 21; Bowler & Morus, 2005, p. 10). In the case of North American Indigenous knowledge,

> There were no anomalies because Indians retained the ability to wonder at the behavior of nature, and they remembered even the most abstruse things with the hope that one day the relationship of these things to existing knowledge would become clear. (Deloria Jr. & Wildcat, 2001, pp. 21-22)

Indigenous holistic learning theory works from an assumption that everything is interconnected, including human and non-human, and all biological life and other forms of existence are in a dynamic relationship of interactive lifeforces. Learning about relations and associated processes connecting everything in Creation is a matter of discovering where in a holistic paradigm the subject matter at hand exists. Sacred teachings held by Elders and spiritual leaders in Aboriginal communities believe that at the beginning of time, all things were given instructions as to their existence. These are known as *original instructions* and govern all things in the corporeal and non-corporeal realms. This includes their lifespan and cycle, behaviour, influences and changes through time.

Aboriginal cultures rely on traditional laws of behaviour respecting sacred teachings to ensure good decision-making creating a reliance of young learners to be exposed to traditional laws as a foundation within their daily lives. Traditional laws themselves are sacred with certain

traditional knowledge holders within Indigenous nations responsible for retaining the knowledge and ensuring it is taught with integrity and accuracy intergenerationally. Inclusion of printed text describing traditional environmental knowledge cannot fully transmit holistic integration in education without the participation of traditional knowledge keepers.

Goals in the Western Canadian Protocol Framework for Aboriginal Language and Culture Programs – Kindergarten to Grade 12 reflect some traditional laws. They include: to live in balance with the Creator; to live in balance with the land; to live in balance with one's self; and to live in balance with others (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000, p. 17).

Aboriginal ontology is a systematic account of existence, including the metaphysical, and is based in the belief that human beings are sacred. The physical body is merely a covering for the non-physical spiritual being containing the sum of all knowledge in existence. Physical existence provides the opportunity to experience the pleasures and pain of physical life before returning to a non-physical state. Aboriginal ontology includes the belief that time and space are accessible and that there are multiple universes. Here, we live according to the original instructions governing this existence.

Aboriginal epistemology is the study of Aboriginal knowledge and knowing. The term 'traditional' is rooted in original instructions and anchors contemporary action and activities through time to that which was meant to be. With each action taken by human beings, there is either a convergence or divergence from the original instructions. First Nations Elders teach that all positive and negative energies come from the same place and subsequently can be seen neither as good nor otherwise. It is only in the intent and application of the energy that we understand something as good or otherwise. Words themselves are said to contain energy and spoken words become conduits invoking unseen energy into this world. Aboriginal ways of knowing are much more than simply hunting and fishing or knowing where the good berry patches are. Ways of knowing involve understanding the cosmological motion of the universe, and our place in it, by understanding traditional teachings held by Elders and spiritual leaders. Knowledges are tribal as well as intertribal and non-tribal. Varying ontologies among groups may be different but all are necessary forms of understanding our collective human experience.

Knowing your own ontology helps understand some of how and where other ontologies exist. Recognizing diverse ontologies contributes to self-development, which contributes to relationship building. A significant part of Aboriginal epistemology is the acceptance that dreams and visions teach and help us learn. This mysterious part of human existence is dismissed in Western Eurocentric science because it is untestable, and subsequently is absent from nurturing in Canadian education systems.

Four primary guideposts defined by Kovach (2005) capture the salient points of the methodology of this study:

- Physical - Decolonizing, Political and Social Action aspect of Indigenous Research
- Emotional – Personal Narrative and the Story-telling aspect of Indigenous Research
- Mental – Language and Thought as it influences the construction of knowledge aspect of Indigenous research
- Spiritual – the Cultural, Metaphysical, Sacred aspect of Indigenous Research (Kovach, 2005, p. 16)

Together, these groupings comprise a useful way of ensuring a methodology considers four sacred realms of what some refer to as a Medicine Wheel and is commonly attributed to First Nations Peoples of the Great Plains region of North America.

The epistemology – theory of knowledge, embedded in the theoretical perspective – informing this research is an Aboriginal epistemology that is subjective, holistic, spiritual and practical. The subjective nature of Aboriginal epistemology provides an appropriate basis for initiating research on Métis traditional environmental knowledge. In its most general sense, Aboriginal epistemology is holistic having the fundamental principle that all parts of the universe influence other parts. Aboriginal epistemology is grounded in environmental knowledge and is filtered through personal and collective ethics of interrelatedness and reciprocity.

Aboriginal worldviews hold that all things in the universe are interconnected. Relationships exist at multiple levels between all things that exist. Atleo (2004) describes some of the Nuu-chah-nulth worldview from a physics perspective, combining quantum theory with traditional knowledge. He says, “The major difficulty with, and limitation of, contemporary research is that current methodologies do not, or perhaps as yet cannot, cope with the multiple variables presented by a theoretical assumption of the unity of all things” (p. 126). Defining one’s role as a researcher must also be an exercise in acknowledging the limitations of our ability to explain phenomena.

3.2 Researcher Positioning

Indigenous knowledge is subjective requiring active involvement of the learner and acknowledgement of one's role and responsibility in their relationship to knowledge. Some First Nations epistemologies use a pictograph or other representation of a concept known as a Medicine Wheel to help illustrate how life exists. The Medicine Wheel is a valued metaphor for a concept of sacred holism that is, perhaps, more complex than we can understand or describe adequately. It conveys the idea that all things in existence are in constant motion and that at any one time an individual is at one and multiple points within the Medicine Wheel depending on where they are in relation to something, as well as where the counterpart in the relationship is with regard to its own progress and development from its 'original instructions' at the time of Creation. My position in relation to this research also exists in multiple perspectives. Some perspectives come from within the Métis community, others from within the academy, and still others as an Indigenous woman. All that I am is reflected in the ideas that I see, interpret and bring forward within this research.

Scientists are commonly described as engaging in objective research that is based only in fact and reflects irrefutable truth. The reality is science also emerges through paradigms that are influenced by social and religious values, philosophical, political, professional and economic interests of those who construct the knowledge (Bowler & Morus, 2005, pp. 11-16). Science is not only about the detailed result of a specific study, but is also about what is chosen to be studied, what is financed and how, what voices are published and supported by the dominant scientific community and society and what is marginalized or dismissed. For example, in 1972 James Lovelock proposed the Gaia hypothesis in which "Gaia is the Earth seen as a single physiological system, an entity that is alive at least to the extent that, like other living organisms, its chemistry and temperature are self-regulated at a state favourable for life" (Lovelock, 1991, p. 11). Lovelock has impressive scientific credentials as a former scientist in the space program where he designed satellite-monitoring systems. Nevertheless, his beliefs, including that Gaia has the capacity to eliminate humanity if it becomes a threat to its systems, has been met with criticism from the scientific community. The Gaia hypothesis was condemned as environmental romanticism and major scientific journals would not publish his work (Bowler & Morus, 2005, pp. 230-232). Feminist researchers have also brought extensive criticism to claims of objective scientific inquiry raising concerns regarding male dominance in science, disregard for women's

contributions to scientific endeavours, and the gendered nature of scientific activity (Bowler & Morus, 2005, p. 487). Challenges by researchers working outside of accepted paradigms have always been vehemently resisted by the establishment but are necessary catalysts for new thinking and change.

Aboriginal ontology and epistemology require researchers to acknowledge their own role within the research because of the subjective nature of discovering, understanding and interpreting knowledge. My own position in relation to research questions about Métis traditional environmental knowledge and issues relating to its absence in contemporary education is shaped by my personal experiences as a Métis person. The paradigm of Aboriginal epistemology is also intricately linked to the paradigm of emancipatory research.

Cynthia Tyson (2003) explains,

> Emancipatory research facilitates radical thought; radical thought supports radical action, and radical action can advance a transformative social agenda. In other words, research can provide a working model for resolving the problems of marginalized populations because it incorporates a more organic methodology, connects with the "grass roots," enhances data collection and collaborative analysis, and because the grounded theory that arises from the specificity of the day-to-day experiences of oppressed people can provide links with broader social and political solutions to educational problems. Its hope and promise lie in courageous action for change and the desire for critical understanding. (pp. 25-26)

For several years, I immersed myself within the Métis Nation political organization working in a variety of capacities to support community development and self-determination. Local, regional, provincial, national and international encounters with environmental issues and processes showed me the voicelessness of Métis in fora designed to discuss and resolve environmental challenges. Lacking adequate supports to have our Métis views documented has also contributed to a near complete absence of any published material concerning Métis traditional environmental knowledge. Without published evidence, there are few opportunities to have Métis views considered by government policymakers in environment, education or any other sector impacted by the loss of traditional environmental knowledge. It was within these contexts I began to realize not only do Métis People not have the capacity to respond within official forums established to address environmental issues, but also neither are we supported at the community level to ensure the perpetuation of traditional land use and traditional environmental knowledges that accompany such use. It appears ironic that global attention now

focused on the search for solutions to our current environmental crises may find them in traditional Indigenous knowledges that grow more fragile with each passing generation.

3.3 Identifying the Problem

This research study emerged because of my participation in international discussions concerning biological diversity, sustainability of the environment and protection of Indigenous Peoples ways of knowing. My awareness that few Indigenous people have the resources to participate in environmental decision-making forums nationally or internationally led me to consider the reasons this was happening. I realized that the reasons were systemic, ranging from the lack of published literature, especially on Métis traditional environmental knowledge, to disengagement of Métis learners from science education, to the disconnection of Métis learners from learning traditional environmental knowledge within Métis cultural contexts in community and on the land. If Métis children and youth are required to attend public education systems, then what is our responsibility to ensuring they have access to critical foundational traditional environmental knowledge as well as the best of Western Eurocentric science education? I believe Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within holistic lifelong learning.

Current literature available from Indigenous academics has provided academia with diverse explanations of Indigenous knowledges and Indigenous research methodologies. Research on Indigenous epistemologies and practices allow discussion of often contrasting worldviews between Indigenous and non-Indigenous groups of people. Writers such as Battiste and Henderson (2000), Atleo (2004), and Hampton (1995) provide insightful interpretations of traditional knowledges and the ecological foundations upon which they exist. While traditional knowledge is unique to each Indigenous culture, intimate knowledge of the natural environment within which the culture resides is an essential element of all. In describing the importance of local knowledge, Battiste and Henderson (2000) explain,

> The localization of traditional ecological knowledge has several important spiritual, social, and legal corollaries. Ecological knowledge is conceptualized as a way of understanding the web of social relationships between a specific group of people (whether a family, clan, or tribe) and a place where they have lived since their beginning. Many Indigenous peoples speak of their knowledge in terms of the "operating instructions" for the land, given to them from time to time by the Creator and the spirit world, not just through revelations or dreams but also through frequent contacts with the minds and spirits of animals and plants. They further describe the ecosystem itself in terms of historical marriages or alliances between humans and

> non-humans, and among different non-human species. Hence, the present structure of the local ecosystem is the cumulative result of a large number of historical contracts, which create reciprocal obligations of kinship and solidarity among all the species and forces which co-exist in that place. (pp. 44-45)

Western Eurocentric understanding of the natural world are largely limited by reliance upon knowledge of purely biological processes, head counts of species and extrapolations of diminishing numbers as a result of massive ecological damages currently occurring on our Earth. Western science has not been able to resolve our consumptive unsustainable lifestyles and the implications for the potential end of an environment that can support human life. Indigenous Peoples have recognized this trend for generations, with each imposed corporate decision resulting in the eradication of individual species and ecosystems. Indigenous Peoples have also recognized the impact of environmental destruction upon their own cultures, languages, and traditional practices. References to the importance of maintaining 'balance' in one's life, does not only refer to personal habits, but to much broader contexts of balance in complex sets of relationships within the universe. Indigenous Peoples know the environment and Indigenous cultures are inextricably linked.

In contemporary times, Indigenous researchers have been working to explain the epistemologies held by many Indigenous Peoples in an effort to describe the knowledge systems that guided the thought and behaviour of those living harmoniously with the Earth. Painstaking work in translating oral traditions into literature has been an effort to share philosophies and practices that have allowed the natural world to thrive along with its human inhabitants. The Western world is beginning to peer into Indigenous philosophies as pressure increases to find models for sustainable lifestyles. Although human society may never arrive at any permanent solutions, with each subsequent stage of development arises an opportunity to bring traditional environmental knowledges out of the shadows of dominant society and into their rightful place.

In March 2005, the United Nations Educational, Scientific and Cultural Organization (UNESCO) declared the UN Decade on Education for Sustainable Development. In a published statement, UNESCO explains, "There can be few more pressing and critical goals for the future of humankind than to ensure steady improvement in the quality of life for this and future generations, in a way that respects our common heritage - the planet we live on" (United Nations Educational, Scientific and Cultural Organization, 2005). Other work underway within the United Nations concerning the Convention on Biological Diversity seeks to affirm the rightful place of Indigenous and local communities in processes resulting in the preservation of biodiversity. Such international forums commit supporting nation-states of the world to development of strategies and initiatives that

can be carried out for our collective best interests. My own personal experiences as a Métis person have shown me that in Canada the identity of Métis People is only minimally acknowledged by mainstream authorities governing education, economic development, health care and other sectors. Consequently, lack of support means Métis contributions to public study of traditional knowledges and promotion of education on sustainable development are few at this time even though Métis comprised an integral part of the development of Canada from the time of the fur trade era. Of an increasingly urban Métis population, those who leave the land are only able return to it upon their death. Métis youth continue to be assimilated into Western Eurocentric education systems, which governments acknowledge are not fertile ground for Aboriginal student success. There are few options for Métis to maintain ecologically based traditional knowledges.

As a student and educator, experience has demonstrated a serious lack of resource material available to assist in understanding or teaching traditional forms of environmental knowledge. The Métis, as much as any other group, are becoming members of an ecologically uninformed public. Lack of published material on the subject of Métis traditional environmental knowledge has inspired this research pursuit. Several fundamental questions require answering in order to begin to build a discourse on Métis traditional environmental knowledge. I created foundational Study Questions that would assist me in responding to the research problem. The Study Questions included:

- According to traditional land users in North West Saskatchewan, what is Métis traditional environmental knowledge?
- How does Métis traditional environmental knowledge in North West Saskatchewan align with established theories of Aboriginal epistemology and supporting principles?
- What evidence and arguments exist that support the development of Métis traditional environmental knowledge as a modality of science education? And
- How can Métis traditional environmental knowledge be developed as a modality of science education?

Linda Smith (1999), a Mäori scholar from Aotearoa / New Zealand, provides insight into decolonizing methodologies that seek not only to deconstruct dominant non-Indigenous ideologies, but also to move forward in reconstructing new methodologies of Indigenous empowerment. Self-determination is placed at the centre of Smith's Indigenous Research Agenda, using concentric rings of development, recovery, and survival as metaphoric tides of movement. Directional elements of mobilization, decolonization, transformation, and healing

are named as key elements in achieving the tidal movement to self-determination (Smith, 1999, pp. 116-117).

Smith (1999) elaborates on the concept of Kaupapa Mäori Research that is determined by Mäori worldview. Kaupapa Mäori Research is a way of structuring assumptions, values, concepts, orientations and priorities in research (p. 183). Distinctly Mäori research processes have been developed by Mäori to facilitate research on themselves, and as beneficiaries of the research. While it would be inappropriate to apply Kaupapa Mäori Research methodology to Métis People, the concept of designing a process specifically for the benefit of the research subjects is supported by Smith's (1999) work and Tyson's (2003) endorsement of emancipatory research.

Hampton (1995) describes a six-directional framework in research about First Nation tribal epistemology and ontology. It is conceivable the six sacred directions (east, west, north, and south, above Earth, below sky) may emerge from some Métis research participants holding similar First Nation's traditions. Axiology, however, may reveal that many Métis may not identify with the framework described by Hampton (1995) because of deeply held Christian values. Research outcomes of this study will help determine how selected participants describe their understanding of Métis traditional environmental knowledge.

Métis People have been active politically for several generations in a quest for self-determination, but the process of decolonization raises interesting questions for a People who are biologically and culturally linked to colonial ancestors. Métis People acknowledge their own European ancestry and cultural influences but also self-identify, and are recognized in the Constitution Act, 1982 as one of the three Aboriginal Peoples in Canada (Government of Canada, n.d.). Decolonization may take the form of resistance to certain Eurocentric epistemologies and in the reconstruction of sustainable ecological epistemologies. The research will also examine challenges or appropriateness of educators using Aboriginal epistemology based in tribal perspectives in an attempt to understand Métis perspectives of the environment that are non-tribal. Métis People also acknowledge their own First Nations ancestry, but do not consider themselves tribal.

The methodology – strategy or plan of action that links methods to outcomes – governing this research is an Indigenous methodology. Scholars researching with Indigenous communities

recommend the need for an Indigenous research methodology appropriate to conducting Indigenous research (Hampton, 1995; Smith, 1999; Steinhauer, 2002). Ethical and methodological research respecting Indigenous cultures requires changes in the way researchers approach Indigenous communities. Western Eurocentric standards of research are inadequate. Marie Battiste provides insight on decolonizing university research. She says,

> ...indigenous peoples have called for new standards of ethics that go beyond the business as usual model of informing and protecting individuals from personal harm and institutions from legal repercussions. They urge new standards that speak to multiple responsibilities of researchers and institutions to indigenous peoples and to their collectivities who own their knowledge. (Battiste M. , 2002, p. 34)

The process of determining responsibilities must begin with researchers and institutions accepting Indigenous ways of managing knowledge. As an Aboriginal researcher, I have a responsibility to honour and respect Métis traditions in the context of observational, interpretive, and literary research. Developing a methodology for research on Métis traditional environmental knowledge includes consideration of protocols and processes held by Métis people.

Evelyn Steinhauer highlights the concept of *personal introduction* used within Indigenous discourse. Introducing oneself by providing information allowing others to gain a sense of who you are and why you are doing what you are (in terms of personal history), is important to raising a comfort level within Indigenous communities (Steinhauer, 2002).

Introduction of the research and methodology to Aboriginal participants is an important step in facilitating an action plan and achieving outcomes. Steinhauer cites Martin's (2002) description of the main features of an Indigenous research methodology:

1. Recognition of our worldviews, our knowledge and our realities as distinctive and vital to our existence and survival. This serves as a research framework;
2. Honouring Aboriginal social mores as essential processes through which we live, learn and situate ourselves as Aboriginal people in our own lands and when in the lands of other Aboriginal people;
3. Emphasizing the social, historical and political contexts which shape our experiences, our lives, positions and futures;
4. Privileging the voices, experiences, and lives of Aboriginal people and Aboriginal lands;
5. Identifying and redressing issues of importance for us. (Steinhauer, 2002, p. 72)

Steinhauer also provides a list of principles put forward by Weber-Pillwax (1999, pp. 31-32) which should also be considered within an Indigenous methodology, being:

1. The interconnectedness of all living things,
2. the impact of motives and intentions on person and community,
3. the foundation of research as lived indigenous experience,
4. the groundedness of theories in indigenous epistemology,
5. the transformative nature of research,
6. the sacredness and the responsibility of maintaining personal and community integrity, and
7. the recognition of languages and cultures as living processes. (Steinhauer, 2002, p. 73)

3.4 Ethical Research in Indigenous Communities

The methodology described in this chapter reveals the manner in which I have chosen to carry out this research. The four methodological signposts described by Kovach (2005) were important factors in framing the research and ensuring, as an Indigenous researcher that this research was consistent with my own experiences and values as a Métis person as well as framed ethically from a Métis community perspective. Kovach's description of decolonizing, political and social action; personal narrative and storytelling; language and thought as they influence the construction of knowledge; and the cultural metaphysical, and sacred aspect of Indigenous research constituted the foundation I believe is necessary in this work.

Additionally, knowledge of literature written by Indigenous scholars and others with expertise in Indigenous issues provides important insight into what is researched and how it is done respectfully from a community perspective as well as an institutional perspective. This research was also prepared in respect of ethical research guidelines suggested for working with Aboriginal communities (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 1998 (with 2000, 2002 and 2005 amendments), pp. 6.1-6.4) and approved by the University of Saskatchewan Behavioural Research Ethics Board.

Once the study plan was approved, I constructed a matrix for potential participants. The three North West Saskatchewan communities were identified with a list to identify both male and female participants. Potential participants were provided with a letter of invitation describing the research, the research and interview questions, a consent form describing the purpose and procedure of the research, potential risks, storage of data, confidentiality terms, withdrawal terms and contact information to the University representatives involved with the research, and a transcript release form. Having been a co-investigator on a similar research project during 2007 and 2008, I had some knowledge of individuals who would be open to invitation and began the

invitations based on that information. Those who accepted the invitations recommended others they believed would bring useful insight into the study questions and outcomes.

3.5 Overview of Method

An Indigenous research methodology can accommodate a variety of methods to collect data, but the formation of relationships is an important feature of Indigenous community interactions when one is seeking knowledge or understanding. The personal interview based on established questions was an appropriate method for this research since an interview can be adapted to harmonize with an Indigenous methodology while respecting Métis-specific research. For example, a question could be rephrased if it was not clear, or the participant could use the question as the basis for a more detailed narrative or story on the general topic.

Other adaptations included utilization of traditional protocols of place such as offering tobacco and tea to Elders if required and respecting locally determined ethics of providing and acquiring information including issues of such things as trust and time. A series of audio-recorded interviews with Métis from three communities in North West Saskatchewan provided the primary data for analysis. Interview questions were adapted from a previous study on Indigenous science (Michell, Vizina, Augustus, & Sawyer, 2008) and were structured to allow flexibility in individual responses that can expand the understanding of the holistic nature of teaching and learning Métis traditional environmental knowledge.

Over the past 10 years, work experience with facilitating discussion groups and interviews within the Métis community provided insight for my role as a researcher. Planning interview spaces where interviewees feel comfortable and are not interrupted is important. Discussion of personal knowledge, including experiences involving spiritual perspectives or value systems, requires trust and time. The participant and the researcher decided the venue for interviews. In this study, interviews were conducted in interviewee homes, local schools, and offices.

Language translation was available to all participants in the study. In most cases, participants spoke English so translators were not required. A language translator was arranged for one participant who spoke very little English and whose first language was Michif. In several of the interviews, the participants used Michif terms intermittently to name things. It is my belief that most participants would have had an easier time to respond to the questions if I

had been a Michif speaker. Quite often, it was apparent that participants' first reaction was to describe or identify something in Michif, but quickly switched to English knowing that I did not understand.

3.6 Interview Questions

The four Study Questions listed earlier, which I designed, were included on the sheet of Interview Questions provided to the participants. Although they were not asked to respond to the Study Questions, I wanted them to know how their questions were informing other questions of the research. The Interview Questions included:

1. What does it mean to be a traditional land user? (knowledge, activities, beliefs, feelings)
   1.1 Describe how you learned about hunting, trapping, fishing and/or harvesting.
   1.2 Who were the important teachers in your learning? How did they influence you?
   1.3 What knowledge and activities were / are important to the Métis in understanding the environment?
   1.4 What values can be learned from learning directly from experiences on the land or water?
   1.5 What happens when these values are lost?
2. How has living in North West Saskatchewan helped you learn about the environment?
   2.1 Can these things be learned in other areas? How?
3. What do you believe youth need to learn about the environment and about Métis traditional environmental knowledge?
   3.1 How do you think this could happen?
4. What language(s) do you know?
   4.1 How has this helped you understand the environment and traditional practices?
   4.2 How would you like to see Aboriginal languages used in teaching traditional environmental practices?
   4.3 How does the loss of speaking an Aboriginal language impact young people?
5. How might Elders, parents or other community resource people be included in the teaching of traditional environmental knowledge?
6. In what ways are land and natural resources used locally that could be used as a basis for teaching Métis traditional environmental knowledge?
   6.1 What practices of Métis traditional environmental knowledge are you aware of?

7. What traditional Métis protocols are you aware of that should be respected by teachers or researchers in seeking information on Métis traditional environmental knowledge?

Participants were invited to respond to all the questions although the responses did not necessarily occur chronologically. The questions were meant to provoke stories that would be helpful to responding to all the questions as a whole.

3.7 Coding Qualitative Research

Computer software programs are available to assist in coding research data. Colorado State University cites Weitzman and Miles (1995) in listing some of the ways software can help the researcher: making field notes, transcribing field notes, editing, coding with keywords, storing data, linking data, content analysis, displaying data, drawing conclusions, building theory, mapping data, and preparing interim and final draft reports (Colorado State University, 1993-2008). Programs such as *HyperRESEARCH*, *NUD*IST*, *AQUAD*, and *ATLAS/ti* are recommended for assistance in qualitative research coding (Catterall & Maclaran, 1997). Interviews in this study were recorded on magnetic audio tape and transcribed using Microsoft Office software on a personal computer. This study used ATLAS/ti as the thematic search software. Use of qualitative data analysis software facilitates searching for patterns, coding and storage of data, but does not carry out the analysis for the researcher. The computer can do certain programmed tasks for which speed is an advantage but more complex research tasks such as determination of appropriate codes, analysis and interpretation remain in the domain of the researcher.

The Holistic Lifelong Learning Model for Métis described in Section 1.1.7 of Chapter One is the thematic model used in the data analysis (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007). Since the conceptual model was developed by Métis people and is supported by supplementary draft literature describing 23 domains of knowledge, 37 indicators of learning, six stages of learning and associated formal and informal indicators of learning it is appropriate to examine the research data in this study in relation to a model already accepted by Métis People. The data in this study provided the opportunity to see which themes from the model emerged, new themes not identified on the model, and gap areas.

3.8 Preparing the Interview Data

Careful preparation of the interview data meant several reviews of the audio and text content. Audio recordings of interviews were transcribed and saved as Microsoft Word documents. The transcripts were reviewed again by the researcher in relation to the audio recording to ensure accuracy in the text of participant statements, to adjust punctuation, and to ensure that the transcripts reflected the grammar and syntax of the speaker. In this regard, I came to note that a linguistic analysis of the interviews might reveal more information about the responses than could be gained by content analysis alone; however, the scope of this research prevents that possibility. The emerging field of ecosemiotics described in Section 2.3 brings some additional context to the importance of how we think about communication, our relationships to the natural world and how that is manifested in language.

As the interviewer, I acknowledge that my own participation in asking the questions, clarifying responses and sharing in the dialogue helped shape the interview narrative to some extent. The "assembly of narratives in interviews (or conversations) is always a two-way process" (Silverman, 2005, p. 47). Based on the Indigenous methodology employed, I felt it would have been inappropriate to engage in this research by means of a simple interrogation of the participant with no active participation by the researcher in terms of sharing stories, demonstrating active listening or sharing my interpretation of what the participant said to ensure I understood correctly. In some cases, what might have been recorded by pencil and paper as field notes in someone else's research became embedded comments in the transcripts. In my view, this constitutes part of transparency and accountability to the participant.

Preparing and reviewing the transcripts showed how different in form and structure our spoken words are in relation to prepared intellectually crafted and grammatically correct statements. I was challenged to indicate in the text when a speaker's statement ended and a new statement began, hence indicating when the speaker has answered the question and was moving on to a new topic. This proved difficult. In order to avoid misinterpreting a statement or series of statements, I represented the pauses in thought by a series of three dots. This technique provided some means of allowing the rhythm of the speakers' dialogue to be reflected as strings of thoughts much like stepping-stones across a stream of water.

Transcripts were returned to the participants for review, editing and authorization.

3.9 Identifying Codes and Themes

The process of codifying data for the purpose of analysis is not a precise science but primarily an interpretive act that can bring evocative meaning to data based on the researcher's academic discipline, ontological and epistemological orientations, theoretical and conceptual frameworks, and even the choice of coding method itself (Saldana, 2009, p. 4). In the case of this research study, I chose to build upon community-based research already carried out in the formation of the Métis Holistic Lifelong Learning Model (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007) described more fully in Section 1.1.7.

The themes, which emerged in the construction of the Model, were products of analysis carried out by the authors following consultations with Métis across Canada. Development of supplementary material to assist in understanding the model then began by the Canadian Council on Learning in 2007, and although the material remains unfinished, the Métis community has been encouraged by the Canadian Council on Learning to continue evolution of the Model (Canadian Council on Learning, 2007).

In 2008, the research study *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008) advanced an understanding of the First Nations and Métis Lifelong Learning Models using themes identified on each respective Model for that data analysis. Application of the themes as codes helped to identify substantive information related to each theme, new emerging themes, and differences in thematic knowledge among participant groups such as traditional land users, Elders, teachers and pre-service teachers.

This process is known as Provisional Coding, which works from a predetermined initial set of codes established prior to fieldwork. The codes can vary in number and can be generated from a variety of sources, including codes established in previous research (Saldana, 2009, pp. 120-123). Naturally, a researcher using Provisional Coding must exercise caution in not seeing the codes as rigid and inflexible pillars, but tools that provide some orientation while facilitating new interpretation of data. In this analysis, it is not my intention to try to re-create a new holistic model, but rather to look at data from new interview participants in relation to the Métis Holistic Lifelong Learning Model, review the outcomes and theorize about the findings. Saldana (2009) cites Day (1993) in describing another method of coding known as Holistic Coding as an attempt

"to grasp basic themes or issues in the data by absorbing them as a whole…rather than by analyzing them line by line" (Saldana, 2009, p. 118). This is useful for being able to return to the data and conduct a self-check that the larger messaging has not been lost. This is a reverse process from a standard coding procedure. Holistic Coding is closely related to the third coding technique I used known as Structural Coding which "both codes and categorizes" the data in identification of large segments of text on broad topics which are then available for more in-depth analysis (Saldana, 2009, pp. 66-68). Structural Coding allows the inclusion of interviewer comments within the data segment and is relevant in the context of my earlier comments on this matter.

3.10 Limitations

This study was limited to a select number of Métis from North West Saskatchewan. The target area was selected because the area is a concentration of predominantly Métis communities. As well, I have worked in the region and have been involved with a cognate research project in the target area. As a result, I had a working knowledge of contacts and protocols of place for working with Métis in North West Saskatchewan.

For the purpose of this study, a traditional land user is defined as someone who has had first-hand experience in traditional Métis cultural activities such as trapping, fishing, harvesting, or hunting. Individuals targeted are adult men and women active in traditional land use activities and persons who may no longer participate in field activities but hold ancestral knowledge or experiential knowledge from their past about traditional land use.

A minimum of four and maximum of six, interviewees were targeted. Additional interviews were allowable under exceptional circumstances. For example, if situation arose of an Elder or traditional land user asking another person to participate, or similar unexpected circumstance. Respecting community member wishes is an important responsibility of researchers. Initially, five participants were interviewed. Each was assigned a code to protect their confidentiality. One of the participants required a translator for the non-English portions of the response. Upon review of the transcript, I determined that it was necessary to include the translator as a participant since much of the transcript included interpretations of significant length. Another participant requested a second interview, which I assigned a separate code. In total, the data provides references to seven sets of data from six participants. Both male and female

participants were included in the study. Interviews were approximately two hours. Participants were provided with transcripts of interviews for review. Written correspondence, site visits and telephone follow-up with participants allowed the opportunity to ensure accuracy of the transcripts.

Participating communities are located in North West Saskatchewan. Three target communities were selected to provide an opportunity for sampling Métis perspectives. Scholarly research (Aikenhead & Huntley, 1999) and my own personal experience reveal communities in the target region do not interact socially a great deal. Including more than one community in the study may provide a sense of interconnectedness from research results. By including three target communities rather than only one, I believe, it avoids creating a sense that one community is more important or has better traditional knowledge than another has. This is an important experiential factor that I have come to believe from time spent in North West Saskatchewan.

3.11 The Research Process

In the preceding Chapters of this study I have provided insight into my background as a Métis person, the motivation to contribute to a body of research on Métis traditional environmental knowledge, the need to examine the current narrow scope of contemporary science education as well as the ideological premise of contemporary science education and the principal reasons that Métis traditional environmental knowledge is not included as a modality of science education, the need to support the preservation of biological diversity and the perpetuation of Métis traditions.

In coming to determine the research topic and methodology, I considered a number of challenges I faced. The paucity of published literature on Métis traditional environmental knowledge and the lack of a research paradigm appropriate for Métis meant there was little available on which to model the research. This research would require describing intellectual concepts and cognitive processes of Western Eurocentric and Aboriginal ideologies. Physical experiences of Métis life on the land and the impact of relegation to sedentary life within permanent communities would have to be explored through those who had first-hand knowledge. Spiritual beliefs and value systems of Christian and Aboriginal traditions are always sensitive subjects and require careful and respectful exploration. I was aware of the need to consider the

emotional impacts of the research on my own life, as a Métis person, with a common history to that of the research participants. While these are all challenging facets of holistic research, it is from within the domain of emotion that revolutionary change emerges. As a Métis person, I felt strongly and passionately that this type of research needed to be initiated to put into printed text voices of a Nation; to explore the idea of unique Métis perspectives of traditional environmental knowledge; and to share the findings within the Métis community and others equally concerned with developing enhanced approaches to science education and environmental sustainability for all life on Earth.

As with all things considered holistically, there is no beginning and no end to anything. Cycles of life and energy show us this truth every day. In the same way, this research has no clear beginning and will have no clear ending. The years of my life before graduate school provided practical experiences that helped to inform my thoughts and clarify my positions within the program of classes required before undertaking research. Formal study provided opportunities to examine such effects as the impacts on Aboriginal Peoples created by colonization of this land, the slow but critical process of decolonization, perspectives of education, wisdom and the natural world and the importance of linguistic diversity as the carrier of multiple worldviews and divergent thinking essential to social ecologies.

The completion of formal course work within the academy, provided time to read additional literary work, spend time with my own Aboriginal spiritual guides and consider the approaches I would take for the research. I talked with First Nations individuals doing similar research, non-Aboriginal scholars and Métis individuals versed in academic and community-based issues and had the opportunity to participate as a co-investigator in a collaborative research study which came to be entitled *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008). During that research study, I renewed friendships and acquaintances within the Métis community in North West Saskatchewan and increased my own expertise with respect to the issues embedded in the research problem. The experience of researching as a co-investigator with the support of a team of researchers showed me that many voices can contribute to the broad spectrum of knowledge, but it also eliminates the ability to convey personal insights derived from spiritual or emotional experiences since the finished work is attributed to all the researchers as opposed to a single researcher. This presented a new dilemma in whether to include these kinds of personal insights in my own thesis work, or not,

and if so, in what degree of detail to share in a public document. Unlike the research participants, as a researcher, I do not have the option of anonymity in sharing my thoughts and experiences.

The selection of participants for this study began with telephone inquiries to people I knew as to their availability. Several individuals I had hoped to include in the study were not available, but other local Métis community members recommended new persons. As indicated by the literature, building personal relationships within the Aboriginal community is critical to working with Indigenous knowledge. I recognized that interviewing Métis individuals who did not know me, or I them, would mean that some time needed to be spent sharing personal stories and getting to know one another. In the case of those I did know, I also recognized that I was now in a new role of researcher, which also changed the nature of our previous relationship dynamic to some extent. In both cases, I wished that I had more time and resources to spend informally with the community members participating in the research before engaging in the formal interviews. Trust-building and having adequate time for participants to share teaching stories takes considerably longer than the allocated two-hour interview. However, the physical distance of approximately 500 kilometers separating me from the interview communities meant limitations to the number of visits.

Arrangements to visit interview participants were made by telephone first. Then, the ethics documents including letter of invitation, list of questions, consent form and transcript release were provided by mail in advance of the interview. At the time of each interview, the content of the ethics documents were reviewed verbally. Interviews were taped with an audio recorder and later transcribed. The transcripts were returned for review to the interview participants who had an opportunity to edit the documents and return them with the stamped self-addressed envelopes along with a transcript release form. When successfully defended, the research results will be shared with the Métis community by way of public presentation.

4. DATA ANALYSIS

I visited a place that has no name. There is no sound. There is no form. It is a place of knowledge without language, understanding without explanation. A white mist appeared, swirling, dancing, reaching upwards and growing denser, then slowly thinning to reveal something for me to see. A great tree appeared in the centre of the mist, its trunk solid and enduring. The top of the tree was covered with leaves that appeared like glass, with each leaf a different colour of red, blue, yellow, green and all the shades in between. They sparkled as though sunlight was shining on them, but there was no sun, only a warm soft lightness bathing the image. The mist remained around the tree, always in motion as though concealing other things not to be seen. Then, above the canopy of the tree began to emerge symbols and images of People long forgotten and existing now only as carvings or paintings on stone. Ancient images of hands, feet, and faces floated in the mist surrounding the treetop. There were no words but I felt a sense of power in that place. It was as though the old ones had come to show that they still existed and that the symbolic tree of life represented not just one People but all Peoples. I did not know who those ancient People were but I understood the importance of looking to the image of the sacred tree of life in my own journey of understanding ancient knowledge carried forward by Métis People and it gave me courage (Vizina, dream, 2007).

4.1 Determining an Analysis Framework

Analyzing interview transcripts can feel like a daunting task when considering application of a holistic methodology. Considering domains of intellectual, physical, emotional and spiritual realms of knowledge, the nature of holistic thought infers that each statement within an interview is important and has a place in the analysis. In that regard, nothing can be ignored, or set aside, as even the smallest detail is relevant and has a place. To overcome this conundrum, I placed my confidence in using the Métis Holistic Lifelong Learning Model (Aboriginal Education Research Centre, University of Saskatchewan and First Nations Adult and Higher Education Consortium, 2007) as the anchor to which Métis People from across Canada had already put forward as that which represented cornerstones of an appropriate learning model for Métis. My efforts to cobble together a holistic, grounded and emancipatory theoretical paradigm leads us on a meandering path that is sometimes contradictory and sometimes certain, looks to the past but retains the flexibility of forward momentum that is at the heart of Métis life.

A variety of questions, listed in Section 3.6, was prepared for use in interviewing that would provide opportunities for participants to share knowledge depending on their personal knowledge strength areas. Generally, the areas includes perspectives of what it means to be a traditional land user, experiential learning from place, youth relationships to the environment, the impact of language in learning about the environment, community members involvement in teaching and learning traditional knowledge, use of local resources in teaching and learning traditional knowledge, and local protocols of place. In setting the context for the interviews, I reviewed the approved ethics process and conveyed in lay terms the purpose of the study which was 1) to begin development of a body of research on Métis traditional environmental knowledge, that I would be 2) examining the current narrow scope of contemporary science education, the ideological premise of contemporary science education and the principal reasons for Métis traditional environmental knowledge not currently being a modality of science education, and that I hoped to 3) support the preservation of biological diversity and the perpetuation of Métis traditions as a result of the study. Participants were also provided with my four research questions for informational purposes on the same sheet containing their interview questions.

To respond to the four research questions, I structured the analysis framework around the four research questions. My response to question one: *According to traditional land users in North West Saskatchewan, what is Métis traditional environmental knowledge?* begins with an analysis of the data in relation to the emergent themes coded in relation to the Métis Holistic Lifelong Learning Model. My response to question two*: How does Métis traditional environmental knowledge in North West Saskatchewan align with established theories of Aboriginal epistemology and supporting principles?* identifies convergences and divergences in relation to the results of question one. My response to question three: *What evidence and arguments exist that support the development of Métis traditional environmental knowledge as a modality of science education?* is analyzed in relation to literature reviewed and the results of question one. Finally, my response to question four: *How can Métis traditional environmental knowledge be developed as a modality of science education?* is analyzed in relation to the results of question one, the original Métis Holistic Lifelong Learning Model and the literature review. By using this analysis structure, I felt that I could bring new information forward in this thesis

that could not necessarily be provided by Métis community members, schools or other policy makers independently.

4.2 According to traditional land users in North West Saskatchewan, what is Métis traditional environmental knowledge?

This key research question was designed to form the basis of information that could feed into the following three research questions found in Section 4.3, 4.4 and 4.5. It was important to me to conduct an analysis from the premise that Métis traditional environmental knowledge constituted more than an individual's botanical knowledge or hunting prowess but rather had an opportunity to be examined for its broader context as well as content. As such, the coding scheme I used was established based on the Métis Holistic Lifelong Learning Model. I imported the Primary Codes from the Learning Indigenous Science from Place (Michell, Vizina, Augustus, & Sawyer, 2008) research project and expanded the search parameters with Secondary Codes that I believed would enrich the data subsets.

Table 4.1 Primary and Secondary Thematic Codes

Families	Primary Codes	Secondary Codes
Living Tree Roots	Balance	stable; measure; sense
	Economic	money; commercial; poor
	Environment	physical; surroundings; location; situation
	Harmony	respect; protocol; tobacco
	Health	medicine; pollution; suicide
	Indigenous knowledge	native; original; local; information; awareness; understanding
	Political	leaders; rights
	Social	community; share; together
	Spirituality	religion; belief; alive; life
	Values	principles; morals; ethics; ideals
Living Tree Tops	Land	wild; bush; place; water; plants; air
	Language* *appears on the LLL Model with Tradition	Cree; Dëne; Michif; English; translation
	People	community; relations; kinship; family; Métis; First Nations; Aboriginal; kids; Elders; person
	Self	personal; personality; nature; identity; person
	Imagination* *appears on the LLL Model as a subset of Self	creative; thoughts; mind; dream
	Tradition* *appears on the LLL Model with Language	custom; practice; belief; way
Other	Learning* (new Primary Code) *does not appear as a subset within the LLL Model	education; knowledge; school; culture; wisdom

The order of the following discussion of the data is based on the number of references that emerged from each set of Primary and Secondary Codes. Subsequently, some sections have longer commentaries than others do in this regard.

The individual thematic units of study that emerged from the coding process also brought forward unexpected information about interconnectedness. At the beginning of each data set, the

Atlas/ti software provided a list of the other thematic units embedded within the requested theme. Quotes about *language* were intertwined with concepts of self, spirituality and tradition. Quotes about *people* were intertwined with concepts of balance, harmony, imagination, land, learning, self and tradition. Quotes about *learning* were intertwined with concepts of balance, harmony, imagination, land, people, self and tradition. Quotes about *social* were intertwined with concepts of economics, learning, people and self. Quotes about *tradition* were intertwined with concepts of balance, harmony, imagination, land, learning, people and self. Quotes about *land* were intertwined with concepts of balance, harmony, imagination, learning, people, self, and tradition. Quotes about *spirituality* were intertwined with concepts of balance, language, learning, people, self and tradition. Quotes about *self* were intertwined with concepts of balance, harmony, imagination, land, learning, people, and tradition. Quotes about *harmony* were intertwined with concepts of balance, imagination, land, learning, people, self and tradition. Quotes about *Indigenous knowledge* were intertwined with concepts of balance, learning, people and self. Quotes about *health* were intertwined with concepts of harmony, land, learning, people, political, social, spirituality and tradition. Quotes about *imagination* were intertwined with concepts of balance, harmony, land, learning, people, self, and tradition. Quotes about *economics* were intertwined with concepts of learning, people, self and social. Quotes about *balance* were intertwined with concepts of harmony, imagination, land, learning, people, self and tradition. Quotes about *political* were intertwined with concepts of economics, land, people, and social. Quotes about *values* were intertwined with concepts of economics, Indigenous knowledge, people, political, social and tradition. Quotes about the *environment* stood alone.

Subsequently, some of the data on the themes is replicated among themes. This replication was left intact to avoid giving the appearance that a comment by a participant was intended only for one specific usage.

4.2.1 Language

The declining use of Indigenous languages across the world is a major concern to Indigenous nations as an indicator of the continued encroachment of foreign ideology on ancient cultural identities. In Canada, it is known that the influence of residential, or boarding schools, instated by religious and political organizations had a devastating impact on First Nations, Métis and Inuit Peoples and their original languages. Boarding schools that controled the lives of the

children and what language was spoken in North West Saskatchewan, introduced new languages, English and French, to supplant the original languages (NWS7 472; NWS2 87). Although, in some instances, Cree and Dëne language continued to be used, most of the children received instructions in French whether they could understand or not (NWS7 506; NWS2 87). Subsequently, over multiple generations, the impact of the diminishing use of Aboriginal languages is seen as a significant part of social and cultural disruption of traditional practices "…basically the language is part of the knowledge…is part of the people…is part of the way of life…so it's got to be more harmonious if you can express yourselves in that way" (NWS4 187).

Today, in North West Saskatchewan, there are still five local languages including Dëne, Michif, Cree, English and French (NWS4 191). Participants acknowledged that dominance of First Nations languages, Cree and Dëne, has also had an impact on diminishing knowledge of the Michif language (NWS4 183, 207), and some community members referred to themselves interchangeably as Cree speakers or Michif speakers. Participants who maintained their original Aboriginal language(s) conveyed that they felt strongly that learning multiple languages was a good thing and part of the Métis community way of building relationships with other communities, meeting new people, intermarrying with other cultures including Cree, Dëne, Blackfoot, and learning traditional knowledge shared in local areas of North West Saskatchewan (NWS5 402, 406, 416, 424; NWS7 140, 265, 519, 623; NWS1 278, 309, 639; NWS2 103). Support for knowledge of multiple languages, including English, was frequently reinforced with a reminder that one should never willingly relinquish the original Aboriginal language(s) spoken by one's family. "No, you can't forget your language. No. No." (NWS1 531).

Participants felt strongly that teaching primarily English in schools combined with the influence of media has negative results for youth in that "Today, young kids, think themselves are white. Yeah. Motz. No." (NWS1 601). Participants felt youth are lonely causing them to turn to drugs and alcohol (NWS7 691; NWS6 114) when in fact Elders are also lonely (NWS1 655; NWS5 344) and have much to contribute within schools. In many ways, Elders and youth need each other. Participants believe teaching traditional values, especially in local Aboriginal languages, can have a positive impact on youth. "…that's one thing they should have in schools is Elders…Elders to talk to the youth. Boy it doesn't take much to change a youth into a good person…it doesn't take much" (NWS5 348). Participants who interact with youth inside and outside schools believe providing traditional Métis values such as kindness, forgiveness,

nurturing, patience and reliability are critically important and youth respond better when the teachings are received in Michif (NWS5 112, 132; NWS1 413; NWS6 114).

Inclusion of male and female Elders in school is seen as a very positive step forward by schools and it is important for the schools and community at large to support the inclusion of traditional teachings, prayer and use of original languages (NWS6 74, 122). Some participants felt that use of English in demonstrating traditional activities, or in ceremonies, to others who didn't speak Michif, Cree or Dëne was probably okay for some things (NWS4 187; NWS2 123), but in other cases "language, and expressions in the language, sometimes aren't capable of literal translation" (NWS4 181). During the interviews, several stories told through a translator described a list of the traditional skills essential for survival in the past such as medicine plant knowledge, trapping, hunting, fishing, food storage, and canoeing which were taught through the oral tradition (NWS7 369; NWS1 105, 142, 371:375), or by 'not speaking' as a technique of reinforcing observational skills (NWS6 27).

Comprehensive knowledge of the land, such as seasonal occurrences and best harvesting times also played a key role in learning plant medicines (NWS1 803). Reliance on written notes, uncertainty with similar looking plants or modifications of traditional medicines could be harmful or even lethal (NWS1 631, NWS7 641). The traditional knowledge holders were the only ones to determine who had earned their trust to carry on this type of knowledge (NWS7 815). If no one was suitable, the knowledge was not passed on.

All the participants expressed their hope that a way might be found to encourage the continued use of local Aboriginal languages in schools, homes and communities and expressed their observation that youth and adults who actively seek to learn Michif, Cree or Dëne gain a tremendous sense of accomplishment and pride in their identity and connection to their own families and communities (NWS2 131; NWS4 183; NWS5 112). While babies should be taught early in life to speak an Aboriginal language (NWS2 95; NWS1 577), culture camps, canoe and camping trips are methods schools and communities could use and immersion is recommended as the best means of acquiring full language skills and to avert youth dropping out of school (NWS5 116; NWS4 239; NWS7 307). Elders see use of original languages as a means to a good life. "I was born to be taught how to speak my language. I would never destroy my language. I

would speak my language…and as I go along, my children knows how to speak the language…and my grandchildren…" (NWS2 95).

4.2.2 People

The interviews conducted in this research yielded largest numbers of references to Language, People and Learning primary and secondary codes. Building self-esteem, building relationships and building healthy communities were recurring tertiary level themes that emerged in the analysis of transcripts. This reflects the foundational knowledge of cultural traditions, and the place of cultural traditions, within the participant group of Métis living in North West Saskatchewan. Traditional land users "are people who simply live in their environment and it's a way of life. So, to them it's nothing strange or unusual, this is how we live" (NWS 4 94). This way of life required individuals to be highly skilled users of natural resources with extensive knowledge of the land and skills such as knowing the cycles of harvest, use of dog teams, knowledge of animal reproductive cycles, fish spawning, commercial fishing practices, trapping, traveling through ice-covered waterways, animal calling, cooking, endurance to walk long distances, and the strength to survive on the land (NWS4 94; 122). There is an evolution of skill and knowledge development in traditional practices that people learn from various family and other community members including such things as appropriate use of weapons, dressing animals, and drying meat that is usually accompanied by learning the Aboriginal language used by the traditional land users (NWS4 110). Participants describing skills Métis had also contextualized the application of skills with experiential stories of respect and sharing (NWS4 122; NWS2 19).

Boarding schools in North West Saskatchewan interrupted intergenerational land-based knowledge transmission and the impact on individuals was, and continues to be, significant (NWS4 90; NWS3 56). Wage labour and access to health care also influenced Métis in moving off the land and away from traditional economies (NWS4 147; NWS3 56); although traditional teachings remain intact, that good health can be returned by spending time in the bush (NWS5 382). Especially for youth, being in the bush was seen to calm and mature young people (NWS5 248), however, since the time of boarding schools, being confined to schools means young people miss out on many of the traditional seasonal activities during those times (NWS4 110).

Re-learning traditional skills by any community member means having an understanding of the natural laws of the land, but also needs to be supported by legal processes that facilitate Métis people's ability to access to natural resources. In this way, rights and responsibilities are part of the discussion and practices of Métis people (NWS4 134). Greed was described as something that harmed relationships and damaged communities (NWS7 871). In the past, although people were poor, they were able to be happy. Love and respect constituted the foundations for teaching and happiness (NWS2 19; 62; 83). These foundations also formed the basis of intergenerational reciprocity in that ancestral teachings were passed on by earlier generations for the purpose of the new knowledge holder passing them on to others (NWS2 26; 139). Relinquishment of basic foundations results in personal and community trauma, but participants believe that active involvement of Elders in sharing their knowledge with youth and encouraging all community members to carry on Métis traditional practices was part of healing (NWS2 49; 147; NWS6 30).

Community-based research, partnerships between academic institutions and local community members, was seen as important but participants felt it must be carried out with respect for local protocols, enacted by processes of reciprocity such as gifting tobacco in exchange for shared insights, and ensuring a primary benefit for Métis people living today as well as future generations. Appropriate protocols need to be determined on a case-by-case basis, but might include researchers approaching local Métis government in some instances, or honouring individual autonomy by engaging with them directly in research as long as the research is not exploitative or harmful to the community, people or environment. The purpose of the research will ultimately determine the most appropriate method of engagement. The raw data from research should not be destroyed but archived and preserved for future generations of Métis (NWS4 301; 303; 315; 323; NWS2 139).

Areas within Saskatchewan that still have concentrations of traditional land users could become hubs of activity where the knowledge could be shared with other Métis who may not necessarily have access to that knowledge (NWS4 147). Alternatively, Batoche, Crescent Lake, or South Bay could become central sites hosting summer-long camps where traditional skills and language could be taught for any Métis person and be a fun and pleasurable experience (NWS4 247; 275; NWS5 120; NWS7 407). In areas where the original Aboriginal language is intact, there are also strong traditional land use skills. Youth from southern Saskatchewan could come

up north to share and exchange cultural knowledge (NWS4 197; 279). Community gatherings of Métis are seen as important activities, which "helps build that sense of who you are", cultivates interest and enthusiasm for traditional knowledge and respect for the people who hold that knowledge (NWS4 231).

All participants believed that learning traditional skills helped youth to become more grounded individuals who learned, and were able to demonstrate a healthy sense of humour and play, respect for each other, their parents, Elders and the natural world (NWS4 130; 165). Knowing family connections and genealogies was seen as an important factor in maintaining relationships (NWS7 623; NWS1 677). Youth need to be encouraged to learn traditional skills and "keep that part of the culture alive" (NWS4 169). Skills such as making moose, duck and goose calls, processing moose hides, beadwork, picking roots, cooking and baking bannock, skinning rabbits, how to collect wood, where to get water, snaring, fishing, processing fish as well as development of values such as conservation and respect need to be learned on-site where the activities can be done (NWS4 279; NWS5 462).

Implementing traditional activities needs to start by being offered to youth through talking sessions with youth, their parents and Elders as alternatives to lifestyles consumed with drugs and alcohol. Choice is key. "You have to talk to the children and ask them if they would prefer to be taught the old lifestyles, or this, with the drugs and alcohol" (NWS7 453; 700). Métis want youth to have traditional knowledge, but also to be literate through formal education processes and have choices for various careers in medicine, law or science (NWS7 751; NWS5 94; 494).

Learning was seen by participants to be circular in nature. Individuals learn ancestral knowledge by watching and doing (NWS6 34) and working hard for the purpose of bringing good teaching to other community members (NWS6 48). Growing into positions of community respect occur over time as one learns humbleness, respect, patience and their own spiritual development. Helping and participating in cultural ceremonies and traditional practices contributes to personal healing, Aboriginal language learning and building teaching and learning skills (NWS2 27; 173; ; 51; 71; NWS7 573) Being able to laugh and cry is seen to be a natural part of learning and healing. Enjoying learning activities is important. As well, directly addressing youth issues such as use of drugs and alcohol is essential in supporting each other in

developing strength to save communities (NWS6 56; 69; 75; NWS2 161). The involvement of both men and women adults and Elders together with youth was seen as a bonding process realized through collaboration in problem-solving (NWS2 49; NWS6 76; 84; NWS4 223; NWS5 344) by examining problems, talking, getting the people involved with specialized knowledge such as those working in the health sector, traditional land users and schools and taking the time required to heal together (NWS6 85:89; 93). Adult community members need time together on a regular basis with others of the same gender who face common challenges (NWS6 104; 124) and jail was not seen as a viable solution for troubled youth (NWS6 89). Developing the patience needed to work with youth takes a lifetime but is necessary to cultivate the caring, wisdom and ability to forgive that forge lasting relationships. These are skills essential to determine limitations, help resolve conflicts and eliminate violence that often emerges in families or communities in today's social structures (NWS5 132; 528). Since schools are a reality, participants felt that schools should support and encourage the involvement of Elders and traditional land users. Cultivating a sense of belonging for the Elders and traditional land users would provide opportunities for them to develop relationships with youth, build trust over time by talking, listening, responding to youth questions, and creating opportunities for youth to learn leadership skills through the development of traditional values and practices (NWS6 64; 77; 106). This is a legacy Elders hope to leave for Métis children.

4.2.3 Learning

Participants believed youth should be encouraged, supervised and trained to learn traditional skills such as hunting (with and without firearms), fishing (including setting nets, gutting fish and cutting it up), trapping, making dry meat, canoeing, harvesting berries, plucking ducks and cooking as well as Michif language and Métis history (NWS4 165; 110; 239). Cultural camps are seen to be a good method for teaching and learning and building trusing relationships although having Elders and traditional land users right in schools and hosting community training programs was also seen to be useful (NWS5 120; 132; NWS4 239; NWS6 93; NWS3 110). Having youth learn traditional skills can support those individuals who wish to carry on working in a traditional economy as well as ensure the skills are carried on for future generations (NWS4 169). Being out in nature was seen to create a different experience for youth that brought out their sense of maturity and natural learning spirit (NWS5 248).

In the past, Métis learned not only from their parents and grandparents but also from other knowledgeable people who were wise and willing to teach them how to do things (NWS2 143). Before boarding school, girls learned from their grandmothers (NWS7 176). Boarding schools interrupted the intergenerational transmission of traditional knowledge, but many Métis retained traditional skills and taught those who did not learn while in boarding schools (NWS4 90; NWS1 46). Inter-community cultural camps are sometimes facilitated by traditional land users from nearby areas to teach skills such as canoeing and giving young people land-based experiences (NWS5 124). "…traditionally, Métis had this knowledge throughout the homeland, because, you know, they lived maybe in different environments but they still lived off the land, they still needed traditional ecological knowledge wherever they were…" (NWS4 142). When people lived off the land, travelers needed to have knowledge of camp locations and the skills to move safely among them by land or water, especially if they were moving as families with children. They had to know when to rest and when to work, when to arrive at the camps so it was not dark because they would have to set up camp, unload cargo, get water and cook. (NWS7 259; 274).

Formal education was seen to be important as it provided options for diverse careers in law, medicine or science as well as important literacy skills for most jobs today (NWS7 751; NWS5 486). Participants believe some youth who are given nothing but bookwork will drop out of school. Providing youth with experiences outside of classrooms encourages youth not to drop out (NWS7 307). At the same time, it is important to ensure that the Elders and traditional land users working with youth and passing on teachings are respected in the community and really value the culture and traditional lifestyles and are not just doing it for financial gain, because that sends the wrong message to youth (NWS7 775). Learning, practicing and maintaining traditional skills is hard work and should not be dismissed as entertainment. Métis know that natural foods are healthier then processed foods imported to the north, but having access to local foods requires that skills be developed which can only happen through hard work (NWS4 138). Participants believe the inclusion of traditional knowledge and languages in schools can, and does, improve the learning experience of youth creating a more positive community environment (NWS2 25; 95; NWS4 130). They acknowledge that in places where such learning is not occurring it would be difficult to "change the thoughts or the mind frame now with the existing

policies in education…but there's somebody out there who probably would know to convince the existing learning cultures to change" (NWS7 755).

Elders would prefer if young people had access to some kind of spiritual or religious teachings in the existing school systems so young people "have something to believe in" (NWS7 502). Improvements to schools were seen as enacted through inclusion of traditional knowledge and skills such as canoeing, fishing, trapping, collecting wood and water, making fire, cooking, beadwork, processing moose hides, skinning rabbits, as well as building self-esteem, interpersonal skill-building, conservation, use of Cree and Michif languages, traditional Métis music and dance, and a variety of life-knowledge of Elders (NWS6 98; 114; 130; NWS3 56; NWS5 112). Inclusion of healing circles to facilitate youth discussion was seen as a very important part of education as it helped the young people learn to speak out in the context of safe cultural environments (NWS6 116). Elders believe taking time with young people can help avert youth suicide and help families to heal (NWS2 173). However, there must also be recognition that it takes time to build trust with youth and then to extend that trust in ways that make youth excited to learn about culture and traditions (NWS2 147). "Some young people don't trust right away…You gotta build it in the school as you come here as an Elder to be known you are that kind of person…to be trusted and to start talking about these things" (NWS6 70). Trust destroyed by boarding schools also has to be re-learned by Elders; this can happen in different ways, but helping others is seen to be one way of healing. Helping youth is believed to be good for Elders also in building self-esteem, taking pride in culture and traditions and developing talking skills (NWS6 36; 38).

Elders, who share traditional stories help youth understand Métis values and provide a model for behaviour in love, respect for each other and parents, and traditional skills (NWS2 83). Young people need to learn what school offers but also need to learn within the family unit and as members of their community to have a healthy life. Youth and adults need to know someone cares about them, which means taking time with everyone (NWS6 102). Good parenting doesn't always involve talking but is demonstrated and shown by encouraging children to learn skills in much the same way that community gatherings can encourage learning skills others have and increasing their appreciation and value of the people who have those skills (NWS2 161; NWS4 122; 231). Collaborations among schools, school divisions and traditional land users including the Trappers Association and the Fur Block Associations can work to integrate traditional

activities within curricula. There also must be sufficient financial resources made available to do this effectively (NWS4 167). People who have traditional values as part of their life are happier healthier people and access to land is critical to preserving traditional practices and helping new learners become herbalists, medicine people and traditional land users in varying ways (NWS2 113; NWS4 147).

4.2.4 Social

Families in North West Saskatchewan and elsewhere were disconnected by residential schools. Some individuals were able to remain, or return to, traditional land use practices, but others went on to choose other lifestyles. Summers remained the primary time that families were able to reconnect to some extent (NWS4 90; 122). During the last few decades, Métis experienced a transition from land-based economies to lives within townships that provided wage labour and houses. However, there are still areas within Saskatchewan where Métis have retained traditional practices to the present day. Métis have legal rights for fishing and hunting but it is also important for Métis youth to learn natural laws and the responsibilities of harvesters. Some Métis still want to learn to live in traditional ways and as communities strengthen, the youth will benefit (NWS4 134; 147; NWS6 108). Options for traditional land use training for youth or abandonment to drugs and alcohol are a choice that must be asked of the Métis community (NWS7 453). Métis people are working hard to establish a variety of programming for youth and Elders. Strengthening community as a whole is facilitated through talking circles for men, women's gathering and community meetings for everyone (NWS6 48; 75). Elder involvement in broader community activities encourages others, including other Elders, to come out. When Métis people come together, it benefits the youth (NWS6 123:124). Youth really listen when adults directly address issues that affect them such as use of drugs and alcohol and bullying (NWS6 69).

All participants believe it is important to have Elders in school, whether they are traditional or not, to encourage youth to connect with community in practicing traditions, speaking their language, learning traditional practices and being proud of their identity (NWS4 223; NWS7 573; NWS6 64). Youth need to be given sufficient time to build trusting relationships with Elders which is helped when school personnel as well as other community members actively demonstrate their respect for Métis culture and support the inclusion of Elders

and traditional land users over time to work with youth. Since Elders tend to be shy, it takes time to build their confidence in teaching about traditions also. Although participants strongly wish for Métis children to excel in school, emulation of white identity and culture was not seen to be beneficial for youth or Métis communities (NWS4 130; NWS7 573; NWS2 147;173; NWS6 36; 62; 74; 77). Whole community solutions are needed to help troubled youth. Averting youth suicide, youth incarceration and trauma is a process of taking time with others, listening and going through grieving processes with others which also helps one's self to heal at the same time as others are healing (NWS6 89; 173). Talking is part of healing and youth need to know community members, including leaders, notice them and care about them. As youth feel comfortable to speak out and heal they can move on to learning traditional skills which then encourages them to have more confidence in themselves, laugh and enjoy what they are learning (NWS6 87;102).

Métis adults need to be interacting with youth to show them how to have good relationships among each other and how to become caring individuals as they learn traditional and leadership skills (NWS2 173; NWS6 77). Youth like the outdoors but they may not have a comfort level to start with, but with encouragement and Métis adults spending time to watch over them, youth, both girls and boys, quickly learn to play and enjoy the outdoors, especially activities such as paddling [canoeing] or snaring rabbits (NWS5 256; NWS2 25). Youth can learn the traditional skills but also Métis values that go along with the skills (NWS2 25). "We taught them about that, many things, and when we go out in the winter, we go out and show them how to snare rabbits and survival also" (NWS2 25).

In past generations, only a limited number of families (e.g. three families) spent time on the land together. This was necessary to facilitate sharing and conservation of resources (NWS7 331). Knowledge of multiple languages was important in past generations and is an important factor in relationship building (NWS2 103). Traditional teachings are still possible even if they are offered in the English language. The core messages are similar, such as demonstrating confidentiality within healing circles or in sweats. If issues of trust are not breeched, traditional teachings can help youth grow spiritually and personally (NWS2 123; 107). Adult Métis community members must solve problems together and practice patience and perseverance to reach the goals they set for a better community and to help youth learn to love and trust (NWS 2

76; 85; NWS6 104). Elders want children to have a good future so they need to learn to protect and value the environment by learning from Elder's wisdom (NWS6 72).

Métis people can appreciate the intergenerational value of research and that the institutional ethics process with consent helps facilitate that process. Depending on the purpose of the research, there are different ways to access the community – either by approaching individuals or through Métis governments. Appropriate research access really needs to be determined on a case-by-case basis. Most importantly, the research must not be harmful to the Métis community. It is helpful for the researcher to have a relationship with the community, the topic of research must be useful to the Métis community and the raw data must be preserved for future generations of Metis (NWS4 301; 303; 315; 323).

4.2.5 Traditions

Learning about traditions as a way of life is more important than what labels are attached to the activities or in what language it is taught (NWS4 187). Many of the terms used today are foreign terms for the skills and skill sets. Generally, the activities included skills such as what kind of fire is best in different circumstances, how to make fire, how to get dry wood, commercial fishing, trapping, mink ranching, cutting hay, feeding animals, knowing cycles of harvesting, living on the land, survival skills and walking long distances, with or without snowshoes, were all important parts of tradition. Hunting, tracking and fishing were learned from childhood through adulthood to build skills at different stages of readiness. Young people need to see and participate in hard work, perseverance, conservation, and practice of respectful protocols as well as being loved and cared for in order to learn the Métis value system and continue the teachings (NWS2 17; 83).

Using firearms and other tools was part of the learning process, but people learned all the skills involved in an activity. For example, fishing required that one learned how to set nets, lift them properly, take out the fish, gut and cut up the fish as well as preserving or cooking. Snaring needs to be done the correct way to eliminate suffering of the animal and ensure the meat was good (NWS7 195; 208). Similarly, hunting involved tracking, shooting, dressing the animal and drying meat (NWS4 110; NWS3 150; NWS7 76). "He was a good hunter, my old man. When they used to go look for moose, they used to kill a moose every time there. He used to teach me how to make dry meat. Yeah, and how to cook too…the way tansikiya neheyaw…" (NWS1 74).

Making traditional medicines, berry picking and other harvesting practices required that people had freedom of movement (NWS4 94; 147; 187). Living in isolation required that the customs, practices and traditions were in place that facilitated survival (NWS4 147). These activities were, and still are, part of a way of life for people. Métis who have been away from the north and reconnect with traditions have to learn, or re-learn, the skills but have a new sense of wonder at the skills required to carry out the activities (NWS4 94; 147). Practicing traditions is hard work and people need to be able to earn a living but also to ensure that need is balanced with conservation values. Local communities that have access to traditional foods will also benefit from the healthier content (NWS4 138).

Métis have had a difficult time as Aboriginal people and have had to be politically active to be recognized as a People. Research is linked into this activity also so it must be done with respect for the people and be used for positive purposes as opposed to exploiting people or making money off knowledge. Respecting local protocols such as giving food or tobacco is how it was done in the old days (NWS4 303; NWS7 762). Métis in North West Saskatchewan come from a variety of heritages including Cree, Dëne and Michif. Knowing your family heritage, languages and genealogies is important as is cultivating and maintaining relationships over time with children, youth and other people (NWS4 207; NWS5 490; NWS7 623; NWS2 103; 165). Traditionally, some skills such as beading, gardening and mink ranching were learned from grandmothers and mothers but also the skills of caring for the elderly and caring for other's children were learned (NWS5 94; 132). Husbands and wives helped each other to do activities such as navigating through bush country and each had skills to contribute (NWS5 208). Parental love and showing skills was an important context of learning, but people other than parents also shared teachings and wisdom. Knowledge was shared with everyone who was there to see and hear. Today, teachers and others could come seasonally to the north to learn traditional skills (NWS2 33; 143; NWS6 34).

There are places that would be good gathering places for Métis to learn traditional skills such as Palmbere Lake in North West Saskatchewan. The spaces of the north are valued for the freedom of movement they provide as well as the beauty and availability of fish and game (NWS2 41). People need beauty, quiet and peacefulness in their lives to enjoy but also to develop observational skills, which can be done by paddling around rivers and lakes or being on the land (NWS2 37). It is harder to find appropriate places in southern Saskatchewan to teach

traditional skills of North West Saskatchewan (NWS 4 267). Kids are raised differently now than in the past and they harbour a lot of anger (NWS5 316). The peace of the wilderness changes youth and calms them (NWS5 248). In school activities, learning Aboriginal languages and learning from Elders is important although trust has to be grown over time in order to learn traditions and become leaders in the community (NWS5 348; NWS6 54; 77). Elders who have been through residential schools know that when trusts are broken that it involves a process of connecting with someone who can help you let go of past wounds and begin to feel good about yourself and then to heal enough to go on to teach others how to have a better life (NWS6 38). Traditions are taught for the future well-being of Métis children as well as protection of the environment (NWS 6 72).

Elders know education is necessary for most jobs now but do not want youth to give up traditional ways and languages. Elders and traditional land users have important contributions to make such as helping youth learn patience and being there for them at times when they are angry and need comfort. Elders and traditional teachers can offer the time, kindness and calmness that youth need. It also benefits the Elders who enjoy the company and are willing to provide the gentle teachings needed (NWS5 94; 128; 132; 300; 344; 486). Healing circles were used as a traditional form of dialogue among adults. A feather or medicine package provided each person equal opportunity to be heard as it was passed around. People talked about their lives on the trapline, fishing, good times and beautiful things they saw as well as hardships they suffered. Participants believe Métis people are healthier when they live traditionally off the land and with the value systems that went along with life on the land including sharing, respect for the land, using local herbs, doing hard work, acting respectfully and teaching others by showing (NWS6 35).

Teaching youth about sweats and ceremonies is part of the cycle of teaching and learning, as they will also need to be able to lead ceremonies in the future. Helping at ceremonies teaches the ceremonies but also teaches patience, hard work, protocols, how to teach others and to seek to be a better person even in old age (NWS2 57; 71; 227). It is important that cultural skills are not sold but taught because of a belief in the Métis culture. Even non-Aboriginal people can learn traditions and local languages if they are determined and enjoy it. This is a teaching of reciprocity in that you helped each other whether that was through teaching skills, feeding, housing, sending visitors home with food, and treating other kindly in respect of those who have

treated you kindly (NWS7 775; NWS2 41). Being an active community member is a way of being a good role model for Métis today. Giving respectfully of yourself, as an Elder, feels good and helps solve community problems (NWS2 147).

Outdoor activities are enjoyed by youth and can include swimming, or practicing traditional protocols such as laying tobacco when harvesting trees, branches, or medicines. These activities help youth learn why it is important to make sure others have food by sharing, never to waste anything and that in past times even though people were poor they were happy (NWS5 128; NWS2 13; 19). Teaching traditional Métis music such as fiddling, dancing such as jigging and games is an important part of celebrating cultural traditions and can contribute to young people feeling good about coming to school (NWS6 130).

4.2.6 Land

This section describes how the interview participants spoke about the land in North West Saskatchewan and all land in general. Use of the land reflects a Métis way of life and is seen as something that should inform one's actions or philosophy in daily living whether traditional land use constitutes full time, part time or occasional practice (NWS4 94). Knowledge and skills are unique to each person and collectively can contribute to a healthier life and lifestyle than would be experienced without traditional Métis teachings (NWS4 94). Specific physical skills are part of traditional environmental knowledge, but also Métis values contextualize the skills which are learned and taught to others about how to forge respectful relationships among human families as well as with the natural world (NWS4 98; 122; 130).

Historic disconnection from the land as a result of residential schools and prohibitive laws is being overcome with Métis success in achieving legal rights to use the land. This is helping Métis regain a comfort level with traditional land use practices (NWS4 134; 147). Young people need to be encouraged to reconnect with traditional teaching in order to learn the skills and value systems balancing rights along with responsible practice (NWS4 130; 134). Traditional land use is hard work and those who wish to rely on the land for a living need to be well grounded in practices that ensure respect for natural laws (NWS4 134).

The term 'land' is used synonymously to describe the Earth, plants, animals, water, sky and wind, and the behaviour of fire as well as the complex interactions and relationships among its inhabitants (NWS4 122; 142; NWS2 37). Diverse environments meant that individuals and

collectives of Métis across the Homeland had diverse knowledge sets depending on where they were living and harvesting. Expertise included knowledge about lakes and rivers including the water flow and appropriate seasonal use, local species of animals as well as their particular life cycles and behaviours, skinning rabbits, trapping on land and in the water, fisheries for both personal and commercial use, location of good water, shelter, types of wood to collect and how to make the right type of fire, weather patterns, where to find and harvest a variety of animals and berries, harvesting wild rice, preparing moose hides, and cooking skills, all of which was essential and contributed to survival, a sense of pride in knowing the traditions and having the wisdom to practice respect and conservation at all times (NWS4 94; 98; 130; 142; 259; NWS5 112; 214; 226; NWS1 313).

Only certain individuals had advanced plant knowledge and skill for application of that knowledge in medicines and healing (NWS4 98; 147). The bush itself is considered to have healing properties that cannot be 'harvested' but rather come from the collective energy of trees, water, air and the place itself, especially when you are in direct contact with them (NWS5 382; 564:568; 576). Spending time in a clean quiet place contributes to improved health in a matter of days (NWS5 368). Participants also felt that eating wild foods was much healthier for people (NWS1 236: 240). In all processes of healing, part of the local protocol involves offering tobacco in exchange for that which is taken or requested of the natural environment (NWS5 368; 564; NWS6 26). In the past, people selected the place they would live by considering the cleanliness of the area, access to water, surrounding habitat as well as the beauty of the area (NWS2 23). In the same way, any kind of medicine harvested needs to be collected from a clean place that is not polluted (NWS6 28). Healing is also seen to be a process of appreciation for the northern environment such as the forests, lakes, sunrises, fresh air and beauty of the place but also developing meaningful relationships with other people and taking time to talk with people and notice what they are feeling, doing or thinking. Healing through overcoming fear of others and learning to trust can happen through talking and helping to teach skills to others (NWS6 38; 100).

Children are sensitive to the natural world. They enjoy being out in nature and should be taught their Aboriginal language from a young age (NWS5 504; NWS3 98). Participants believe youth who are able to spend time outside school buildings in the bush learning traditional skills become much calmer clearer thinking individuals, which leads them to mature more quickly.

Youth may not initially have a comfort level being in the bush for the first few days, but within a week, they gain the comfort level and do not worry about appearances but are more interested in enjoying themselves and doing activities. It is important that adults supervising them teach but do not interfere with the development of their skills, sense of freedom and play. Through cultural camps, youth can learn to appreciate the beauty and richness of the north, or at other locations within Saskatchewan such as Batoche or Crescent Lake. They can learn such skills as paddling, swimming, how to set nets for fishing, swimming, shooting skills and be able to practice what they have learned (NWS5 256; NWS4 247; NWS1 343; NWS2 37). Within days, adults observe that youth voices soften, swearing disappears and they do not want to hear anyone yelling. Youth respond better to adult guidance when it is delivered in the Michif language, and at the same time, it encourages them to learn the language and use it in conversation (NWS5 112; 248; 256; 284).

The intergenerational transmission of skills and knowledge extends not only to children and to youth, but also laterally between husbands and wives, extended family members and other members of the community, which all contributes, to collective knowledge (NWS3 102; NWS5 208). In the past women often learned traditional skills from their grandmothers (NWS1 193). Today, Métis women are willing to teach other adults as well as youth. Men can also learn by getting together. Mixed groups are important but gender specific group learning is important for those who do not have a comfort level to talk in mixed groups (NWS6 103; NWS5 232). Traditionally, families did their work together and regardless of the task or who was doing it respect for the land and water was taught by adults through their behaviour and expected to be demonstrated by the children so that they would learn and be able to pass on the knowledge to their children in the future (NWS6 30).

The legacy that adults and Elders hope to leave is to have been able to show children how to live a good life through the development of loving relationships, teaching them to develop trust, patience, language, hard work and their own spirituality at ceremonies and through everyday life in close association with the natural world (NWS2 41; 83). Traditional spiritual practices such as sweat lodge ceremonies led by pipe carriers are highly regarded by many Métis. Métis who follow traditional Aboriginal cultural belief systems hold the status of Elder in high honour. Participants felt that not just any person can carry out spiritual leadership. The honour has to be earned through humility, respectful life practices, hard work and sacrifices. Young

people can obtain these skills from observation and direct teaching. Earning the teachings and knowing how and when to take your place as a leader can take a lifetime. This is a very personal act and comes with the wisdom and readiness of each person (NWS2 71).

Research collected and preserved from the past has also contributed to present day knowledge; "the interviews done by others that still survive and are in archives are helpful to us because it describes a way of life, because people are gone now…there's no other way they can speak…" (NWS4 299). The ethics process helps ensure the research is done right (NWS4 299).

4.2.7 Spirituality

Concepts and practices of spirituality emerged from participant interviews as a part of their discussion about other subjects. Spirituality could be thought of partially as the harmonious coming together of skills, language and teachings of the culture in the way of life of the Métis. Together, the customs, practices and traditions have enabled Métis to survive. People today, as in the past, have different skill sets such as trapping, harvesting, or knowledge of medicines that have changed as the habitat they live in has changed. Persons who have various knowledges can help younger people or other adults to learn these skills, which are seen by some as a responsibility to ensure passing on of traditions (NWS4 187; 147; NWS2 147). Skills learned through structured activities and discipline lead to a good life (NWS7 472).

Establishing ethical processes for research involving traditional knowledge, such as for use in post-secondary institutions, can help to assure that trusting relationships are built which will in turn assure accuracy of knowledge collected and appropriate use of the knowledge (NWS4 299). Participants believe it is essential that youth be given the opportunity to learn cultural traditions (NWS4 169). The spirit of Métis culture is talked about within the context of extended family genealogies, knowing one's direct family lineage, their names, what languages they spoke and specific cultural traditions they practiced, all of which emerged in the interviews as part of what contributes to the choices each person makes in carrying on certain traditions (NWS4 207; 181). Diverse backgrounds were spoken about with pride in connectedness to other families, communities and cultures. This seems to account for the ease with which Métis people accept and adopt particular cultural practices that contribute to collective ways of life. Trade and commerce are another example of exchange that patterns with the sharing of traditional

knowledge. Pride in identity means youth will respect what their parents, Elders and other traditional land users know.

Much of the dialogue about the subject of spirituality in these interviews revolved around self-development and maturity that is needed to build good friendships and relationships (NSW5 532). Participants believe formal education in today's school systems is important, but does not have to involve sacrifice of cultural traditions (NWS5 486).

> …I was really concerned because in the future they'd want to learn about these things, they'd want to learn how to speak their language, "why wasn't I taught?" you know, they'd be asking, "what did my dad do while he was alive? I don't know these things, never been taught to me and I want to learn from somebody else too…that can tell me that your dad was a good hard working person…or he done this good deed"…they want to see that, children in schools, they want to learn about these things…"oh, that's the way my dad was" "Gee, I'm really happy that my dad was able to help in many ways in the community, a good role model in the community to these children…and to help them. They are eager to learn…(NWS2 83)

Introducing youth to land-based experiences can be done through schools by involving traditional land users and Elders and allowing sufficient time for youth to build trusting relationships. It can be difficult, at first, for youth who are not used to this way of life, but helping them to enjoy themselves is a foundational teaching (NWS5 256; NWS4 187; NWS2 147). Young people can learn about trapping, paddling, healthy eating from wild foods, and bush life by being with Elders and traditional land users but it is also important for parents and children to spend time together each day and evening (NWS3 102; 254; NWS7 476; NWS1 236). The unspoiled beauty of the north and peaceful surroundings can contribute to peaceful families (NWS2 37; 41). Respect, hard work and patience have to be learned and practiced, modeled by parents and supplemented with kindness and love. Parents taught children how to use the land and respect it. Elders bring these teachings to their communities through prayer and through participation in community activities (NWS2 83; 165). In all cases, passing on teachings is done for the purpose of children, and other adults, to learn respect and how to be happy (NWS6 113).

Many individuals are coming together in families and communities to talk about solutions to hardships such as the impacts of drugs and alcohol or suicides. Participants spoke about these solutions in terms of systemic change, which involves personal growth, family, community and other larger collectives. Individual strength and healing means that you can be there to help your family and others in times of trouble to help them recover and heal (NWS2 173). Individuals

have different ways of learning and practicing spirituality and all are rooted in the purpose of caring about others. In the past, adults sat in circles to talk about their experiences on the land when they would gather together from different places. These are known today as healing circles (NWS6 55). In some cases, adults who attended residential schools found that healing and regaining the ability to form trusting relationships took a long time, and is a process of having someone to trust, talking, letting go of past wounding experiences as a matter of healing the self and building the courage and skills to help others. Healing is about appreciating your environment and other people (NWS6 38; 72; 100).

Sweat lodge ceremonies provide an opportunity to learn and practice cultural traditions, to talk about personal matters and to know that confidentiality is respected in the healing process. Burning of tobacco before leaving is part of the act of closure to the ceremony. Healing and spiritual growth is a process of listening, watching, participating, internalizing what is experienced and applying learned teachings to oneself (NWS2 54; 61).

4.2.8 Self

In applying an Indigenous methodology to this research study, one of the principles involves acknowledging the role of self within the research process. Within Western scientific research, the concept of objectivity is believed to facilitate theory that does not include any bias or influence from the researcher. Aboriginal holistic thinking, on the other hand, fully accepts and acknowledges that each individual is immersed in life and this is a natural interactive process. Dismissing the role of self in any learning would mean that the learner has not grasped one of the foundational teachings of Aboriginal philosophy. Throughout the thematic summaries of this research, participants talk about themselves and their own experiences as the method of teaching about what they view is important and might be adopted or applied as part of a system to ensure Métis traditional environmental knowledge has an opportunity to exist in the future.

Participants interviewed recognize the impact of residential schools and changing economy as contributing to lifestyle changes interrupting Métis traditional forms of land use. The redirection of children into formal school settings does limit the capacity of families to live and work together on the land, but those who remain traditional land users are available to continue developing their skills by actively practicing them and passing on their skills in collaboration with schools (NWS4 187; 130; NWS5 204; NWS6 50). Elders who have

traditional knowledge and wisdom are motivated to overcome their own shyness and wounds because "the youth who are still suffering in many ways" can benefit from the self-development which emerges from being exposed to traditional teachings (NWS6 36). Elders who begin to work in schools reflect on the process they are following as well as the specific teachings. For example, Elders have their own personal way of enacting respectful behaviour as well as expecting it from others; they draw on life experiences for knowing what relationships are needed; they need to be aware of their own comfort levels with topics and limitations to address challenges which might come up; and mostly they are aware the impact their teachings can have on the learner (NWS2 147). Issues faced by youth such as bullying and lack of trust are understood by Métis adults and Elders. Youth may have no one they feel they can go to that can talk with them and give them hope (NWS6 50; 70).

Each person has a role to play in being responsible for helping others. Even if you are busy, taking time when someone needs to talk is seen to be a very important cultural practice. You may not know what is going on with someone so taking time to talk or noticing accomplishments and acknowledging them is a way of caring and can make a big difference in someone's day or their life so it is important, especially with young people (NWS2 83; NWS6 102). In a way, it is a foundational protocol, directly affecting both individuals and communities at the same time, which could be understood as existing outside the gifting of tobacco. A sense of pride comes from caring about others and teaching children and grandchildren ancestral values. Passing on traditions to others can be seen as intra-generational or inter-generational reciprocity and is always motivated by a hope for the health and happiness of the recipient learner (NWS2 173; 113).

Learning together helps build skills, but also friendships, trust, confidence, a sense of identity and community that one carries with them no matter where they travel or end up living (NWS4 231; NWS7 573; NWS5 532; NWS6 107). "I think they should have cultural survival camps…not just during the school terms, but during the summer holidays…take kids onto the land" (NWS4 231). In communities where Métis cultural events are held, people get together to share stories, show pictures, get to know other people through demonstrations of traditional skills, dance and enjoy music which can be a bonding experience for Elders, adults and children and contribute to a "sense of who you are" (NWS4 231). Traditional land users are very skilled

at what they do which can be a source of inspiration for someone who only has access to the information found in books (NWS4 94).

In many ways, traditional land users are the original lifelong learners talked about in contemporary literature. The skills learned by individuals were essential to survival and were "an accumulation over the years" as a natural process because "you always continue…continue learning" (NWS4 94; 126). Traditional environmental knowledge is both general and specific across territories and in local environments. Some things might be talked about as similar practices such as fishing, but depending on the specific region or area, Métis would have needed to develop knowledge appropriate to their environment.

> …if they were on the Prairies they still needed to know, you know, the dangers of, you know, prairie fires, the winds, where you can find good water, where you can find good shelter, where you can find and harvest different animals…where there's lakes and rivers…so they had their knowledge. (NWS4 142)

Skills learned at culture camps for youth would also provide traditional teachings with supervision, training and encouragement that would enable them to begin to build those skills such as hunting, harvesting berries, catching and cleaning fish, boating, plucking ducks as well as what you should take from the natural world, and what you shouldn't take, what you can eat and what should not be eaten (NWS4 165). In having individuals passing on what they have been taught and have experienced, communities benefit and recognize those who have positive messages to contribute. Pipe carriers who carry out spiritual practices, such as sweats and other ceremonies, also do this to help others, but they don't say it, they just do it and are recognized by community members to have this role as a result of the sacredness of the teachings, empathy and respect for trusting relationships (NWS2 71; 83; NWS6 54). Learning traditional skills and spiritual knowledge happens over time by participating, observation and repetition (NWS6 52; NWS5 528). The individual contributions of Métis traditional environmental knowledge to collective knowledge is seen as an important feature of Métis culture and is based in the tradition of sharing. Participants recognize there is a positive impact on youth as a result of having Elders involved in schools. The Elders themselves believe that they can help youth orient themselves to being good people (NWS4 323; NWS5 348). Individuals who have not had an opportunity to live on the land in a traditional lifestyle can still learn from others who have retained traditional skills, language and value systems. Adults and youth learn best by observation and doing.

Experiences become stories that remain with the individual and can be passed on to others (NWS4 187; 122).

The collection of individual stories through research can be a valuable source of information to Métis communities; however, there is a responsibility for researchers to ensure no harm to individuals or community occurs because of the research. This assurance is better facilitated if the research has an understanding of the community context and includes Métis contacts who also are aware of the potential impact on communities (NWS4 315; NWS7 863).

4.2.9 Harmony

The concept of harmony, or harmonious relationships, emerged in a variety of instances. For example, integration of skills and values learned from traditional knowledge extend through all areas of life from survival skills to relationships and respectful behaviour and it was felt that schools in North West Saskatchewan are doing a good job of working to bring these learning opportunities to northern youth (NWS4 130). Harmonious interaction involves practicing respectful skills, as well as practicing restraint, to avoid misusing the land. Michif language plays an important role in reinforcing these teachings as it was felt that youth respond better when encouraged to interact in their local language, as it connects them directly to the way ancestral knowledge was passed down (NWS5 112; NWS6 27; 64).

In some cases it was felt that youth are not learning respectful behaviours in their day to day lives but they could if they had more access to land-based experiences taught by Elders and other traditional land users (NWS7 399; 445). Connecting schools to Elders willing to share traditional teachings is a part of community harmony. Educators in schools can put Elders at ease by being kind and respectful, for example, welcoming them personally, shaking hands and helping the Elder feel as if they belong in the school (NWS2 62). The wisdom of past generations is being reconnected to youth through schools who do involve Elders. Involving a variety of people in schools can facilitate language learning, values, skills, and helping youth recognize the value of what community and family members know and can do (NWS2 83; 147; NWS6 68; 82). Learning about herbs and medicines, learning how to work hard and still share foods hunted or harvested, and always maintaining respect as foremost in all actions are all things which can be learned (NWS6 35). In spiritual ceremonies, the teachers show respect for the Earth in the ceremonies that also helps young people understand that they will also be

respected which leads to trust (NWS6 51). When trusting relationships are built, one learns skills that can be passed on to others (NWS6 54). Traditional knowledge in various regions can also contribute to other regions where the knowledge is more limited. Such knowledge transfer and mobilization would also contribute to a broader use and knowledge base across the Métis Homeland (NWS4 147).

Building relationships can happen in various ways among individuals, but the concept of honouring spiritual protocols as well as what might be called procedural protocols emerged in the interview transcripts over and over again. It was commonly felt that procedural protocols should be observed by anyone attempting to access knowledge, by informing local Métis governments of what they are doing so Métis leadership might have an opportunity to assist in determining process as well as being available to protect Métis individuals and communities from exploitation. Additionally, researchers or others acknowledging spiritual traditions by gifting tobacco is appreciated by Elders as it is seen as an acknowledgement of a mutual understanding of a foundational law of reciprocity (NWS4 315; NWS7 762; NWS1 764). Spiritual protocols were talked about in terms of offering tobacco in that "You have to be clean and you have to respect the land. Yeah. Even chopping down a tree…you have to put tobacco…whatever you take off the Earth…even a leaf…you put an offering down. And that's respecting the land" (NWS3 106). The teachings of harmonious interaction and being careful with the land were extremely serious, as Métis knew that it is the only source of survival. Eating fresh foods from the land ensured life (NWS6 29). Offering tobacco in exchange for things taken from the Earth is an act of reciprocity as "they put tobacco to say thanks to the Mother Earth" (NWS7 783). Tobacco can also be gifted to water in exchange for healing or to other individuals in exchange for traditional medicines (NWS5 568; NWS1 791; NWS7 779). Whether one is cutting a tree or taking only a small item from the Earth, using wood for shelter or plants for medicine, tobacco was always put down and reminded individuals not to waste, destroy or misuse anything and never to take something without giving something back (NWS2 13; NWS6 25:26). Today's youth are going to be the leaders in the future so they can be better prepared with traditional teachings (NWS6 77).

Areas that facilitate harmony might include spaces for men to meet together to discuss things they may not feel comfortable discussing in mixed groups, and availability of sweats or other ceremonies for youth. Helping new generations achieve happiness and respectful

behaviour helps overcome personal wounds (NWS6 107; 113). Humility and respect are necessary behaviours associated with sweat lodge ceremonies. Youth who participate understand this and know this is part of the learning environment. There is an element of patience required when participating at sweats. Youth have to learn to be patient, but by watching and listening to the teachings of the pipe carriers who are very patient with them, it is a skill that can be learned over time. The importance of patience and taking time for others extends throughout life as a traditional teaching. Even in community events, prayers help people relax, set a respectful tone and reinforce the importance of confidentiality so there is discussion that is more productive. Sweats provide an opportunity for healing for youth who are dealing with the impacts of drugs and alcohol in their own lives or those around them. Tobacco offerings are also part of the sweat lodge ceremony (NWS2 57; 61; 71; 139; NWS6 106).

Interlude…as I prepared to continue summarizing the words of the people from North West Saskatchewan that I interviewed, I found that I was very tired and needed to rest physically, mentally, emotionally and spiritually. I felt weary from the long hours sitting at the computer thinking and typing, and even though I took time to walk out along the Saskatchewan river each morning, at times I felt discouraged in my solitude wondering if this work would matter to anyone, whether the time and care I was trying to take to express myself in the research was more, or less, important than speeding through the process just to be finished the task and what would come after the research was done. I prayed in the quiet of my home and asked for some help to get through these last parts of the work. With a big breath, I got ready to go back to the computer when a knock came at the door. An Aboriginal man stood at my door, smiling and reached out to shake my hand. He had a name badge pinned to his jacket and was canvassing on behalf of his church and their youth programming. He asked if I remembered him from the year before when he stopped by. As we stood and chatted, I shared some information about my past work with the Métis Nation and current research. We talked about some of the history of the North West, heroes and tragedies and the legacy of residential schools. Before he left, this man prayed for me in Cree with a prayer taught to him by his father. I heard him mention 'harmony' that I noticed since I just finished writing the section on it but he could not have known that. He took the time to interpret his words, which were almost unbelievably direct responses to my own unspoken uncertainties. A voice of hope and encouragement and certainty

delivered to my door by a fellow Métis who also just happened to be from North West Saskatchewan…

4.2.10 Indigenous Knowledge

Métis do not commonly use the term Métis traditional environmental knowledge, or other derivative labels, to describe what is truly a way of life. Indigenous knowledge can really only be identified through the stories and practices of particular Indigenous individuals and communities. All of the information emerging in these interview summaries constitute part of what Indigenous knowledge means to Métis in North West Saskatchewan. The information that is shared by participants is unique to this study, another interviewer might gain different knowledge just as another set of participants would share their own personal knowledge in relation to questions asked. As participants have said during the interviews, individual contributions by Métis traditional knowledge holders contribute to the collective set of knowledge of Métis People. With that information in mind, participants did offer insights that contribute to how we think about Indigenous knowledge.

Collection of Indigenous knowledge must be done ethically. Métis have struggled for a long time to gain recognition and research on traditional land use, mapping or done by interviews can continue to help this process if done in consideration of this struggle and the data collected is preserved. Research should not be detrimental to the Métis community (NWS4 303: 315; 323; 301).

> I would think as long as people doing research are doing it from a positive point of view…that they are respectful of people and basically work with what they get in a respectful manner…and that it's used for positive purposes as opposed to, you know, exploiting people and making money off people… (NWS4 303).

Since the participants describe Indigenous knowledge as their way of life, a number of examples from the transcripts are used to characterize how the knowledge is animated. Community members at schools, camps and in community events (NWS4 231) can facilitate connecting youth to traditional knowledge. Individuals have varying amounts of traditional knowledge so having the community and schools work together can bring a collective benefit (NWS4 223). If Elders are welcomed and feel like they belong, schools can open the door to greater exposure of children to traditional knowledge and language. These are the same conditions needed to encourage use of traditional knowledge within the broader community

(NWS6 64). Indigenous knowledge involves learning through stories about people and traditions of the past and present by participating in actual on-site experiences. Learning the local languages should also be part of the experiences. Adults can also learn the Michif language with commitment by the learner and help from those who know the language (NWS4 183). Activities could include picking plants like rat root and correct harvesting processes. Hunting, calling moose, ducks and geese are other activities. Learning where local burial grounds are located is believed to be very important for community members to know (NWS2 279). Knowing traditions and living a traditional life is about living with traditional values that will enable one to enjoy the natural world. Families should be raised with these same values and experiences. Fundamental purposes of traditional knowledge include teaching children right and wrong according to traditional values and providing love and understanding to family. Treating other people nicely, in the same manner as immediate family, will result in being treated nicely by others (NWS2 41). All of the knowledge and skills that constitute Métis identity are intended to instill a sense of pride so that individuals do not need to conceal who they are, their history or their language. Elders have maintained this sense of pride despite many hardships in their lives. They want to see this same sense of pride in young people (NWS7 573; 607). Children who have traditional knowledge and skills are happier, respectful and aware of things that affect the northern communities and the north itself (NWS6 113).

4.2.11 Health

Participants spoke about health in a variety of ways ranging from direct medicines to the holistic context of what constitutes good health and healing. In the context of changing Métis society, the isolation of the North has kept traditional lifestyles going but pressure to engage in wage labour, to access more services in townships and to live under prohibitive legislation did change lifestyles and diverted younger people away from reliance on traditional knowledge and traditional medicines. In southern Saskatchewan, dramatic changes to habitat have also meant the loss of traditional knowledge and practices. However, some people still have this knowledge; and while it cannot be directly exported to other areas, there are some facets that can be shared. Hunting, trapping, snaring, fishing, and picking berries are still practiced and contribute to traditional diet (NWS4 147; NWS5 462). Learning and practising with traditional medicines requires extensive knowledge. For example, roots often look alike but some are lethal and can easily be confused with the desired plant. As well, harvesting plants used for medicine

needs to be done at certain times of the year and from clean places that are not polluted. Learning the protocols, medicines and healing processes was done through observation and repetition. Not everyone can learn traditional medicinal knowledge and this is partly determined by the teacher as well as the learner. Men and women each had opportunities to learn to be healers (NWS7 641; NWS1 631; 803; NWS6 26: 28).

The oral tradition was the method of knowledge transmission in past times. "Nothing was written down. And it was only people that you trusted, you passed it on down to them, it didn't come automatically" (NWS7 815). Some of the sources of medicines came from local plants like willows and roots but other skills comprised the holistic use of items harvested. For example, animals provided meat but there is additional knowledge learned when hides were processed for use. Beading and cooking (by men and women) are also activities that were done as part of the traditional learning process (NWS5 462). Medicine also includes the processes of teaching and learning, caring, listening when someone needs to talk, sharing knowledge, healing one's self through helping others, overcoming hurt, anger and blame and helping others to do the same (NWS2 173). Women who acted as midwives were highly skilled in ensuring healthy births and traditional medicines given to mothers at different stages of the pregnancy, labour and after giving birth. In addition to these skills, the healers often had to walk long distances through bush country. Participants said traditional medicine should not be altered in any way; even the addition of sugar is not allowed (NWS7 10; NWS1 651).

When obtaining specific medicines in trade, tobacco was given by the person requiring the medicine in the same way that tobacco was put down for anything taken from the Earth by the harvester. The tobacco signals that the user understood the value of the item and honoured the values of how to use things and how not to use things. In some cases, a little bit of money might be given to a healer but this was an act of kindness by the recipient of the medicine and not required (NWS1 791; NWS2 13). In the past, a healer might visit the person requiring help and stay for weeks until they recovered. Money was not exchanged, rather "…with the old lifestyles and ways, you feed them, you house them and when they leave they take food. That's the old ways" (NWS7 775). Elders believe any sale of traditional medicine is wrong (NWS7 771). Participants believe institutions and researchers should not have traditional medicinal knowledge if they do not respect the traditional protocols and use of medicinal knowledge. Some Elders died with the knowledge rather than give it up to those who did not hold these

values (NWS7 815). In the same regard, schools need to ensure cultural values are demonstrated foremost by anyone in the role of bringing traditional knowledge into schools (NWS7 775).

Uses of circles, including talking circles, are a very old healing tradition. Everyone has time to speak and talk about his or her experiences. Medicines bundled into a small package or other sacred object was passed around to facilitate respectful dialogue (NWS6 55). Contemporary medicine wheel teachings are based in these old traditions (NWS2 45). Solving problems was not limited by time, or restricted to working hours during the day. It is believed that people need to be available at all times when others are in distress. In many cases, those who have been through difficult experiences themselves are finding the courage to bring their knowledge and experiences to others in the community (NWS6 86; 115).

Elders believe traditional medicines are better than pills but it is harder to find people with these skills today. As well, participants indicated there is more trust in old people who have traditional medicinal knowledge than younger people just learning (NWS1 795: 799).

4.2.13 Imagination

Like the use of the term Indigenous knowledge, imagination is also a concept that can be defined through the stories that emerge from the process of living. Métis culture emerged as a necessity for survival, and in North West Saskatchewan, the resourceful nature of mixed-blood people took a degree of imagination to develop a sustainable lifestyle that suited their needs. A future research project on the subject of imagination and adaptation would make an interesting study on how they relate to teaching and learning. However, some concepts that did emerge in this study related primarily to language and spirituality.

Today, in some areas, the predominance of Cree and English means fewer people are speaking Michif but with encouragement and effort, it is still possible for individuals to communicate in this language. At fish camps, for example, individuals use a variety of local languages, including Michif. Individuals who are not fluent in local languages use English but are learning by hearing the local languages used in context and have to figure out what is being said even to respond in English (NWS4 185). Translation of someone else's words requires the ability to imagine not only the literal translation, but the intent and purpose of their message (NWS7 903; 920).

In prayer and healing, part of the effect is releasing thoughts and energies through performing sacred actions. For example, using water and tobacco to assist in communicating prayers involves a personal act of being committed to what you are doing and why you are doing it, as well as imagining what you would like the result to be (NWS5 568). For some, being invited to deliver prayers at public events or in other forums can be intimidating. The quiet respect and humility inherent in Aboriginal prayer means individuals may not have experience in such roles. However, with increasing acknowledgement of the value of traditional thought and wisdom, Elders who are asked to perform these sacred acts find refuge in their own inner strength that has been built on traditional teachings. Using their own language helps to express traditional thoughts about the contemporary issues at hand (NWS6 122).

4.2.14 Economic

As a way of life, traditional land users invested their skills and knowledge as their livelihood and a means of survival. In the past, it was necessary to do this full time, but in more modern times, people also rely on other means to support themselves and their families. Traditional economies were built on hard work and broad skill sets. In addition to the outcome of making a living, traditional land users had to have a range of skills such as being able to cook, knowing how to navigate waterways, travelling in icy conditions, how to call animals, reproductive cycles of fish and animals, making tools if required, as well as respect for nature and traditional laws such as sharing. It is said that although people may have been poor, they were happy. Ancestral knowledge was passed on for the benefit of others and this is still the case today. Elders want young people to have a good education and have access to traditional knowledge (NWS4 90; 94; 122; NWS2 19; NWS6 112). In the context of this study, a respectful and safe environment would characterize a good education where Métis culture and language were taught in addition to knowledge and skills currently in provincial curriculum, which provide options for career choices.

Residential schools split some families apart which resulted in some carrying on as traditional resource users, commercial fisherman, trappers and hunters while others went on to have other careers (NWS4 90). Access to schools for children or health services continues to contribute to diminished land use as families moved off the land and took up permanent residences. Trapping and commercial fishing are examples of ways individuals made a living

and are still available to be part of youth learning experiences, since there are traditional land users who can teach these skills (NWS3 56; NWS7 307). Today, youth can benefit from being reconnected to traditional knowledge and skills upon which traditional economies were based. Survival skills involve more than the physical tasks comprising traditional land use; there are responsibilities to the natural world. In addition to helping kids learn to enjoy the outdoors with skills like fishing, trapping and making fire,

> …it's still important that people, young people, are taught respect for nature and have respect for the Elders and for their mothers and fathers, families, and for each other. But it goes beyond that in respect for nature…how to cope with nature, how to survive, and that is necessary because you're still living in the elements when you happen to travel out of your community (NWS4 130).

Acquisition of legal rights has meant that Métis are returning to land-based activities such as fishing and hunting without fear of retribution. Increased use of the land has been accompanied by community discussion about the need to ensure that individuals also have good harvesting practices according to Métis and natural laws. In the past food was always shared. Nothing was wasted. Still today, not everyone has the ability to get their own wild food, which requires balanced decisions between rights and responsibilities to laws and accepted community practices. Resolving challenges that may arise can be accomplished through discussion, concern for the situation at hand and with the good leadership of Elders (NWS4 134; NWS2 19).

Traditional knowledge is part of how people survived and the value of it should remain with the people. As such, ethical processes for collecting or using traditional knowledge by all researchers is very important. Some researchers are bound by ethical practices and most would abide by them but some organizations may not be bound by these processes and would seek to collect traditional knowledge for commercialization without regard for historic social, political or economic struggles of Métis (NWS4 303).

4.2.15 Balance

A balanced life is achieved through an integration of traditional life skills and processes. Re-learning the parts to reconnect the whole can be done by building on the languages and skills which people have available. Individuals who do not speak a local language can learn from the fluent speakers as they learn the skills. "Basically the language is part of the knowledge…is part of the people…is part of the way of life…" (NWS4 187). Including the whole community in

activities and events that honour Métis identity will encourage broader engagement in future activities that schools might host. Activities suggested by participants included cultural survival camps, canoe trips, trapping, fishing, music and dance activities. Participants believe it is important for people to understand the planning processes behind traditional land use. Planning involves knowing why it is important to have appropriate numbers of people involved in certain activities, who can share the work, and what is harvested (NWS4 231; NWS7 331: 335).

4.2.16 Political

Métis nationhood emerged during the fur trade era because of individuals with common ancestry and experiences coming together in solidarity to protect their way of life. Métis experienced hardships over many generations as a result of being ostracized from other entrenched and encroaching cultures, surviving cultural and linguistic changes forced by residential school and other social policies, and the imposition of restrictive legislation. Finding spaces to continue to live in a traditional manner has been a remarkable feat and continues today. The quest for legal rights has been part of the Métis political struggle not to conquer others or acquire anything other than the right to exist as a People and practice customs and traditions that contribute to the well-being of the People and the environment within which they live.

Political and legal action during the late 1990s resulted in Métis successfully regaining their traditional right to fish and hunt. This has contributed to Métis returning to land-based activities and has provided more opportunity for Métis to build community processes to ensure that natural and Métis laws are learned and followed by community members (NWS4 134). When knowledge systems are disrupted, it takes time to rebuild the holistic processes that enable learning culture and language. Political activity helps stimulate community action by providing people with an understanding of what can be accomplished for the benefit of the whole community.

Participants acknowledge that youth are troubled and may not have the skills or opportunities they need to prepare for their time as leaders in the future. Providing them with skills and opportunities through the acquisition of traditional knowledge can help them understand the beauty and respect embedded within the teachings (NWS6 77). Communities in southern Saskatchewan were exposed more rapidly to changes in the economy and habitat, which contributed to a loss of traditional lifestyles. Northern communities were able to retain

traditional lifestyles longer because of isolation. But those who have retained these skills can come together to build up the collective knowledge for those who want to return to traditional land use practices or for younger people who have never had an opportunity to learn this way of life (NWS4 147; NWS6 87).

On-going political activity within the Métis community involves the protection of intellectual property rights. These are described in Sections 2.4.4, 2.4.8.4 and 5.2 of this thesis. In rebuilding and sharing the collective knowledge, research projects that involve traditional knowledge can contribute to the collective knowledge of Métis people. Research can also play a role in helping individuals recognize the value and worth of their own identity as Métis people through the processes of map building and interviews. Participants believe institutional and local ethical processes for research are essential to ensure no harm comes to individuals or the Métis as a People. Ethical processes will also help ensure the integrity and extent of the knowledge collected (NWS4 299:303).

4.2.17 Values

The values that Métis people hold are found within the teachings and the skills of individuals and the collective. Predominant values that emerged throughout the interviews ranged from pride in culture and identity through respect for each plant and animal in the natural world. The value system held by Métis may differ somewhat from person to person but all derive from foundations of love and respect of all things; hard work for survival; appreciation of the aesthetics of wondrous landscapes, lakes, rivers and wildlife; and concern for the preservation of the natural world as well as good relations with all other people.

Research that identifies the scope, complexity and components of Métis traditional environmental knowledge contributes to the collective knowledge of Métis. The values identified within the knowledge and activities, such as found in the content of the thematic data, will "be helpful to our people, cause they're capturing this information and it's going to be shared with others who will understand more about the Métis" (NWS4 303). Past research has enabled Métis of the past to continue to have a voice into the future, which has contributed to the ongoing struggle for Métis rights. Ethical research processes and use of appropriate protocols can help to ensure Métis are protected from, and not subjected to, harmful interpretations of information (NWS4 299; 295).

In all understanding of Métis value systems, language affects how teachings are conveyed and understood. Some knowledge cannot be translated from local languages into English (NWS4 181).

4.2.18 Environment

Ironically, this thematic area had the least number of direct references that emerged from the coding process. This might be understood as a result of participant's view that the environment is not something discussed as separate and apart from their lives, but something that is spoken about in the context of other parts of traditional life. Throughout the transcripts extensive data appeared about facets of the environment through the other thematic areas, which indicates that, Métis continue to have rich knowledge concerning the environment. Specific discussion about the environment has achieved a place of importance in contemporary society. This has been a general response to growing environmental degradation and misuse. Public discussion has led to an awareness that all people need to be active participants in developing responsible societies. Responsibility is not a new concept to Aboriginal Peoples, but connecting new generations to old knowledge is part of an exciting discovery and action process.

Participants acknowledged that environmental changes because of industrial activities (e.g. farming or logging) have direct correlations to diminished ability to carry on traditional activities such as trapping or harvesting plants, roots and berries (NWS4 283). The challenge remains for all of us to find successful solutions through sharing and valuing the knowledge and wisdom that exists and is accessible through dialogue and a healthy vision for the future.

4.3 How does Métis traditional environmental knowledge in North West Saskatchewan align with established theories of Aboriginal epistemology and supporting principles?

Describing the alignment of the data collected in this research study with the stated theoretical foundations of Indigenous traditional knowledge provides an opportunity to begin the process of describing the richness of Métis traditional environmental knowledge within the context of holistic thought as opposed to assessing the rightness or wrongness of the findings or the theories. The data provides insight into the worldview of Métis People. Perspectives of teaching and learning; individual insights; and collective knowledge contribute to a Métis way of living and understanding the complexities of an interconnected world. Each person or family holds unique knowledge that is simultaneously personal knowledge but also becomes part of the

ontology, epistemology, and axiology of what is considered community, regional and collective Métis traditional environmental knowledge. In this regard, Métis traditional environmental knowledge is consistent with Aboriginal epistemology and supporting principles as described in the literature review.

At the outset of this study, one of my first tasks was to try to determine a theory and methodology for doing research appropriately within the Métis community. The theory I selected to work with needed to constitute "a framework for critically understanding phenomena and a basis for considering how what is unknown might be organized" (Silverman, 2005, p. 99). In this challenge, I opted to look to the scholarly writers who have shared insight into the holistic thought of Indigenous knowledge and Western Eurocentric forms of research and combine their ideologies with the pictograph representing Métis worldview found within the Métis Holistic Lifelong Learning Model. As a Métis person, I did not believe that we could be defined within non-holistic parameters which would provide little opportunity to allow the emergence of a uniquely Métis voice describing their historical and contemporary experience. Qualitative methodologies facilitate an understanding of Aboriginal epistemology that provides insight into the worldview and spirit of Métis People who continue to fight to preserve their identity in the face of oppression and marginalization. I studied books describing ranges of qualitative methodologies including phenomenological reduction, case studies, interviews and narratives. "Like theories, methodologies cannot be true or false, only more or less useful" (Silverman, 2005, p. 99). The methodology helps to understand the relationships within the data and for that I needed to trust all of which I had to work with including scholarly writing on Indigenous knowledges, Western Eurocentric methodologies, the data collected and my own knowledge and understanding of the world around me. This research is purposeful in attempting to understand how Métis traditional environmental knowledge can become a modality of science education within structured teaching and learning and so is limited in being able to speak to broader insights on other topics.

The data collected and described in the previous section provides insight into each of the primary and secondary codes established in the analysis framework. I expected to be overwhelmed with data about specific aspects of the natural environment and wondered how I would bring a sense of humanity and applicability of formal education to the knowledge. Instead, the data differed from that collected in the *Learning Indigenous Science from Place*

study (Michell, Vizina, Augustus, & Sawyer, 2008) revealing new conceptual knowledge, based quantitatively on the number of quotes extracted from the data, emphasizing the importance of language, people, learning, social, tradition, land, spirituality, self, harmony, Indigenous knowledge, health, imagination, economic, balance, political, values, and lastly, environment, in that order.

The questions in this study were not dramatically different from the other study (e.g. Minor word changes clarified questions) but the interview participants were different individuals who brought different knowledge to bear in the research. What remained consistent was the interconnectedness of the information within the construct of the Métis Holistic Lifelong Learning Model, which, as Wilson points out in his description of Indigenous research, equates to a sum that is greater than the parts. To me, the sum of Métis knowledge is not simply a Medicine Wheel or a pictograph of the Métis Holistic Lifelong Learning Model, but a paradigm for life that encompasses all which constitutes our lived and remembered experiences. Métis knowledge connects other realms of knowledge that might be called the past, the future, or spiritual knowledge. None of the names we assign to life and the creation of life, an afterlife or time itself seems quite adequate to describe that which exists. Perhaps that is why the Cree People refer to the Creator as Kitchi-Manitou, or the Great Mystery. In our own small way, we can only talk within the limited knowledge that we have acquired on our individual learning journey. In this study, I can illustrate that even the Métis Holistic Lifelong Learning Model is only an entry point for understanding individual and collective knowledge and how what the interview participants have shared aligns with the theory and methodology employed for this work and yet tells a story that is greater than that which is committed to paper.

After spending many months building this research, I had a difficult time believing that the thematic unit of data specifically on ‘environment’ had the least discussion within the data collected. I went back and reviewed the data again and again to be sure I had not made a mistake or that the computer had not failed me in this effort. When I was sure the data was intact, it took some time to think about what the results were telling me and how to make sense of that particular finding. I knew that this was not a participant deficiency in knowledge, concern or experience with the environment, but rather it constituted a view of the environment from a perspective different than I had gained years before in formal post-secondary studies as an educator specializing in the discipline of biology. The participants in this study were describing

how they think about understanding the environment. Their lived experiences did not separate a study of the natural world into a process of looking at slides under a microscope, identifying parts of plants and animals at the cellular level or even looking at individual life forms or ecosystems as though we somehow could look at these things 'objectively' or as value-added objects without acknowledging the subjective part we each bring to understanding all parts of life. In asking questions about Métis traditional environmental knowledge, all of the thematic units described on the Métis Holistic Lifelong Learning Model did emerge and provided a greater or lesser degree of information in relation to the other thematic units.

Theories of Indigenous knowledge brought forward by Bishop, Steinhauer, Martin, Pillwax-Weber, Deloria and Wildcat speak about the holistic and subjective nature of knowledge, the ethics of reciprocity, and interconnectedness. These concepts were revealed in the data of this study, giving rise to the challenge of how to write about the research. Scholarly descriptions by Creswell, Rossman and Rallis of the roles of power issues related to race, class, gender and political orientation appeared in the data and were useful in understandings described experiences in relation to these features of social life and the silencing of those who are oppressed and marginalized. Kovach's description of four guideposts useful in applying an Indigenous methodology became anchors for me in understanding:

- why we look to the physical world to understand the decolonizing, political and social action aspect of Indigenous research;
- why we look to our emotional responses in understanding personal narrative and the story-telling aspect of Indigenous research;
- why we look to our mental faculties in understanding the role of language and thought as it influences the construction of knowledge in Indigenous research; and
- why we look to spiritual experiences as ways to understand cultural, metaphysical and sacred aspects of Indigenous research.

These guideposts, for me, provided context for the process of comprehending and describing the complexity of Métis traditional environmental knowledge and convergences and divergences with generalized information on Aboriginal epistemology and supporting principles.

I also looked back through the data to see what portions of the interviews had not received codes in the coding process and how the information might be added to this grounding

of theory within a Métis worldview. The following topics are not explicitly defined in the Métis Holistic Lifelong Learning Model, and provide new information about Métis epistemology.

Songs sung at sweatlodge ceremonies have an important place within Métis experience. The songs are purposeful in themselves and part of the ceremonial protocol, but the songs also have another role in that they also draw people toward the ceremony. The songs are described as beautiful and help those new to the sweatlodge ceremony overcome their fear of the heat and the dark within the lodge. **Laughter** and telling stories after a lodge ceremony contribute to the healing process in the same way that crying can become part of the healing process. Teasing and humour are part of everyday life. Even such activities as processing smelly fish give you something to laugh about with others. It was said that the old people always had a lot of laughter in their daily lives (NWS6 053:056; NWS4 014; 054; NWS3 80: 86).

In the old days, people would **travel** on the waterways and stayed only in voyageur camps, not just anywhere (NWS7 268). Living on the land as a traditional land user taught the skills that would be passed on during life. Participants believe that by **staying** and living with traditional land users for a few months others can learn traditional skills like picking berries and mushrooms, being organized to be safe and warm out on the land, learning the healing power of water and trees. Learning was lifelong for Elders and they believe it was important to have the Aboriginal language required to learn certain knowledge as teachings are contained within the languages (NWS2 021; 115; NWS5 180; 288; 474; 568:580).

Although in the past, churches arranged some **marriages**, spouses brought what they knew to the relationship and learned from each other about land-based knowledge (e.g. What animals to eat, how to trap, and how to make dry meat). Elders believe personal spiritual faith, and trust that God would help you, helped overcome hardships. Old age is considered a gift from God (NWS1 056; 092, 210; 484; 879).

Old **prophecies** conveyed by Elders through ceremony showed troubled times were coming. Traditonal land users and Elders see troubled time today in the false pride of youth that leads them to drug addictions. Youth think they are happy but when they realize they are not, it is too late. Participants believe children need to hear that they are loved from parents and grandparents (NWS2 169; NWS1 702; 713: 737; NWS7 704).

Youth who participate in traditional activities can learn from the people who have those skills, but the parents and grandparents also need to **be involved**. Those with traditional skills can take kids with them when doing these activities and encourage the kids to learn and participate in age-appropriate activities as well as participate in school activities. In past times, parents were hard on kids to make them tough so they could do things like trapping, travelling through the snow and running with dog teams. It is humourous to see how quickly young people get over their need for style and adopt bush clothing and bush behaviour when they are camping. Being in the bush is good for exercise, but also for appreciating the beauty of the land and animals. Being in the quiet, out of town, is nice and you can hear the animals. Elders believe that life in the old way was better than how it is today and wish to share this wisdom with youth (NWS6 118; NWS4 159; 163; NWS1 303; NWS3 150:158; 162; 358; NWS5 184:188; 276).

Established **Métis institutions** such as the Gabriel Dumont Institute and the Saskatchewan Urban Native Teachers Education Program should be involved in cultural camps hosted for youth at places such as South Bay near Ile-a-la-Crosse (NWS4 263; 271).

Although the research questions in this study are hard for a community person to understand, **sharing knowledge** within this research process provided a sense of happiness to the participants and a willingness to contribute more in the future (NWS4 066; NWS6 134).

Together, the evidence of alignment with general information on Aboriginal epistemology and supporting principles; the evidence of convergences in the interview data on Métis perspectives of traditional environmental knowledge; and the new thematic areas listed above comprise a view that also contributes to one of the purposes of the study which is to begin development of a body of research on Métis traditional environmental knowledge.

What evidence and arguments exist that support the development of Métis traditional environmental knowledge as a modality of science education?

Initially when I had developed this question for the research proposal, I wanted to provide an opportunity to sift through the data to look for jewels of important information that could help advance my contention that *Métis traditional environmental knowledge can be a modality of science education that will engage learners in understanding relationships with the natural world and with the importance of developing sustainable lifestyles within holistic lifelong learning*. Arriving at this stage of the data analysis, I started to formulate my response to the

research question of Section 4.4 by asking myself what evidence and arguments in the research oppose such an idea? There are no statements by the participants or respected authors that claim traditional environmental knowledge has no place in our lives. Métis individuals, provincial school systems, national and international organizations all express a sense of the importance of traditional knowledge. Yet, the fact remains that traditional environmental knowledge, known by its many titles or labels, is quietly absent within Western scientific methodologies and modalities of teaching and learning in our contemporary lives. To advance my response to this research question, and keep the analysis manageable in relation to the large amount of data, I applied the four dimensional model illustrated as the core of Métis Identity within the Learning Rings of Sources of Knowledge and Knowing on the Métis Holistic Lifelong Learning Model. The dimensions encompass intellectual, physical, spiritual and emotional domains.

Intellectually, the evidence provided within literature has provided us with a historic view of Métis People, their struggles, successes and contributions to the development of Canada. The Métis who lived and died were real people. They were faced with enormous challenges of survival. They understood their heritage provided important diverse knowledges upon which they developed a culture that led to a national identity as Métis. Theories of colonization help us to understand the forces at work that manifested in political and social struggles of the Métis that endure to this day.

Racialization in Canada and Saskatchewan marginalized Métis People, oppressed language and cultural activities, and limited Métis from finding success in mainstream society. Yet, despite generations of persecution and being ostracized from both ancestral tribal communities and settler society, Métis People have persisted in continuing to carry on traditional activities, speaking their Indigenous languages and identifying as Aboriginal Peoples within Canada with legal and moral rights and responsibilities to pass on their knowledge to future generations of Métis children. "Relearning traditional skills by any community members means having an understanding of the natural laws of the land, but also needs to be supported by legal processes which facilitate Métis people's ability to access to natural resources. In this way, rights and responsibilities are part of the discussion and practices of Métis People" (NWS4 134).

As Métis continue to find victory within the legal systems of Canada and as Indigenous Peoples of the world gain a firmer foothold in participation in international fora such as the

United Nations, the argument to facilitate cultural traditions locally becomes stronger as pressure is exerted within the systems that resist inclusion of Métis culture.

Article 8(j) of the United Nations Convention on Biological Diversity acknowledges the role of its nation members and Indigenous communities in that

> Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices; (Secretariat on the Convention on Biological Diversity, n.d.a, p. 9)

Since Canada is a nation member of the United Nations that does not have a federal education department, the jurisdiction for education falls to provincial and territorial governments but the legislation referred to in Article 8(j) still includes all federal legislation impacting Aboriginal Peoples of Canada. The legal and procedural conditions for Métis to respond to the challenges of the CBD are complex and require appropriate representation. In turn, those representatives require community support from Métis who are involved with local traditional activities. Article 13 on Public Education and Awareness is an example of the need to have an informed citizenry. The 2010 Biodiversity Targets describe the need to develop research ethics governing traditional knowledge. The interest of the Métis community in being able to perpetuate traditional environmental knowledge is a primary goal in, and of, itself. What part of this thesis is concerned with is the intent of the messaging of the CBD and how it might be manifested within Saskatchewan education systems.

In the past five years, the Government of Saskatchewan has worked to build Aboriginal focused outcomes and indicators into a revised provincial science curriculum. While frail, it may provide a launching point for development of Métis-specific activities, curriculum and resources over the next several years. The development of such activities and material is supported by provincial policy such as the Saskatchewan Ministry of Education Pre-K-12 Continuous Improvement Framework (Ministry of Education, 2008); Building Partnerships: First Nations and Métis Peoples and the Provincial Education System (Saskatchewan Learning, 2003); A Time for Significant Leadership (Ministry of Education, 2008); and advice from the Aboriginal Education Provincial Advisory Committee.

The Common Curriculum Framework for Aboriginal Language and Culture Programs Kindergarten to Grade 12 (The Crown in Right of the Governments of Alberta, British Columbia, Manitoba, Yukon Territory, Northwest Territories and Saskatchewan, 2000) underscores the common vision of some provincial and territorial governments, First Nations, Métis and Inuit. It is their collective wish that education includes voices of Elders; teachings about traditional laws of relationships with the natural world and human beings; the history of colonization and reconstruction; knowledge about Aboriginal education, rights and local control; and guidance on how to establish frameworks and outcomes for cultural and language programming.

> Since schools are a reality, participants felt that schools should support and encourage the involvement of Elders and traditional land users. Cultivating a sense of belonging for the Elders and traditional land users would provide opportunities for them to develop relationships with youth, build trust over time by talking, listening, responding to youth questions, and creating opportunities for youth to learn leadership skills through the development of traditional values and practices. (NWS6 64; 77; 106)

The idea of merging culture with school emerged throughout participant interviews and was seen to be the legacy that Elders believe is important for future generations of Métis.

Evidence and arguments supporting the development of Métis traditional environmental knowledge as a modality of science education is seen in the **physical** domain of action. Intellectually, we may know the reasons for the marginalization of Métis environmental knowledge, but translating that into practical activities is required to see integral and meaningful change. Traditional land users are lost with every passing generation, and with them, the knowledge built in relation to specific places inhabited and passed down from their ancestors. The Elders and traditional land users still practicing their skills have become important parts of the education process in some schools and divisions. Their willingness to share what they know, and their ways of knowing, is apparent within the study's interviews. The interviews also describe Elders' and traditional land users' sense of humility and desire to ensure they are welcome members of the school community. Participants expressed ideas of how to integrate traditional environmental knowledge within schools and praised those schools making the effort to create a new learning environment. Some of the integration ideas include extended cultural camps; encouragement of fluency in Indigenous languages; spiritual and personal development of youth, adults and Elders; as well as learning traditional knowledge and skills for leadership

roles. Participants conveyed that in places where schools have no access to traditional knowledge holders, they might need to collaborate with other regions thereby facilitating knowledge exchange and mobilization.

Provincial policy provides adequate guidance on inclusion of Aboriginal Peoples perspectives in education; international conventions encourage broad participation of Indigenous communities in addressing protection of the Earth as well as Indigenous cultures and languages; intellectual think-tanks provide evidence of the need to inspire and engage Aboriginal learners in science education and within the labour force involving science-based skills; and the public at large continues to express horror and outrage at the environmental destruction occurring in accidents like the 2010 British Petroleum oil spill in the Gulf of Mexico or the harvesting of oil sands in Alberta. So, the question arises: If all of these people know how important it is to look after the planet we live on, why are we not doing a better job of it? So far, it seems that we have accomplished the intellectual development to do so, but there remains a greater need to put what we know into action. Reconnecting people to the land that sustains us will contribute to greater awareness and first-hand knowledge of how to modify our behaviour as consumers. We will perpetuate the teachings that we live.

Spiritual development is both a collective and personal process within Métis communities. Discussion of spiritual beliefs is deeply personal and Métis cross many boundaries with their chosen belief systems. It can be difficult for any person to explain spiritual beliefs, and people who have been subject to extensive persecution and oppression may not have a comfort level in speaking about their own personal spiritual beliefs within a two-hour interview. In this study, the focus was on traditional environmental knowledge that provided some commentary on traditional spiritual practices rooted in the First Nations belief systems of Métis relatives and ancestors. In a previous study, *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008), there was some commentary on Métis beliefs rooted in Christian tradition. Participants who spoke about spirituality usually did so within the context of stories about other topics. Some spoke directly about traditional Aboriginal spiritual beliefs, but some did not volunteer their personal insights on this topic. Participants described the need for an individual to develop through a process of self-discovery and maturity. This process was believed to involve developing the intellect; finding success in school; having respect for others; getting a good job; contributing to healthy communities; having access to spiritual guidance; and

to knowing the natural world. Participants believe "formal education in today's school systems is important, but does not have to involve sacrifice of cultural traditions" (NWS5 486).

Participants said spirituality could also be thought of partially as the harmonious coming together of skills, language and teachings of the culture in the way of life of the Métis. This might include participating in sweatlodge and other ceremonies, or it might include Christian traditions, or both. Interview participants expressed concern that "Institutions and researchers should not have traditional medicinal knowledge if they do not respect the traditional protocols and use of medicinal knowledge. Some Elders died with the knowledge rather than give it up to those who didn't hold these values. In the same regard, schools need to ensure cultural values are demonstrated foremost by anyone in the role of bringing traditional knowledge into schools" (NWS7 775: 815). The provision of cautionary advice is important to ensure that educators are careful in bringing traditional environmental knowledge into school curriculum. Educators need support to be knowledgeable about forging relationships that will help them address sacred knowledge, ethical protocols, and other local knowledges that the community would support as age-appropriate for children and youth.

Perhaps one of the hardest challenges for our provincial education system will be how to address the idea of spirituality in science education. Even raising the question of Aboriginal cultural perspectives in science education has been a long road and there is still significant discomfort by educators, and perhaps within the Métis community, in talking about how the inclusion of spirituality might be accomplished. As a researcher, I had my own worries about how I would address the topic in my study. How could I identify something that transcends our limited human knowledge of corporeal life? Without defining spirituality, how could I bring into discussion that it is an absent feature of contemporary science education? Most personal to me, was the sense that the approach of 'infusing' Aboriginal traditional knowledge into provincial science curriculum can come to mean a superficial inclusion that does not represent the beauty and depth of Métis culture.

During brief consultations I was part of on the inclusion of Aboriginal perspectives in provincial science curriculum, I felt paralyzed during the two or three hours allocated to assist with contributing to outcomes and indicators intended to reflect First Nations and Métis cultures within specific science thematic areas. Although I understood the task of the curriculum writers

was established and had to be done within a given time, the few words that would make it into the text of the curriculum seemed disjointed, like bones tossed into a soup pot. There was no opportunity to build a sense of historical perspectives, the importance of holistic learning, the continuum of personal and spiritual development, or sense of community integral to the context of learning traditional skills and beliefs.

Spirituality is part of culture and inherent in the Aboriginal languages representing those cultures. Certainly, provincial and Western Canadian education policy supports the inclusion of Aboriginal perspectives within public school systems. So too does the information emerging from the individuals participating in this study. Searching through the coded transcripts of the participant interviews provided insight that spiritual beliefs and practices are part of every facet of Métis life. Spirituality is amplified by an individual, reflecting what they know and leading individuals and communities to gain a sense of where they are strong and where the weaknesses are. If spirituality is not part of the cultural teachings provided within schools, then it is not cultural teachings that are being provided, but a continuation of assimilation processes designed to eliminate Aboriginal cultural knowledge.

The **emotional** part of medicine wheel teachings can also be identified as the ethical, axiological, or value systems, inherent in a culture. These are the principles that both ground the culture and contextualize new knowledge. Scholarly literature describing traditional foundations of Aboriginal cultures provides some orientation in relationship building, the deeper meaning and intent in philosophy and practices of respect, and learning from others as a means of personal development.

Throughout this study and the many hours of research, I returned time and time again to the four methodological signposts described by Kovach (2005) to orient my thinking to the 1) Physical domain of decolonizing, political and social action aspect of Indigenous research; 2) Emotional domain of personal narrative and the story-telling aspect of Indigenous research; 3) Mental domain of language and thought as it influences the construction of knowledge in relation to Indigenous research; and 4) Spiritual domain including the cultural, metaphysical, and sacred aspects of research (Kovach, 2005). In my view, why we are doing something must always be the measure of how we are undertaking that task, whether it is developing guiding policy, curriculum or supporting resources.

Specific examples provided by Steinhauer (2002) based on earlier work by Martin (2002) and Weber-Pillwax (1999) help scope Indigenous research methodologies useful in planning and developing school curriculum. Other publications guiding scholarly research contain extensive guidelines on ethical interaction with Aboriginal communities. These include:

- The current and proposed revised draft of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 1998 (with 2000, 2002 and 2005 amendments); Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 2009);
- Sections C and D of the Annex of the 2010 Biodiversity Target; A Framework for Implementation (Secretariat on the Convention on Biological Diversity, 2004c);
- The Ethics of Research Involving Aboriginal Peoples (Indigenous Peoples' Health Research Centre, 2004);
- The Akwé: Kon Guidelines (Secretariat of the Convention on Biological Diversity, 2004a); and
- The Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization (Secretariat of the Convention on Biological Diversity, 2002).

These are just some of the guides that have been produced nationally and internationally in support of ethical considerations of individuals, institutions or governments working with Aboriginal communities.

Participants interviewed for this thesis shared their insights and knowledge of local community protocols concerning ethical interaction and use of traditional knowledge. The recurrence of protocols related to the spiritual use of tobacco offerings can be seen as a process of reciprocity that is intended as an agreement between the knowledge holder (human or non-human) and the recipient of teaching or item received to acknowledge the spiritual aspect of the agreement. Tobacco offerings facilitate the exchange of knowledge in an integral and respectful manner that requires the person requesting practice patience, restraint and thoughtfulness about what they are asking for and their readiness to participate in the knowledge exchange process.

Like the written procedural tools for ethical interaction available to researchers, institutions or governments, local community protocols are intended to provide the means for relationship building. While the tobacco protocols may appear to be less mind-bending and stressful than the written procedural tools, both are complex processes that require caution in harvesting traditional knowledge. There are ethical and legal responsibilities that go along with both systems.

In concluding my analysis for this section, I believe there is ample evidence from local Métis communities, within provincial and inter-provincial education policy, as well as in international conventions that support my contention that Métis traditional environmental knowledge can be a modality of science education. The holistic nature of Métis traditional knowledge encompasses environmental knowledge but contextualizes it with knowledge of self, languages and traditions, human considerations, economics, politics, spirituality, healthcare, balance and harmony. The thematic units described in provincial science curriculum provide specific topics of study and a series of outcomes and indicators but the process of including First Nations and Métis perspectives remains a minimalist process of infusing bits and pieces of traditional perspectives and not addressing traditional knowledge from an integral cultural point of view. In this regard, it can be seen that there is an opportunity to design a Métis-specific holistic curriculum that has the best interests of Métis culture, preservation of biological diversity and sustainable lifestyles at the core and includes Western science. The thematic and conceptual teachings (life cycles, solar system, electricity, Earth systems, etc.) are not incompatible, but in many ways the current curriculum is deficient and leads to the disengagement of many youth from being excited about science, from learning by other means in addition to books, and the loss of opportunity for individuals to contribute to societal well-being through the gifts inherent in Métis traditional environmental knowledge. The few interview participants within this study and *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008) have provided some information that could be used to begin a dialogue about developing such a curriculum. That curriculum could then be actualized as a mode of instruction for science education.

4.5 How can Métis traditional environmental knowledge be developed as a modality of science education?

Throughout this research study, I felt that it was important to begin the primary research to learn how some of the Métis community views traditional environmental knowledge, to look at published literature concerning Indigenous knowledge, and to consider what the interview participants told me in relation to established provincial education policy in Saskatchewan. This brings me to the last step in the inquiry, which is to try to provide some insight into the process of potentially developing a new modality of science education based on Métis traditional environmental knowledge.

Participant interviews provided a wealth of information to begin the process of response to the topic of Métis traditional environmental knowledge. This data provides the anchor for understanding how Métis think about traditional environmental knowledge, where they see strength areas and how these strength areas are available to benefit individuals, including youth, adults and Elders, education systems and whole communities. In many cases, where interview participants pointed out areas of concern, their concerns and insight into the identified challenges can also be viewed as strength areas to work from in finding resolution. Early in this research, some of the participants expressed worry that they were not familiar with curriculum or even what went on in schools to a great extent and were apprehensive when I initially approached them to participate in the study. I reassured them that, for this study, it was not expected that members of the Métis community who are not directly involved in formal education to be familiar with policy, curriculum or published research. Yet, it raises the question: How often do school systems, or government representatives, provide information to the public about education policy and curriculum, other than passive posting of documents on the internet? Community dialogue would seem to be an important part of ensuring an informed public, and certainly a process that ultimately affects all citizens and facets of community life.

Using a holistic orientation to respond to question 4.5 herein, I believe that it is possible to scope the task in a manageable format. **Intellectually**, developing Métis traditional environmental knowledge as a modality of science education would require a planned effort. Based on an *ethical* process, it would be important to identify traditional activities of importance to Métis. In school systems where there is little, or no, content of Métis traditional environmental knowledge, the challenge is to "change the thoughts or the mind frame now with

the existing policies in education…but there's somebody out there who probably would know to convince the existing learning cultures to change" (NWS7 755). This implies a need for continued *collaboration* between the Government of Saskatchewan and the Métis community. It might involve establishing a group to pilot the activity in a test site. To accomplish the task for the general goal, it would be important to *share information* using established research, expanding and adding new research as required, and familiarize community members with existing helpful provincial education policy, especially that which is specifically relevant to First Nations and Métis. As part of the process, government and school representatives could begin their own *professional development* in respect of Métis traditional environmental knowledge. The planning process should be able to view a new modality of science education as a form of interdisciplinary studies that is able to accommodate *holistic* learning. The pilot group and site could serve as demonstration site, providing the framework for the new curriculum, options for local adaptation, training opportunities for inexperienced educators and reference information such as lessons learned.

Physically, moving the plan from conceptual to actual also is required as part of collaborative strategic planning. Having school representatives prepare presentations useful to the Métis community as well as having Métis leadership to assist with the discussion on Métis traditional environmental knowledge will encourage collaboration and ensure key people are in place to facilitate successful experiences but also to assist in overcoming setbacks or disillusionment if things go wrong as they tend to do from time to time. 'Learning together helps build skills, but also friendships, trust, confidence, a sense of identity and community that one carries with them no matter where they travel or end up living' (NWS4 231; NWS7 573; NWS5 532; NWS6 107). Sample activities could be drawn from traditional land user's experiential knowledge or published research as models. The creation of a list of resource people knowledgeable in specific areas of traditional environmental knowledge can help to determine who is available and the type of orientation to task they might need. In this regard, it might be helpful to establish a core group of resource Elders and traditional land users to provide advice to planners, welcome new members to the resource group and assist with ensuring the new members have a comfort level with what will be asked of them. Involving experienced schools, educators and Elders will help with orientation of resource group members as well as outreach to new schools, educators, Elders and traditional land users at other sites in Saskatchewan.

The **spiritual** domain of this work will be an important part of planning and actualizing a new curriculum. Spirituality, in its many forms, constitutes part of Métis culture and will be an important area of discussion in the collaborative planning process. Involving Elders in the development of a new curriculum, and subsequently in the fulfillment of a new curriculum, will mean that different people will bring different perspectives to the learning experience. 'In spiritual ceremonies, the teachers show respect for the Earth in the ceremonies which also helps young people understand that they will also be respected which leads to trust' (NWS6 51). It will be important that there is an opportunity for diverse spiritual beliefs for those bringing traditional environmental knowledge, as well as those learning about traditional environmental knowledge. In preparation for dialogue and development of the spiritual aspect of Métis traditional environmental knowledge, it may be advisable for educators and other personnel in education to have an opportunity to participate in some traditional spiritual activities and have some sense of the diverse perspectives that Métis individuals have.

> …it's still important that people, young people, are taught respect for nature and have respect for the Elders and for their mothers and fathers, families, and for each other. But it goes beyond that in respect for nature…how to cope with nature, how to survive, and that is necessary because you're still living in the elements when you happen to travel out of your community. (NWS4 130)

Educators should also have an orientation to, and information about, the legacy of residential schools in Canada to ensure they are aware of the historical and intergenerational impacts resulting from several generations of exposure to residential schools among Métis. The result of healthy spirituality translates into the ability of individuals to forge healthy relationships with others, whether the other is human or non-human. Aside from specific ceremonial activities, spiritual development can also manifest in a sense of shared responsibility within the curriculum development process. Sharing responsibilities for planning, recording and writing new curriculum documents, teaching traditional skills, knowledge and ways of knowing, supervising children and youth, creating and facilitating Elders' circles and resource groups of traditional land users will require the participation of many different individuals with many different skills.

From an **emotional** / ethical perspective, it will be necessary to establish some common principles that can guide all participants in the curriculum development process. There are several ethical frameworks already developed nationally and internationally for use in working with Aboriginal communities. Some of these documents ensure protection of the Aboriginal

communities, and some may lean more toward protection of researchers or research institutions. However, the published sources are available and provide an opportunity to adopt or adapt for local application.

> 'Appropriate protocols need to be determined on a case by case basis, but might include researchers approaching local Métis government in some instances, or honouring individual autonomy by engaging with them directly in research as long as the research is not exploitative or harmful to the community, people or environment. The purpose of the research will ultimately determine the most appropriate method of engagement. The raw data from research should not be destroyed but archived and preserved for future generations of Métis'. (NWS4 301; 303; 315; 323; NWS2 139)

Informed by local Elders' guidance, the establishment of an ethical framework can serve multiple purposes. The framework can guide the development of a new curriculum by becoming part of the methodology, it can help orient new members of the group, and it can accompany the adaptable curriculum to ensure it comprises part of the development activities at other sites.

The purpose of building a new curriculum to advance Métis traditional environmental knowledge as a new modality of science education is to avoid the 'infusion' model where Western science maintains the dominant literature with bits and pieces of disjointed pan-Aboriginal traditional knowledge added on. Rethinking science education from a Métis perspective means that there must also be consideration for meaningful content and progression of skills. Age-appropriate activities, collaborative learning, reconnecting Elders to children and youth, learning concepts from an interdisciplinary perspective, and sharing new experiences will all comprise part of holistic learning. It is within the emotional domain that I see the most important feature of a new modality of science education. Here, there is an opportunity to inspire young people to learn to love science. If they can learn to love science, they will see opportunities for the future in traditional environmental activities, Western science or the possibilities when these two worlds are brought together.

5. INTERPRETATION OF RESEARCH FINDINGS

The final chapter of this thesis provides my interpretation of the research findings. After the long journey of exploring the subject of Métis traditional environmental knowledge, it is tempting to sum up the research by reiterating a condensed version of the literature, data and analysis. However, the purpose of a final chapter is best constructed by looking at what has emerged in the research and taking it a little further to share insights and possibilities for the future.

5.1 Theory, Literature, Relationships and Questions

This section describes relationships between the work done, the original research questions, previous work discussed in the literature review chapter and any new work appearing since the study began.

In beginning this research, I was motivated by my concern for the health of the natural world, respect for Métis traditional environmental knowledge, and an awareness of the disconnect between what is being taught in schools as science education and what was being discussed in the United Nations Convention on Biological Diversity forums with regard to Indigenous knowledge. My commitment to an exploration of these issues led me to a much bigger research study than I was perhaps prepared for, but despite the size of the task, encouragement from First Nations and Métis friends helped remind me of how passionate I feel about the need to find a better system of teaching and learning about our Earth and our place within Earth systems.

The academic process of developing the technical elements of a thesis was the starting point of the written work, but it is the generations of First Nations and Métis ancestors that really gave rise to the purpose of the work. Without those who lived in close connection to the land and shared what they knew, I might have been of the opinion that all we need is more technology and more science to solve our current environmental dilemmas. Many, if not most, people in contemporary education systems still hold singularly to the Western science that has given so many gifts and served to eliminate many of humanity's hardships. It is not my intention to dismiss these accomplishments, or to imply that Aboriginal traditional knowledge holders somehow live outside of the global society that constitutes our physical life. I have never met a

person who does not freely own up to being as much a part of 'the problem' of environmental degradation as the next person. Nor do I. However, it is grievously easy to ignore the shortcomings of science, including the massive damage to our planet yielded by the same science that has given so many gifts. There is irony in the fact that the Western world, in particular North America, has some of the highest education in the world and offers some of the highest standards of living, yet we consume the majority of the Earth's resources with little restraint. There would appear to be a gap in our rational thinking as a society; one that may challenge our ability to survive in years to come.

In the spirit of lifelong learning, I accept the challenge of believing that as a species, we are capable of using our intellect to view the status of something, acknowledge short-comings and develop a better, less harmful, process whether it be in social sciences, humanities, law, medicine, economics, science, or education. In an ironic way, this was the original challenge and motivation for Western scientists and other thinkers concerned with advancing human and societal development. Becoming locked into a dominant paradigm or a context of being unable to explore alternatives can ultimately destroy cultures or it can bring about radical changes. In European history, church authorities persecuted some scientists, like Galileo, who were forced to recant their discoveries, exiled, or worse (Bowler & Morus, 2005). Nevertheless, thanks to Galileo and his forbearers, truths prevail and discoveries such as the heliostatic model provide common knowledge that the sun is stationary in our solar system. Historically, many scientists have risked their lives to bring about radical change. Today, there is freedom to undertake exploratory research without fear of retribution in most countries, but we are also recognizing that the drive to become experts in our chosen field does create a context where we often cannot see beyond our own paradigm. Knowledge becomes compartmentalized. Interdisciplinary relationships break down and opportunities to create better knowledge are lost. Change is threatening when issues of power are involved and contemporary science is very powerful.

Increasingly, we are challenged to seek collaborations that take us beyond what we can manage as individuals or groups. Resistance to change within the discipline of science is to be expected. The choice of examining my thesis questions using an Indigenous methodology helped to do the research from a holistic perspective and allow some commentary on what I believe are the many facets of knowledge, experience and imagination that can give rise to a better form of science education. Change in science education does not need to be viewed as

adversarial if we understand that a holistic model is inclusive, facilitating a balanced approach and acknowledgement of the value of all knowledge. When conflict in perspectives arise and difficult decisions need to be made, informed balanced decision-making tempered with restraint and humility need not be seen as a sign of societal weakness, but a source of strength and wisdom. Co-management boards, consultations and other forms of collaboration can be useful processes; but can fall short of expectations if the context is designed around serving the interests of non-Aboriginal people and the ultimate authoritative decision-makers or beneficiaries are non-Aboriginal organizations. This is where we are challenged to create authentic authorities with balanced power-relations working from a common paradigm.

As part of this investigation into the idea of Métis traditional environmental knowledge becoming a new modality of science education, I looked to my own identity and experiences as a Métis person of mixed heritage as a part of the qualitative process. During the interviews, I shared stories and engaged in the interview discussion as a means of ensuring the participants knew what I was thinking about the questions as we went along. The literature reviewed provided insight into issues of colonization and decolonization, racialization in Canada and Saskatchewan as well as the current educational norm of monolingualism and cognitive assimilation. I value my European heritage, the bonds of family and the values imparted through the wisdom and energy of those good people who helped forge who I am. However, I also recognize that the experiences of racism, oppression and marginalization over several generations harmed many other members of my family. My own personal context is not dramatically different from thousands of other Aboriginal people across Canada. Traditional knowledge and skills of many First Nations and Métis ancestors have not been passed on intergenerationally in the hope that somehow, the children coming up will not be subjected to the same hatred. Aboriginal languages have been forsaken in favour of English language proficiency. Much has been lost, but the process of decolonization is not a benefit only to Aboriginal Peoples, but to society as a whole.

Decolonization requires that we deconstruct, or look to the context of our society, and understand the reality of the history that has created it. For the dominant society, there is a moral responsibility to learn about the history and cultures of Aboriginal Peoples in order to forge better relationships and understand how perpetuating the same conditions of our educational processes result in a status quo that is destructive to them, Aboriginal cultures and the global

environment. Aboriginal Peoples have held onto cultural traditions to the best of their ability and can find strength in grounding personal identity in the value systems that have sustained them. The history that resulted in Treaties and the Scrip process diminished or eliminated Aboriginal Peoples' access to traditional land use. 'Having sufficient lands and natural resources returned will enable the Métis to survive as a distinct people and retain their culture, traditions, customs, livelihood, languages and dignity' (Chartier, 1993). While Aboriginal Peoples have found it necessary to turn to Canada's legal processes to determine rights, we can look to education to provide a means of finding common ground in developing a better future for all learners.

According to the Canadian Council on Learning (2010), the demand for trained personnel in the environment sector has outpaced the pool of qualified candidates in Canada. Opportunities as botanists, conservation officers, ecologists, environmental analysts, educators, geologists, pollution control technologists and toxicologists are just a few of the numerous careers available. In 2009, the Canadian Council on Learning consulted with representatives from provincial ministries of education, universities, environmental education associations and career-education providers about factors that influence career decision-making, including the pursuit of careers in the environment. The study concluded that "the primary driving forces behind environmental career choices were personal values such as a sense of responsibility, community-mindedness, ethics, aesthetics and social awareness" (p. para 17) and that "students choose green careers primarily because of their personal interest in environmental issues, strong emotional connection toward the environment and passion about the environment and environmental issues" (p. para 17). We know that we need to do a much better job of motivating young people to take on these important roles within the world of science.

To inspire young learners, educators must learn not to hurl more statistics and technology at young learners, nor continue assimilative processes that strip away their sense of responsibility and personal connection to the Earth. Rather, the decolonization process allows us to look at what is failing within science education and create a process that inspires communities of learners to get involved and draw on the personal and cultural strengths that are available for development.

I propose that starting with the Métis Holistic Lifelong Learning Model is one way of re-imagining a modality of science education. Current processes of research by post-secondary

institutions funded by the Tri-Council have described ethical processes essential for collaboration with Aboriginal communities (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, Social Sciences and Humanities Research Council of Canada, 2009). Ethical compliance is not only desirable, it is mandatory to receive Tri-Council funding. Use of ethical procedures, including forms that accommodate institutional and customary Aboriginal law, can provide additional support to Aboriginal communities who have often been subjected to research that does not benefit their communities. The spirit of collaboration must constitute the foundation of future development of any new science education and Aboriginal communities should hold organizations not bound by these ethical processes to the same standards.

The data gathered and analyzed in this thesis is an example of the rich content that can be generated in a single study. It is unfortunate that so little has been published concerning Métis perspectives of traditional environmental knowledge, but others who may choose to take on similar studies will contribute to a larger body of information that can help to guide future educational processes. The collaborative study on *Learning Indigenous Science from Place* (Michell, Vizina, Augustus, & Sawyer, 2008) yielded different data because of the involvement of different interview participants. It can be expected that additional research with some of the half-million Métis in Canada would provide a wealth of data useful in advancing knowledge in Métis traditional land use, educational perspectives, and increased connections and contributions to international discussions. Since schools are not likely to be going away any time soon, part of the holistic paradigm must address the pragmatics of formal curriculum. We can look at the thematic data in the study and extract knowledge that will contribute to policy development, professional development, curriculum content and supporting resources, new forms of assessment meaningful to a holistic model and based on outcomes and indicators desired by Métis People.

During the interviews and data analysis process of this research, I was reminded of a dialogue session I participated in with First Nations Elders concerning the process of Nourishing the Learning Spirit (Vizina, 2008). The Elders who had been able to avoid residential schools and had strong ties to their original language and culture spoke at length through interpreters about their view of traditional forms of education. Witness participants at the event were asked to listen to the teachings of the Cree, Dëne, and Nakwē Elders and describe their reflections on

the teachings in the form of journals. While the languages and cultures of each of the First Nations represented at the Dialogue are unique, there are still many philosophical similarities. Some of the Elders mentioned that it was the first time they had sat together with Elders of other First Nation cultures sharing personal stories and perspectives of education. I marveled at the ease with which differences in ceremonial processes were quickly resolved, the respect given each other throughout the four-day event and the integral teachings so generously shared. Those Elders cautioned about relying too heavily on the pictograph of the First Nations Holistic Lifelong Learning Model and to be sure not to confuse that model with the actual culture. This is a wise caveat that also applies in the application of the Métis Holistic Lifelong Learning Model. The pictograph Models help serve a teaching and learning process, but cannot fully encompass all that constitutes any culture. That said, changing the way we deliver science education must begin somewhere and approaching a merger of Western science with Métis traditional environmental knowledge will still require holistic thinking.

Moving from research and conceptual thinking into the realm of the physical world means community and educational leadership must find a way to actualize the results of the data. This will mean capacity building in terms of human expertise and financial resources among other things. A recent article in the Saskatoon Star Phoenix indicates that Northern Saskatchewan is the second poorest region in Canada (Kyle, 2010, p. A8). It is hard to imagine how this has happened, given the bountiful natural resources in Northern Saskatchewan but perhaps the severe exploitation of resources in Northern Alberta and the associated environmental destruction can serve as reminder of the value of restraint, the need to have decision-makers involved that are not solely driven by financial gain, and the involvement of professional technical people who have local ties and can bring an ethic of environmental protection to any future development. It is likely that in future years we will see increased development in Northern Saskatchewan as the demand for minerals, fossil fuels, forest products and fresh water increases. New wealth will create its own set of social issues, so it makes sense to develop educational programming that will provide the opportunity for a labour force that is cognizant of environmental issues and provided with strong science training grounded in Métis traditional environmental knowledge.

North West Saskatchewan appears to be an ideal location for piloting a new modality of science education given the strength of local traditional knowledge, the availability of natural

habitat and the desire of the community to ensure the well-being of young people. Ideally, all grade levels of existing science curriculum should be looked at as a whole to plan a comprehensive continuum that is able to merge the Western science themes, outcomes and indicators together with Métis traditional environmental knowledge. This would require collaboration between Métis communities and educators to ensure the best possible results in terms of curriculum and community support. The planning process should include well-designed research projects that would 1) scope the availability of local resources such as camp sites, availability of specialized local experts, inclusion of spiritual guidance and support, parental engagement and plans for options; 2) develop a draft curriculum for Métis traditional environmental knowledge based on a holistic model; 3) ensure that the educational foundations and the philosophical underpinnings of the linguistic and cultural activities are accurately described and useful to the Métis community as well as educators; and 4) track the development, actualization and outcomes, including successes and areas for improvement.

On a smaller scale, as an example, let us explore one possible scenario for redesigning how science education is delivered. The major thematic units in Grade 9 Science are: Life Science – Reproduction and Human Development; Physical Science – Atoms and Elements; Characteristics of Electricity; and Earth and Space Science – Exploring our Universe (Ministry of Education, 2009, p. 29). The current curriculum provides a list of 15 outcomes that educators are required to achieve during the teaching year. Each outcome has a companion list of Indicators that teachers can use to ensure they will achieve the particular outcome. While my argument in this thesis continues to be that Métis traditional environmental knowledge can form the core of a science curriculum, I feel that it is respectful to offer some space in this final commentary to illustrate how Western scientific concepts can be included to remain important features of learning for young people.

The theme of Reproduction and Human Development is intended to help young people understand genetic diversity, how cells reproduce, sexual and asexual reproduction in plants and animals, and the process of human reproduction and contraception. It is possible to develop the learning activities around traditional knowledge by contextualizing them within an exploration of Métis history, issues of race and racism, biological diversity in North West Saskatchewan, population demographics of Aboriginal Peoples, and health issues. Some activities can be

planned solely for girls, some activities solely for boys, and some combined learning could be included, also providing opportunities for involvement of community members.

The theme of Atoms and Elements includes learning about physical and chemical properties of common substances, historical explanations of the structure of matter, and understanding the classification of elements and compounds. These are especially important issues for residents of North West Saskatchewan as it is rich in minerals and the mining industries have been long-term harvesters and employers of Northern people. Additionally, issues of pollution affect local residents and wildlife. Knowledge about the spiritual aspect of Indigenous knowledge concerning rocks could be shared as young people explore local habitat.

The theme Characteristics of Electricity looks at static electric charges and electrical currents, including historical and cultural understandings, relationships among voltage, current and resistance in circuits, and impacts of electrical energy production and distribution in Saskatchewan. Many Elders have traditional knowledge about the origin of electricity and the spiritual perspectives within Cree, Nakwē and other Aboriginal cultures. This is very old knowledge that predates the industrial development of electricity. Issues of availability of power in North West Saskatchewan are common topics of discussion and are related to economic development, safety and environmental concerns. For example, placing power poles along the highway has meant clearing forested areas and keeping the flora from encroaching along the roadway. Spraying herbicides or using employment to cut road corridors can be controversial and an opportunity for young people to consider all the factors involved with choice.

The theme Exploring our Universe provides an opportunity to explore the motion and characteristics of astronomical bodies, analyze scientific explanations of the formation and evolution of the solar system and universe, examine how various cultures, including First Nations and Métis, understand and represent astronomical phenomenon, and look at human capabilities for exploring and understanding the universe and associated technologies. Study of the cosmos can be one of the most exciting adventures for young learners. The night sky in North West Saskatchewan is breathtaking, because of minimal light and environmental pollution (note relation to the previous study of electricity). Study of the constellations, planets and potential careers in astronomy with the Canadian Space Agency can be discussed. Learning to navigate on the land by the night sky was necessary for hunters and trappers who did not have

access to motor vehicles, cell phones or global positioning systems. Traditional sacred First Nations stories about Creation and our spiritual beliefs are a natural fit as youth consider their value systems and how this relates to our relationships with others.

At a minimum, if the existing science curriculum for Grade 9 were delivered completely, or in part, through seasonal cultural camps or other planned excursions, exciting activities could be planned to teach the scientific concepts within the context of cultural knowledge. It is too easy to sit inside a classroom for most of the year and continue to hope that somehow young learners will be inspired solely by words on a page. There is an important place for literacy and book learning in science education; they bring knowledge from other parts of the world that would otherwise not be accessible. However, this should be supplementary knowledge that is built upon local foundations. Having a young person able to identify local plant and animal species, to know where migratory birds travel and why they choose local habitat, recognizing changes in ecosystems, learning survival skills appropriate to the region, how to skin a rabbit or catch fish are just a few of the appropriate activities for this area of Saskatchewan. The data provided within this research project is intended to provide an inspired look at the diverse themes that could constitute a new paradigm for science education.

5.2 Considerations for Future Studies

In 2009, the Ministry of Education in Saskatchewan redesigned Grades 6 to 9 Science curriculum and included some First Nations and Métis content. In addition, a major publishing company, Pearson Canada Inc., visited Saskatchewan, consulted with First Nations and Métis Elders and the Ministry of Education and subsequently developed new Science textbooks and associated teacher resource books for Grades 6, 7 and 8. The textbooks include feature pages of notable Elders and traditional land users from across Saskatchewan who share insights about some of the thematic areas in science curriculum (Pearson Canada Inc., 2009a; Pearson Canada Inc., 2009b; Pearson Canada Inc., 2009c). While textbooks in other disciplines, such as social studies, contain some Aboriginal content by publishers, it is only in this millennium that we are seeing the tentative inclusion of Aboriginal content within science. I was pleased to have been able to participate in one of the consultation sessions as a scribe and listen to the wise teachings offered by the Elders. It was an exciting opportunity that will stay with me forever. I am also reminded that the issues of ethical process and intellectual property rights play a role in the

development of such material. As the knowledge of the Elders and traditional land users is shared, it then becomes copyrighted by the publisher, or can innocently be put out into the public domain for access and use by anyone. This situation is a concern to Aboriginal Peoples who feel that medicine plant knowledge, sacred stories, songs or other family-held knowledge may be appropriated and commercialized without negotiated consent processes.

Intellectual property issues are in discussion and development all over the world. Indigenous Nations have had some victories in cases where their rights have been violated. For example, pharmaceutical development of the Hoodia cactus as an appetite suppressant and anti-obesity treatment was based on Indigenous knowledge of the San people, who have lived in the Kalahari Desert in South Africa for thousands of years, and used the cactus as an appetite suppressant when travelling on long journeys through the desert. Nearly 100,000 San people took a stand to protect their Indigenous knowledge that resulted in the pharmaceutical company involved negotiating an agreement with the San people and the establishment of the San Hoodia Benefit Sharing Trust (World Intellectual Property Organization, 2008). While this particular case ultimately had a good result for all involved parties, there are many other cases where Indigenous knowledge is simply appropriated and the original knowledge holders are not given the opportunity to retain the knowledge within their own control or participate in benefit-sharing agreements. This situation can easily emerge within research on science education when Elders and traditional land users generously share what they know and educators are not informed about intellectual property issues.

Within this thesis, and the *Learning Indigenous Science from Place* study (Michell, Vizina, Augustus, & Sawyer, 2008), specific traditional knowledge about medicines was deliberately left out of the data as a result of respecting intellectual property rights of Métis People. While some medicine plant knowledge is shared among Aboriginal Peoples, and known by non-Aboriginal individuals with an interest in this area, protocols governing what knowledge is repeated, written and published must be respected morally and legally. Discussion of the availability of knowledge for publication should only be done after extensive consultation with Aboriginal knowledge holders and community leaders as well as research institutions or others with expertise in this area.

Researchers who take on similar studies on Métis traditional environmental knowledge may wish to consult with the Governing Members of the Métis National Council including the Métis Provincial Council of British Columbia, the Métis Nation of Alberta, the Métis Nation – Saskatchewan, the Manitoba Métis Federation and the Métis Nation of Ontario to explore ongoing development in their environment and natural resource portfolios. Attendance at a Métis rights conference revealed the progress being made in the area of traditional land use (Metis National Council, July 16-17, 2010). This can also be helpful in relationship-building, developing research projects useful to Métis People and finding individuals who are willing to participate in research studies. From my own experience, with the completion of this study, I am hopeful to reconnect with the people from North West Saskatchewan who contributed to this study and with whom I wish to visit more regularly when the arduous task of writing up the research is finished.

5.3 Implications for Policy and Practice

It is my hope that the content of this research project provides an opportunity for educational policy-makers in Saskatchewan, or elsewhere, to see Métis traditional environmental knowledge as a viable modality of science education that will engage learners in understanding relationships with the natural world and the importance of developing sustainable lifestyles within holistic lifelong learning. As a Métis person and former science educator, I believe this is possible and desirable. I have reviewed existing educational policy, talked with Métis Elders and traditional land users and drawn on my own experiences as an educator. Despite the length of this thesis, I feel like I barely scratched the surface of this investigation. In future years, I hope to have an opportunity to continue this research and focus on actualizing the findings, work with the Métis community and bring new practices to bear in science classrooms.

On Sunday, August 1, 2010, I watched an episode of Indigenous Circle on television that included a feature on the community of Île-a-la-Crosse. Located in North West Saskatchewan, Île-a-la-Crosse is a predominantly Métis community of about 1500 with an active Métis culture and many Aboriginal language speakers. Students, administrators and local leadership interviewed shared their enthusiasm for the new school facility built in recent years. One student commented excitedly about the new laboratory facilities that were now available for advanced studies in biology and chemistry. It reminded me of the same enthusiasm the Willow Cree

students brought to science education at Beardy's and Okemasis First Nation when I was an educator there several years ago. Personally, I can attest to the care and attention to detail of my former students, which, in my view, greatly outshone most of the first year university students with whom I had been trained when beginning my own Bachelor of Education Degree. I believe that with a little attention, effort, and capacity, that a new modality of science education can use the existing education policy in Saskatchewan to justify creating more advanced practices in science education as I have illustrated earlier in this chapter.

When I see statistics that speak to Aboriginal students dropping out of school, or falling behind non-Aboriginal students in achievement, I do not believe the solution is to maintain the status quo and keep hoping for a different result. Nor do I believe we should water down the curriculum or disregard the accomplishments and traditional environmental knowledge of Métis People. As educators, *we* have to take the initiative to create a better education system in which *all* students can succeed. However, the development of new material, and especially new science material, needs to consider the ontological, epistemological and axiological foundations of Métis culture. In order to understand how traditional knowledge differs from Western science there must be a focused effort to provide professional development to educators to ensure the Métis community is not harmed by their efforts. The Elders also recommend that educators and administrators should learn along side of the students and that they would enjoy this process.

I am aware that few Métis and educators, or the general public are knowledgable about the United Nations Convention on Biological Diversity and the opportunity for participation of Indigenous Peoples. Sadly, lack of capacity has meant that the Métis Nation struggles to find the means of ensuring Métis voices are adequately represented along with the Assembly of First Nations and the Inuit Tapiirit Kanatami. The issues being discussed within the CBD are broad and the processes are complex. However, the reality of the discussions revolves around the preservation of life on Earth, and all people need to be concerned with that. Some of the United Nations guiding texts have been offered in this thesis to illustrate some of the specific references to the inclusion of Indigenous Peoples of the world. The inclusion of Métis People's voices is intended to represent Métis traditional environmental knowledge. The UN already has a bevy of Western scientists to advise them on issues of concern to Western science. My own personal knowledge does not extend to Middle Eastern science or Far Eastern science, but the representatives from most Nation States I have observed appear to have a Western science point

of view. Exceptionally, I can recall one meeting where an individual from an African nation spoke about the recent murder of two local community members, father and son, who were killed with machetes by the paramilitary because they were traditional knowledge holders who were opposed to certain developments in the region. We cannot always overcome the horrors perpetrated by oppressive regimes globally, but our freedom in Canada should provide us with an opportunity to challenge ourselves and advance knowledge that may ultimately result in models that can be employed worldwide as effective collaborative paradigms.

5.4 Further research

I would recommend that additional studies be done concerning Métis traditional environmental knowledge is done along with the Métis Holistic Lifelong Learning Model as a data analysis framework. Curriculum development projects are needed to advance how the Model can be used as a frame of reference to develop texts on philosophical views of Métis People and holistic education from a Métis perspective. The continuum of curriculum from Kindergarten to Grade 12 needs to be looked at to determine a traditional perspective with Métis traditional environmental knowledge at the core with inclusion of Western scientific concepts. Specific curriculum on thematic units and an assessment process appropriate for the curriculum needs extensive research and development. Some of the work around themes was been begun by the Canadian Council on Learning and is available for public input at their website at http://cli.ccl-cca.ca/Metis/index.php?q=home&l=en. Groundbreaking work on Redefining How Success is Measured in Aboriginal Learning can help contextualize future research (Canadian Council on Learning, 2007).

5.5 Future Hopes

Finally, in concluding this study, I want to share a vision I have for the future. Although I have no known familial ties to North West Saskatchewan, the land is very much like the area where I grew up in East Central Saskatchewan. Heavily wooded, lakes, streams and an abundance of game touched my learning spirit as a child and throughout my life. Having an opportunity to live and work with Métis people in North West Saskatchewan inspired me with the rich traditional environmental knowledge held by individuals' resident within the communities. I had learned to be politically aware as well as environmentally conscious as an adult, and felt the sorrow along with local people at the lack of employment opportunities despite the heroic efforts of many

individuals to bring new opportunities to the North. I felt embarrassed at government officials who dismissed Métis Elders in meetings because the officials did not understand what they were hearing, did not care, or were powerless themselves to act on the advice received. I grieved quietly in my own way each time I learned of another youth suicide, lost to hopelessness and despair from the systemic social issues of our society. Yet, in spite of the many factors that serve to diminish the spirit, there were, and continue to be, many moments of inspiration in the North West. The laughter and comedy of Métis People helps overcome hardship; the dedicated educators who take the initiative to include traditional knowledge in curriculum to the best of their ability; and the certainty of the Métis People in speaking up on behalf of protection of their culture and languages gives me hope.

I have imagined that a Métis Traditional Knowledge Centre could be established in North West Saskatchewan as a hub from which Métis traditional environmental knowledge could be shared with all community members and with schools. Elders could have an honoured place and pass on traditional skills to young people, adults and other Elders. Outdoor education excursions could be hosted; curriculum and curriculum resources could be developed. I am aware that some work was done several years ago on the development of a proposal for a similar venue, but I am not certain as to the specific content or intention of the plan. However, I believe that a Métis Traditional Knowledge Centre could provide many new opportunities in science education, arts and culture, language programming, repository for preservation of research and archival items and potentially tourism. I imagine that post-secondary students from across Canada studying in Western scientific disciplines such as Biological Sciences, Chemical Sciences, and Physics as well as trades and technologies could have an opportunity to augment their learning in North West Saskatchewan by spending time with traditional land users and learning from the Métis. Partnerships could be forged with local post-secondary institutions for this purpose. Revenue from local natural resource development could be used to create such a Centre, or, as the San People in South Africa did, create a benefit-sharing fund to further develop processes to perpetuate traditional knowledge and practices. These are just my musings, but I believe that there are many possibilities for the future of Métis traditional environmental knowledge and for the Métis People of Canada to bring our knowledge and expertise to the honoured place it deserves. Ekosi.

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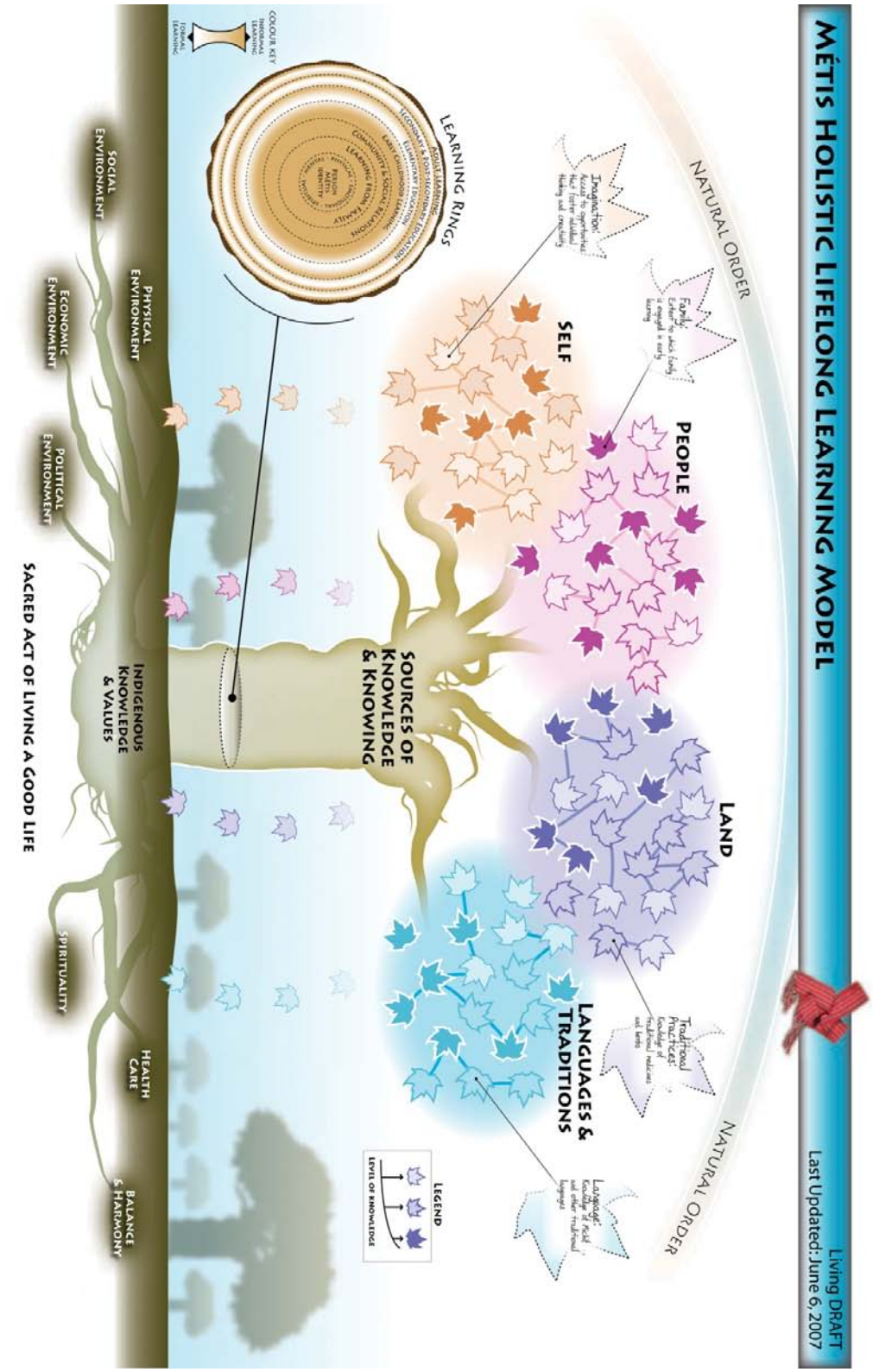
Appendix II: Métis Holistic Lifelong Learning Model



About the Métis Holistic Lifelong Learning Model

The *Métis Holistic Lifelong Learning Model* represents the link between Métis lifelong learning and community well-being, and can be used as a framework for measuring success in lifelong learning.

The Métis understand learning in the context of the "Sacred Act of Living a Good Life," a perspective that incorporates learning experienced in the physical world and acquired by "doing," and a distinct form of knowledge—sacred laws governing relationships within the community and the world at large—that comes from the Creator. To symbolize these forms of knowledge and their dynamic processes, the Métis Holistic Lifelong Learning Model uses a stylistic graphic of a living tree.

The *Métis Holistic Lifelong Learning Model* is a result of ongoing discussions among First Nations learning professionals, community practitioners, researchers and analysts. For a complete list of individuals and organizations that have contributed to the development of this learning model, visit www.ccl-cca.ca.

Describing the Model

The Métis learner, like the tree, is a complex, living entity that needs certain conditions for optimum growth. As conditions change throughout the natural cycle, so will the regenerative capacity of the tree. The health of the tree, or the Métis learner, impacts the future health of the root system and the "forest" of learners.

Métis people view lifelong learning as part of a regenerative, living system—the "Natural Order" that governs the passage of seasons and encompasses a community (or forest) of learners. Within this organic system, relationships are interconnected, and balance and harmony are maintained.

The tree's roots represent the individual's health and well-being (social, physical, economic, spiritual, etc.) and provide the conditions that nurture lifelong learning. The root base of the tree represents the indigenous knowledge and values that provide stability for the Métis learner.

A cross-sectional view of the trunk's "Learning Rings" depicts how learning occurs holistically across the individual's life cycle. At the trunk's core are the spiritual, emotional, physical and mental dimensions of the Métis self and identity. Intergenerational knowledge and values are transmitted through the processes that first influence the individual's development—learning from family, and learning from community and social relations (represented by the two rings surrounding the core). The four outer rings illustrate the stages of lifelong learning, from early childhood through to adulthood; they depict the dynamic interplay of informal and formal learning that occurs at different rates and stages, as represented by the extent of growth across each ring.

Extending from the trunk are the branches—"Sources of Knowledge and Knowing" such as self, people, land and language and traditions. The clusters of leaves on each branch represent the domains of knowledge. The intensity of their colour indicates the extent of individual understanding in any knowledge domain. The leaves of knowledge eventually fall to the ground, signifying how knowledge transmission enriches the foundations of learning and produces more knowledge (more vibrant leaves).

CCL CCA
CANADIAN COUNCIL ON LEARNING CONSEIL CANADIEN SUR L'APPRENTISSAGE
ABORIGINAL LEARNING KNOWLEDGE CENTRE

First Nations Adult & Higher Education Consortium
University of Saskatchewan

Appendix III: University of Saskatchewan Ethics

1. Name of researcher and/or supervisor and related department(s).

Graduate Student:
Ms. Yvonne Vizina, Graduate Student
Department of Educational Foundations, University of Saskatchewan

Under the supervision of:
Robert Regnier, Professor
Department of Educational Foundations, University of Saskatchewan

1.a. N/A

1.b. Anticipated start date of the research study (phase) and the expected completion date of the study (phase).

June 2008 – April 2009

2. Title of Study

Métis Traditional Environmental Knowledge and Science Education: Building on the Understanding of Selected Land Users in North West Saskatchewan

3. Abstract (100-250 words)

This research is being completed as part of the requirement for a Master of Education thesis and is intended to investigate the subject of Métis Traditional Environmental Knowledge (MTEK) in selected Métis communities of North West Saskatchewan and its role in Saskatchewan school science curriculum. This study has three goals. They are 1) to begin development of a body of research on Métis traditional environmental knowledge; 2) to examine the current narrow scope of contemporary science education, the ideological premise of contemporary science education and the principal reasons for MTEK not currently being a modality of science education; and 3) to support the preservation of biological diversity and the perpetuation of Métis traditions.

The first part of the study will require a literature review of existing theories of Indigenous epistemology, educational decolonization, cross-cultural research methodologies, Aboriginal languages, biological diversity, ecosemiotics and environmental education as relevant to Métis People.

The second part of the study will gather data applying an Indigenous research methodology using interviews of adult male and female Métis traditional land users. Participants will be interviewed on aspects of their life experiences as traditional land users to determine how being a traditional land user has shaped their worldview (belief systems, culture, language, practices), and particularly their relationships with the natural environment as Métis People.

The third part of the study will be an analysis of the interview data in relation to the literature review to determine opportunities which currently exist in communities, provincial education systems, and national and international processes in support of traditional environmental knowledge as a modality of science education in lifelong learning.

4. Funding

The research is being funded by the researcher.

5. Expertise

Robert Regnier, Faculty member in the Department of Educational Foundations at the University of Saskatchewan is a proponent of ecological education. He is active in local, national and international fora in environmental issues and education. He teaches course work on environmental education and assists graduate students in developing reading courses that advance their field of interest. His expertise in the philosophical works of Alfred North Whitehead will bring a critical eye to this thesis work.

Glen Aikenhead, Emeritus Professor, Department of Curriculum Studies, College of Education, U of S is one of the foremost experts on issues regarding Indigenous science in school curriculum. Dr. Aikenhead has researched with Indigenous peoples within Canada and abroad and has extensive publications on the subject of Indigenous science.

Researcher Yvonne Vizina is a graduate student in the Department of Educational Foundations. She is a Métis woman and graduated with Great Distinction from the College of Education, U of S. Ms. Vizina completed her B.Ed Degree at the Saskatchewan Urban Native Teachers Education Program through the Gabriel Dumont Institute, achieving a double-major in Native Studies and Biology. She worked extensively within the Métis community at a regional, provincial, national and international level in community development, intergovernmental affairs, and environment portfolios.

6. Conflict of Interest

There is no conflict of interest of the researchers or experts involved in this study. The researcher worked within the infrastructure of the elected Métis Nation during 1998 to 2004 and is a member of the Métis Nation. This experience may assist in facilitating the research as she will be familiar to some community members.

7. Participants

Participants have not yet been identified. Following approval of the ethics proposal by the Behavioural Ethics Committee, the researcher will contact Métis community

members of North West Saskatchewan by telephone to explain the research project and invite their participation. Four to six interviewees will be sought, three male and three female. Interviewees may be non-English speakers if translators are available. Individuals agreeing to be interviewed will be provided with detailed information on the nature of the research and methods proposed in the Letter of Invitation attached in Appendix I.

8. Consent

Following approval of the ethics proposal by the Behavioural Ethics Committee, the potential interview participants will be introduced to the research project by the researcher by telephone. A Letter of Invitation and Consent Form will be provided by mail. The Consent Form will be reviewed, signed and witnessed by the participant and the researcher at the time of the interview. Participants will be informed that transcripts of their interview data will be provided back to them for review to ensure accuracy of information. Data from other interview participants will not be made available to them. Participants will be informed of the ethics process required by the University, their rights as individuals will be respected and that they may withdraw their participation and interview data from the research at any time until a signed Transcript Release is received from the participant approving the final edited transcript of his or her interview. The proposed Consent Form is attached in Appendix II.

9. Methods / Procedures

I will be requesting the participation of four to six Métis participants for personal interviews. A copy of the Study Questions and Interview Questions are attached in Appendix III.

Participant interviews will take approximately two hours each. Interviews will be recorded on audio media and will have accompanying field notes. Participants may request that the recording device be turned off at any time during the interview. Participants may refuse to answer any interview questions that they are not comfortable with. Participants will be provided with a Consent Form before any dialogue occurs, and assured of their right to withdraw from the study until 14 days following receipt of a copy of their transcript. If required, Cree and/or Michif translators will be arranged by the researcher to facilitate non-English speakers. Transcripts will be provided to respective interview participants for review and feedback.

The approved thesis will be made available at no charge to interview participants in printed form, and an oral presentation will be made publicly in North West Saskatchewan to maximize transparency of the study within the community.

10. Storage of Data

The study, data and associated material will be safeguarded and securely stored by Professor Robert Regnier at the University of Saskatchewan for a minimum of five years. After a period of five years, at the discretion of the University of Saskatchewan, the data may be destroyed beyond recovery.

11. Dissemination of Results

The data collected is intended for use in the formation of the researchers Master's thesis. The researcher will share interview transcripts with respective interview participants to ensure accuracy and ongoing consent. A verbal presentation on the approved thesis will be provided to Métis communities in North West Saskatchewan as a means of continued community involvement and dialogue. A print copy of the approved thesis will be provided at no cost to each of the interview participants. Results will also be disseminated at conferences, workshops, seminars, and in publications.

12. Risks, Benefits, and Deception

This study will involve research with Métis people. The researcher is also Métis, and has designed this study in consideration of cultural sensitivities to consultation, research and transparency.

Risks:
There are no perceived risks to participants in this study.

Benefits:
This research project is designed using an Indigenous research methodology, respecting community cultural sensitivities and addressing issues of importance to the Métis community. This means the researcher will respect the availability and comfort level of participants by conducting interviews in the participants most familiar surroundings such as their home or outdoors, maintain flexibility in the duration of interviews if the participant wishes, especially if they are elderly, and be accountable to the Métis community for research results by providing each participant with a copy of the completed research and being available to the Métis community for future discussion about the research. An Indigenous research methodology respects a Métis worldview including social, historical and political contexts. This research project is principally for the well-being of the Métis community participating. The approved research results will be shared with research participants and the broader Métis community in Canada. The Métis community will have an opportunity to use the completed thesis as reference material in future educational planning processes. The research may stimulate further discussion and dialogue about the subject matter and contribute to the development of new ideas among Métis community members and educational professionals regarding Métis traditional practices and educational processes. The approved research results will also contribute to a body of academic literature on Métis traditional environmental knowledge.

Deception:
This research does not involve deception methods of any kind.

13. Confidentiality

Interview participants will only have access to their own data and transcripts. Interview participants will not have access to interview transcripts of other interview participants. Unless the participant wishes to be identified, quotations used from the interviews will not identify the speaker. If desired by participants, pseudonyms will be used, and any potential identifying information removed.

14. Data/Transcript Release

Participants will be given the opportunity to withdraw any of their responses at any time until a signed Transcript Release is received from the participant approving the final edited transcript of his or her interview. The Transcript Release Form is attached in Appendix IV.

15. Debriefing and Feedback

Participants will be provided with their interview transcript for review, feedback and authorization or withdrawal. Participants will be informed that the approved thesis will be presented to Métis communities in north west Saskatchewan in a public forum as a means of continued community involvement and dialogue. Participants will be informed that a copy of the print thesis will be provided to each interview participant. Participants will be informed that information from the approved thesis will be disseminated in a variety of forms at conferences, workshops, seminars, and in publications.

16. Required Signatures

Signatures of the student, supervisor and Department Head are included in the application.

17. Contact Name and Information

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