Combining the Views of Both Worlds:
piqusiit tamainik katisugit

Combining the Views of Both Worlds in Inuktitut: Place-based Science Education in Qikiqtani

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Executive Summary

This report summarizes several phases of a multiphase science education development project occurring between April, 2004 and November, 2009 in three Inuit communities in the northern Qikiqtani (Baffin Island) Region of Nunavut, Canada. Although the Canadian Council on Learning (CCL) funding for this project is confined to the development, implementation and evaluation of the influence of Inuktitut-language place-based resources on Inuit students' learning, it is believed by the participants of this project that because of the dissemination forum provided by CCL, the contents in this report should be a cumulative summary outlining the chronology of the project and its overall findings. The project, in its entirety, is motivated to assist Inuit school communities in achieving their aspirations for science education. The project overall focuses on (1) establishing the current situation in science education in Kindergarten through to Grade 7 in the Qikiqtani communities, (2) identifying developmental aspirations for stakeholders within the communities and potential contributors and constraints to these aspirations, (3) implementing mechanisms for achieving identified aspirations, (4) evaluating the effectiveness of such mechanisms and (5) providing suggestions for further development projects established to assist Aboriginal, especially Inuit, communities in achieving their goals for curriculum, in particular, science education. This project attempts to "combine the views of both worlds" in science education for Qikiqtani students; that is, it combines the knowledge, practices, values, beliefs, and ways of knowing of both the community of scientists and Inuit culture. Equally, it also combines the views of both worlds in achieving these goals through two process development frameworks: Urie Bronfenbrenner's bio-ecological model (a model that identifies teacher attributes and the environment in which they work as determinants on development) and *Inuit Qaujimajatuqangit* (IQ, Inuit ways of knowing and doing). This report focuses upon an evaluative overview of all phases of the development project and the efficacy of this "two-way" model in fostering school development, especially in the area of science education.

The relative political infancy of Nunavut and perceptions of the risk factors likely to impede the realization of its science education aspirations based on previous research (Lewthwaite, 1992) prompted the University of Manitoba's Centre for Research, Youth, Science Teaching and Learning (CRYSTAL) in 2003 to approach the Nunavut Department of Education to support a five-year community-based research and development project in science education. The three communities were identified by the Nunavut Department of Education and Qikiqtani School Operations as being a logical site for the development project. Identification was based on the geographical situation of the communities (both in terms of proximity to one another and their remoteness from other communities in Nunavut); each community's aspiration to work toward a science program that honoured community epistemology; and the high level of Inuktitut language use in the school and community.

In the first phase of the project, each of the community's aspirations for science education was determined through a variety of data collection methods. In particular, school community meetings were held to elicit both community aspirations for science education and to gain an understanding of the processes community members perceived would influence positively or negatively the fulfilment of these aspirations. Framing the understanding of the processes likely to assist in making these aspirations realized were the principles of *Inuit Qaujimajatuqangit* (IQ) and the assertions of Bronfenbrenner's bio-ecological theory. The common theme, without exception, advocated for a science education experience that combined the views of "both worlds": that is combined the knowledge, values and skills of both Inuit ways of knowing and western science. This "both-ways education" that combines the knowledge, practices, values, beliefs, and ways of knowing of both the community of scientists and Inuit culture is known by elders in the Igloolik region as *piqusiit tamainik katisugit.* Stakeholders indicated a high regard for, and even an obligation to see, science education experiences for their students that integrated traditional (cultural) and contemporary science knowledge and processes. Second, stakeholders were able to identify a variety of factors they perceived would individually and collectively mitigate the realization of these aspirations within science classrooms. The factors identified were not only teacher-specific but also environmental characteristics. Teachers, school administrators and community members identified that knowledge of

Inuit Qaujimajatuqangit and teacher and school community interest in teaching form an IQ perspective were pivotal to teaching with respect to the perspective of IQ. Correspondingly, their professional science adequacy; professional science attitude and interest towards science and the teaching of science; and professional science knowledge were critical and pivotal factors perceived by teachers to be either contributing to or impeding "two-way" science program delivery. Teachers identified the need for a multi-dimensional knowledge base which included not only knowledge of science content, but also less salient dimensions of science knowledge such as pedagogical content knowledge and knowledge of instructional skills for supporting the learning of science in Inuktitut and in ways specific to Inuit learners; that is, culturally preferred pedagogy. Teachers commonly suggested their own and students' limited Inuktitut or English base made science teaching difficult and identified that they needed support in teaching science in a two-way manner in the medium of Inuktitut or English. This limited language base also influenced teachers' decisions about curriculum priorities, often sidelining science within the overall school program. Of critical importance to teachers was not just their knowledge of *Inuit Qaujimajatuqangit* but ways in which they could integrate *Inuit Qaujimajatuqangit* with contemporary western science knowledge. Equally, the process of curriculum delivery was mitigated or inhibited by several other factors, many of these associated with the physical and psycho-social dimensions and social processes occurring within the school community environment.

Although teachers may be the critical agents in the curriculum implementation process, these initial conversations affirmed that teacher professional adequacy, knowledge, and interest are but one dimension in the complex matrix of factors that influence primary science delivery. School-community members, including administrators, teachers and elected Inuit members of the District Education Authority, were able to identify that at the heart of their achievement of a school science program that re-established the importance of *Inuit Qaujimajatuqangit* were the principles of *pilimmaksarniq* (development through practice and action ensuring members of the communities are full and meaningful partners community in social development activities) and *piliriqatigiinniq* (working together for a common cause). Of particular significance was the perceived role of school-community leadership provided by the principal in working

with the District Education Authority in influencing science curriculum implementation and program delivery. Curriculum-focused leadership and a school culture that advocates collaborative curriculum development in science in conjunction with the support of family members to enhance educational opportunities for students, were factors frequently cited as strongly negatively influencing science program delivery.

In the second and ongoing phase of the project members of the project team worked with individual Inuit and non-Inuit teachers in the development of twelve place-based science education resources. These resources, both in English and Inuktitut, focus on topics such as Return of the Sun and Electricity and Changes in Inuit Society. The CCL project evaluated the effectiveness of the development and implementation of the resources in a variety of ways. First, teacher's perceptions of factors influencing two-way science delivery in Inuit settings are being monitored by the *Science Delivery Evaluation Instrument for Nunavut Schools* (SDEINS), a validated instrument in both English and Inuktitut, containing 28 items (Appendix 2). The instrument aims to assess the participants' perceptions of the various attributes of the educational environment that influence "two-way" science teaching. The SDEINS was completed by all teachers of science twice in each school and will again be invigilated again in May, 2010. When the data collected from the instrument application were coupled with staff discussion, they provided a foundation for increasing collective knowledge and understanding of organizational processes influencing the project which could be used as a foundation for developing strategies for further improvement. The 28 items of the SDEINS represent seven four-item scales including (1) teacher knowledge of contemporary science; (2) teacher knowledge of *Inuit Qaujimajatuqangit;* (3) teacher knowledge of how to harmonize *Inuit Qaujimajatuqangit* and contemporary science; (4) teacher knowledge of culturally-preferred teaching strategies; (5) student interest in learning science in a two-way orientation; time availability; (6) support and resource availability; and (7) teacher interest and confidence in teaching from a two-way perspective. Significant progress was made in all areas monitored by the SDEINS in two schools. Progress was made in only one area measured by the SDEINS in the third school. Second, in order to provide some further measures for evaluating the influence of the project, three teachers at each school were interviewed annually over the duration of the project to gain a deeper understanding of their

experiences and the changes they are experiencing and observing as a result of their involvement in the development project. Third, student "success" in two-way learning in science was documented through interviews with Grade 6 and 7 students to determine where and how they had been successful in science and what helped them be successful. These interviews provided a list of several student categories of success and what contributed to this success. This list has been developed into an Effective Teaching Profile for Inuit students.

Several factors were found to influence the achievement of school-community aspirations for science education. Although staff turnover was a problem experienced in all of these settings, the most critical role was played by senior administrators and teachers in working collaboratively to ensure the achievement of the project's goals. Of particular importance was ensuring that newly appointed principals understood their role and responsibility in assisting District Education Authorities achieve their goals. As suggested by Goddard and Foster (2002), northern (Aboriginal) schools are commonly characterized by conflicting understandings between imported educators and indigenous parents reflected in the significant linguistic, cultural and world-view differences between the dominant national society and the minority society of the community. Of particular significance is the importance of the principal in working with the District Education Authority in influencing science curriculum implementation and program delivery consistent with community aspirations and place-based policy requirement. At the classroom level, students identified a variety of teacher-specific behaviours that influenced their learning and perceived success, one of which was the use of place-based resources. At the heart of these behaviours was a regard by teachers that they are the central player in fostering change, first in themselves in shifting power relationships and working collaboratively towards an environment where practices reflect the culture in which students are situated. Second, by changing their teaching practices so they assist students in their learning. These practices are at the heart of culturally responsive teaching; using the cultural knowledge, prior experiences, and performance styles of students to make learning encounters more relevant to and effective for them. Such is the challenge the outcomes of this study place on the educators and administrators of Inuit students and Aboriginal students in general.

Chapter 1: Background to the Study

1.1 Nunavut and Culture-Based Education

The establishment of the territory of Nunavut in 1999 emanated from a deep-rooted and overwhelming call through years of lobbying and ultimately a referendum for Nunavummiut (the people of Nunavut) to move towards self-governance in all aspects of Inuit society. In no context was there greater resonance of voice for self-determination than in the domain of education. Through the establishment of Nunavut, Inuit in policy gained self-rule and control over their own institutions including schools. Since 1999, Nunavut has moved towards the establishment of an *Education Act* (Government of Nunavut, 2008) that sets the course for future developments in education across Nunavut. As the past-Minister of Education, Ed Picco, purports in legitimizing the length of time it has taken to come to a collectively accepted document, "Nunavummiut want a made-in-Nunavut *Education Act* that reflects Inuit values and culture. We want to ensure [it provides the foundation for] the best quality of education for our children" (Government of Nunavut (GN), 2005).

With the establishment of Nunavut and, ultimately, the *Education Act*, the territory faces the challenge of reversing assimilation and regaining a sense of identity especially within the processes that influence the education of their children. Typical of most Indigenous peoples, Inuit in Nunavut presently participate in a school system that has been drawn from the dominant culture: in their case southern Canadian school system models. Although Inuit staff work in the schools, especially elementary schools, the majority of teachers, principals and school operations administrators are non-Inuit, and the curricula and pedagogy of classrooms is based on southern models. Because of this, school practices such as the content of curricula, pedagogical practices and language of instruction have both intentionally and unintentionally denied the inclusion of those aspects of (Inuit) culture that have value and are important to (Inuit) children (Bishop & Glynn, 1999).

Paradoxically, "culture-based education" is identified by the territorial government (GN) as one of the foundational principles for school development in Nunavut. The GN

policy requires the activities of organizations, including schools, in Nunavut communities to create, preserve, promote, and enhance their culture, including arts, heritage and language. This policy is based upon the principle that culture in all its expression, provides a foundation for learning and growth, and that the GN should support individuals, organizations and communities to promote, preserve and enhance their culture (GN, 2004). The underlying premise of culture-based education is similar to what is advocated in place-based education. Place-based education is rooted in place; that is, the organizing focus of the school is on the local socio-cultural, ecological setting. As Dewey (1907) stated,

> The great waste in schools, from a child's perspective, is his inability to use the experience he gets outside of the school in any complete or free way within the school itself; while on the other hand he is unable to apply what he is learning in daily life. That is the isolation of the school – its isolation from life. When the child gets into the schoolroom, he has to put outside of his mind a large part of the ideas, interests and activities that predominate in his home and neighborhood.

In place-based and culture-based education, the role of schooling is to provide a secure, nurturing environment that reflects the culture of the community and promotes the participation of educational staff, students, families and the community in making decisions about learning (Funder's Forum of Environment and Education, 2001) Teaching is grounded in what students are familiar with - actualities rather than abstractions. It emerges from the particular characteristics of place. It draws from the unique characteristics and strengths of the community and, thus, does not lend itself to duplication or replication. It promotes the use of community resource people and is inherently experiential, drawing upon the opportunities provided by the local context and its people. The underlying premise of culture-based education is that the educational experiences provided for children should reflect, validate and promote the culture and language of Nunavummiut. These experiences should be reflected not only in the management and operation of the school but also in the curricula, programs implemented and the pedagogy of classrooms.

The guiding principles of *Inuit Qaujimajatuqangit* (IQ) are assumed to be capable of supporting the development of curricula and overall school operation and management structures as well as classroom practices. To many people, the "traditional knowledge" aspect of IQ is often the only side that is seen, but that describes only one half of it as IQ is equally and probably more importantly about process (Arnakak, 2001). IQ is really about

healthy, sustainable communities, including school communities, regaining their rights to a say in the governance of their lives using processes, principles and values they regard as integral to who and what they are (Arnakak, 2001). A basic foundation of IQ is the ground rules, customs and the right way of doing things for Inuit. The often quoted eight principles of IQ include (1) *tunnganarniq* (respecting others and relationships) (2) *pijitsirniq* (serving and providing for family and community especially for organizations within the community and who they serve) (3) *aajiiqatigijnniq* (ensuring all aspects of community development are fostered through decision making through collaboration and consensus) (4) *pilimmaksarniq* (development through practice and action ensuring members of the communities are full and meaningful partners community and social development activities) (5) *piliriqatigiinniq* (working together for a common cause) (6) *qanuqtuurniq* (being innovative in seeking solutions) (7) *avatittinnik kamatsiarniq* (respect and care for all aspects of the environment) and (8) *inuuqatigiitsiarniq* (fostering good spirit by being open and inclusive) (Arnakak, 2001; Government of Nunavut, 2002).

It is likely that IQ evolved organically out of discussions within Inuit communities including senior members of government as a deliberate means to comprehend, resist, and transform crises related to dual concerns of Inuit marginalization and underachievement and the ongoing erosion of Inuit language, knowledge and culture as a result of colonization (Smith, 1997). As Graham Smith, a Māori education academic would assert, IQ contests the positional superiority of Western knowledge (and in Canada's case, southern knowledge) and processes and endeavors to re-establish Indigenous (Inuit) knowledge and processes within contemporary (Nunavut) society (1997). Although these principles are identified by Inuit as foundations of social operation in traditional Inuit society they are asserted as being the operative procedures or "living technology" for all aspects of social development in Nunavut, including schools, and whether or not the participants in the social development process are Inuit. It is a means of rationalizing thought and action, a means of organizing tasks and resources, a means of organizing family and society into coherent wholes (Arnakak, 2001).

Several may scorn the possibility of such traditional principles having a transformative influence on contemporary education practice within Nunavut, especially within the context of assisting a school-community in achieving its curriculum and

classroom priorities. Similar developments in education among Māori, the Indigenous people of Aotearoa-New Zealand provide some validation of this attempt and the principles themselves. Over the past two decades in excess of several hundred "special character" kura (schools) have been established by Māori communities according to Maori kuapapa (traditional ways of knowing and doing). Since the times of colonization of Aoteoroa-New Zealand, Māori similar to Inuit have been marginalized and Pakeha (European) knowledge and processes have been continuously privileged over Māori knowledge, especially in curriculum and pedagogy. School science curriculum is only one of a plethora of domains in which this privileging of knowledge occurs (McKinley, 2000). This privileging originates, is delivered from and is further perpetuated through the imposition of colonial institutions, one of which is education (Pihama et al., 2004). However, it is within this institution that the processes of knowledge contestation and validation have been vigorously undertaken by Māori. Within the New Zealand education system, the realization that "Te Reo Māori (the language of New Zealand Māori) was in the last throes of language death" provided the impetus for Māori to prompt radical action to defend and validate their language and culture in an educational system that perennially was essentially designed to reproduce and perpetuate the aspirations of the status quo of Pakeha (white New Zealand) dominance (Smith, 1997). An important and key element to the development of Kura Kaupapa Māori (special character early learning centres) and Te Kōhanga Reo (special character schools) was that it originated from Māori and is driven by Māori and was underpinned by Māori-centred philosophical and theoretical principles. Therefore, Te Kōhanga Reo and Kura Kaupapa Māori can both be viewed as expressions of what is called Kaupapa Māori Theory, similar to IQ, is a system of ground rules and customs that focus on process based on traditional Māori society.

According to Smith (1997), Kaupapa Māori Theory seeks to not only analyze structures and the power relations that exist within Pakeha-dominated institutions, it also seeks to intervene and transform pedagogy, curricula and evaluation aspects and perhaps more importantly, the management and operation of schools at an institutional level, including classrooms. As a form of critical theory, Kaupapa Māori Theory challenges, questions and critiques the dominance of Pakeha hegemony and seeks to transform the unequal power relations that exist within Aotearoa-New Zealand society. Kaupapa Māori

Theory must be viewed as a form of critical analysis driven by Māori understandings. It "asserts explicitly the validation and legitimating of Te Reo Māori (language) and tikanga (ways of doing)" (Smith, 1997). In addition to Smith, the Māori Language Commission (1999, cited in Pihama et al., 2004) have outlined a number of key principles evidenced as underpinning Māori medium education sites such as Kura Kaupapa Māori. According to Smith (1997), the principles are common to transformative Māori educational developments and school initiatives. Although many kura operate by and exhibit these characteristics, the achievement of these ends has often been bedevilled by a complexity of issues. Smith (1997) asserts that where this practice occurs, a series of transformative elements is common to such initiatives. This statement is supported by the research of Wood and Lewthwaite (2008) who identify that a complex amalgam of individual teacher and principal and school and community characteristics constrain or contribute to the realization of the charter statements of such kura in curriculum delivery. Where successful school curriculum development has occurred in a manner consistent with school community aspirations, several principles are considered to have been the crucial change factors that have guided the process and these are consistent with effective Kaupapa Māori practice.

Although not listed, here these principles correspond closely to the principles of *Inuit Qaujimajatuqangit*, especially those focusing on the principles of pilimmaksarniq and piliriqatigiinniq. These principles endorse the need for development through practice and action ensuring that the community is a full and meaningful partner in educational development activities; a collaborative relationship that is often cited as lacking in northern education processes (Goddard & Foster, 2002). Working together for common cause ensuring equal power relationships becomes imperative to any successful project. Ensuring that there is a re-establishing of the importance of Inuit knowledge, values and processes within schools becomes a fundamental journey in re-establishing Inuit priorities for Nunavut schools and classrooms.

1.2 Science Education in Aboriginal Settings

Although significant attention to and improvement in the delivery of science programs at Kindergarten through Grade 6 levels have been recognized over the past two decades, there

is continued acknowledgement of the complex set of factors impeding effective science delivery at these levels in many educational jurisdictions (Lewthwaite, Stoeber & Renaud, 2007). Teacher personal attributes, or intrinsic factors, such as science teaching self-efficacy, professional science knowledge, and science teaching interest and motivation are critical dimensions and frequently cited barriers in the delivery of science programs (Abell & Roth, 1992; Eick & Reed, 2002; Harlen, 1997, 1988; Harlen, Holroyd, & Byrne, 1995; Levitt, 2002; Lewthwaite, 2001; Seatter, 2003). As well, environmental factors, also referred to as extrinsic factors, are identified equally as critical elements to the effective delivery of science programs in elementary schools (Harlen, 1997, 1988; Lewthwaite, 2001). The commonly cited list of environmental factors includes more salient features such as time constraints and resource inadequacy associated with limited equipment, space, and facilities. Less commonly cited factors such as poor administrative support and the overall low priority placed on science as a curriculum area are identified as further critical agents impeding science delivery internationally (Lewthwaite, Stableford & Fisher, 2001). Because of the many complex, interrelated, and difficult to address factors that can interfere with science delivery, it is not surprising that some authors regard science education, particularly from Kindergarten through Grade 6, to be in a perilous state (Mulholland & Wallace, 1996).

The concerns expressed by Mulholland and Wallace are more often than not magnified in northern Aboriginal (for example, First Nations, Metis and Inuit) settings where isolation from professional support, the inadequacy of culturally-relevant resources, high teacher turnover especially among non-Aboriginal teachers, the limited science teaching experience of teachers, multi-level classroom teaching responsibilities, poor student attendance and second language development collectively amplify the factors impeding the delivery of science programs in northern Canadian settings (Lewthwaite, 1992). Several of these factors have been identified as possible contributors to the comparatively poor performance of Canadian students in the Northwest Territories in the recently conducted in national science testing conducted through the School Achievement Indicators Program (SAIP) (Council of Ministers of Education, 2006).

Compounding the problems associated with effective science program delivery in northern indigenous communities are the more acute epistemological issues cited in the

literature. As an example, school science improvement literature has been criticized for universalizing schools and students, paying insufficient attention to context, especially in terms of racial, class, and gender differences (Harlen, 1997). Science curricula, in particular, tend to focus on western science and in so doing ignore indigenous epistemologies and aspirations (McKinley, 2000). As suggested by Ezeife (2003), science instruction often fails to give priority to harmonizing the science being learned with students' life-world culture, including their native language and culturally-appropriate learning strategies. McKinley (2000) argues that mandated science curricula are largely expressions of the dominant culture, and that the intentions of these curricula are not adequately grounded in the priorities of indigenous communities. McKinley goes further to suggest that the lack of inclusion of indigenous perspectives in science curricula and teaching is a reflection of science improvement initiatives as being 'nationalizing' in aspiration for economic and technological gain. By being so, such government-mandated science curricula fail to acknowledge and thereby override the aspirations of local indigenous communities along with their knowledge, ways of coming to know, values, and beliefs as thoughtful and purposeful cultures.

In contrast to studies like those reported by Ezeife and McKinley, a few national, provincial, and territorial curricula explicitly acknowledge indigenous communities and their knowledge, ways of coming to know, values, and beliefs and advocate science delivery in a manner that honours indigenous epistemologies (see for example, Ministry of Education, 1996; Northwest Territories Education, Culture and Employment, 1996). As one example, *Inuuqatigiit: The Curriculum from the Inuit Perspective* is the foundation curriculum document underpinning and informing curriculum development for Inuit in the Northwest Territories and Nunavut. *Inuuqatigiit* focuses on the enhancement and enrichment of the language and culture of Inuit students by promoting the integration of the Inuit perspective with the school curriculum. It advocates that in every subject, including science, students should learn about Inuit history, knowledge, and traditions and practice Inuit values and beliefs in order to strengthen their education and enhance personal identity (Northwest Territories Education, Culture and Employment, 1996, p.2). *Inuuqatigiit* was developed in response to an identified need to provide a formalized curriculum framework that would support Nunavut school communities in providing educational experiences that

are permeated with Inuit language, culture, traditions, and beliefs and designed to preserve and reinforce the Inuit identify of children, teachers, administrators, and community members (Ibid, p. 3). This document also outlines characteristics of traditional Inuit learning practices in an attempt to encourage teachers of Inuit children to adopt culturally-located pedagogical practices. As well, the Nunavut Government in conjunction with its citizens further developed *Inuit Qaujimajatuqangit* (IQ). *Qaujimajatuqangit* is a term that describes all aspects of traditional Inuit culture including values, worldview, language, social organization, knowledge, life skills, perceptions, and expectations. IQ is a body of knowledge and a synthesis of the unique cultural insights of Inuit into the workings of nature, humans, and animals. As such, *Inuit Qaujimajatuqangit* denotes traditional Inuit knowledge and principles that are to be incorporated into all aspects of or used in the development of Nunavut policy and practice, including school curricula. The principles most closely connected to science education and school development include: (1) the principle of decision-making through discussion and consensus (*aajiiqatiginniq*) ; (2) the principle of developing lifelong skills and knowledge acquisition through practice, effort and action (*pilimmaksarniq/pijariuqsarniq*) ; (3) the principle of collaborative relationships or working together for a common purpose (*piliriqatigiinniq/ikajuqtigiinniq*); and (4) the principle of being resourceful to solve problems (*qanuqtuurniq*).

What are the ramifications of *Inuuqatigiit* and *IQ* for the delivery of science programs in Nunavut? *Inuuqatigiit* implies that students in science classes are likely to possess a traditional knowledge system that is different from the conventional science typically taught in schools. As well, it implies that culturally-specific pedagogies need to be adopted in classrooms to support Inuit students in their learning. For this reason, school science requires most students and their teachers to cross boundaries between the cultural context of their home, family, and community (i.e., traditional knowledge, language, beliefs, values, ways of knowing) and the context of Western or contemporary science. As an example, the Inuit of northern Qikiqtani hold a common belief that many natural events that cause calamities such as summer storms or winter blizzards are caused by human action that upsets *Sila,* the "personified character" that influences all aspects of the atmosphere. In contrast, western Science would suggest that summer storms and winter blizzards are caused by interactions between low and high pressure systems and that the

formation of these systems is largely influenced by physical factors such as solar radiation inputs and ocean currents. Jegede (1995) has described the potential consequences for students in traditional settings when they encounter school science concepts and principles that are different from those that they use in their everyday lives. He proposed a theory of collateral learning to characterize the many possibilities that students may experience in such contexts. With parallel collateral learning, for example, the student is able to hold the two conflicting schemata with minimum interference and to access at will the schema that best suits the situation at hand. With secured collateral learning, the student is able to resolve the conflict. The student may either find good reasons to hold on to both schemata, or he/she may decide to incorporate some aspect of one schema into the other. Jegebe suggests that between these two extremes are other positions representing varying degrees of interaction and conflict resolution. For reasons such as these, Aikenhead (1997, 2001) has argued that Aboriginal students require a teacher who acts as a "culture-broker". A culture-broker science teacher would help students to move back and forth between the knowledge and practices of their indigenous culture and the knowledge and practices of contemporary science, and assist students in resolving conflicts that may arise. Similarly, Ezeife (2003) maintains that every effort has to be made to harmonize the science being taught with the students' life-world culture, including their first language. Such thinking underlies cross-cultural approaches to science teaching referred to as "two-way" learning (Fleer, 1997) or "both-ways education" (McTaggert, 1991) (both cited by Aikenhead, 2001). Within some communities of Qikiqtani this "both-ways education" that combines the knowledge, practices, values, beliefs, and ways of knowing of both the community of scientists and Inuit culture is known as *piqusiit tamainik katisugit.*

1.3 Understanding the Complexities of Factors Influencing "Both-Ways" Science Education

The introduction of *Inuuqatigiit* is consistent with McKinley's call for mandated curricula in Aboriginal settings that take greater awareness of indigenous knowledge systems and language (McKinley, 2000). Although such efforts are admirable, they magnify the complexity of factors influencing effective science delivery. Berger and Epp (2005) identified in their analysis of practices in selected Nunavut schools that for most Qallunaat

(non-Inuit) teachers, teaching to the intent of *Inuuqatigit* is beyond their ability as it deals with traditional Inuit knowledge, beliefs, practices, values, and ways of knowing. This is consistent with Aikenhead and Otsiji's (2000) identification of the role of teacher-as-culture-broker as complex. This complexity is a consequence of most curriculum developers and teachers of science being members of the mainstream culture and having limited knowledge of Aboriginal knowledge systems and culturally-appropriate pedagogies. In this context, it is not surprising to read that teachers in Lewthwaite's (2004) Yukon case study recognized and admitted their limited interest, efficacy, and knowledge to teach in a manner that honoured student traditional epistemologies (Lewthwaite, 2005a). Christianson (2004) extends this limitation by suggesting that despite efforts in New Zealand to promote science and mathematics instruction in a manner that honours Maori epistemology, even indigenous Māori teachers have difficulty in teaching mathematics and science because of their inadequate language and epistemological base. Clearly, if teachers cite a limited professional science knowledge base for teaching in mainstream schools, this knowledge base is even less adequate for teaching in settings where the teaching of science calls for teachers to help students move back-and-forth between their indigenous culture and Western science.

The professional science knowledge base of individual teachers is likely to be one, and potentially not the most significant, of a multiplicity of factors that influences a school community's aspiration towards the delivery of science that honours Aboriginal, in this study Inuit, epistemology. Understanding how other personal attribute factors and multi-system environmental factors influence successful science delivery and development that harmonizes traditional epistemology and contemporary science teaching can be understood by considering cultural-contextual theories of development. One such theory appropriate for the context of this project is put forward in the work of Urie Bronfenbrenner (1979, 1989, 2005). Although this theory is believed to offer little insight as two how existing power differentials can be addressed in Aboriginal settings, it, nevertheless, provides insight into the identification of multi-system factors that can support or impede development projects (Wood & Lewthwaite, 2008). Bronfenbrenner's (1979) bio-ecological theory of development posits that development (both individual and group) is a joint function of the person and all levels of their environment. He regards development is

evident in progressively more complex behaviors sustainable over time. Thus, within the context of this study, a school or teacher may show evidence of development in a "two-way" manner by using a broader range of teacher pedagogies and resources that are grounded both within the cultural norms of the community and the protocols and understandings of western science. For example, in a topic like Weather, both western Science and *Inuit Qaujimajatuqangit* (IQ) perspectives on the causes of summer storms would be presented to students, potentially by not just the teacher but, as well, through the visit of a knowledgeable elder to the classroom.

The personal attribute factors influencing teacher development are both biological and psychological (e.g., genetic heritage and personality) (Moen, 1995, p.1). As suggested by other studies (for example, Lewthwaite, Stableford & Fisher, 2001), teacher personal attribute factors such as professional science knowledge, science teaching efficacy, interest and motivation in teaching science, and interest and motivation in "both-ways education" are likely to be important determinants influencing the delivery of science in a manner that honors Inuit epistemology. The latter, all levels of one's environment, encompasses the physical, social, and cultural features of immediate settings in which one lives (e.g., family, school, and neighborhood) (Ibid, p.1). Bronfenbrenner sees the ecological environment as a system of five nested structures. The innermost structure represents the individual, which in this case is the teacher. The remaining four nested structures range from the immediate face-to-face setting to the more remote setting of the larger culture (Hoffman, Paris & Hall, 1994, p. 47). The first of these four structures is labelled the microsystem. The microsystem consists of a teacher's students, colleagues, and, possibly, friends and family. As the immediate proximal setting in which the teacher directly interacts, the microsystem invites, permits, or inhibits activity (Bronfenbrenner, 2005). It is likely that if students are very responsive to using or learning their traditional knowledge, a teacher is more likely to make reference to it in her teaching. Conversely, if students do not respond well to a teacher's inclusion of traditional knowledge, the teacher is less apt to include it in the future. The developmental processes that occur within the microsystem are in good part defined and limited by the beliefs and practices of the mesosystem, the second of the four nested structures. The mesosystem contains society's blueprint for a particular culture or subculture (Hoffman, Paris & Hall, 1994, p. 47). Thus, the school's belief systems and

values may strongly influence the expectations endorsed by members of a microsystem. As an example, within the school context the belief systems held by senior teachers, the principal, and school administration (including the District Educational Authority (DEA) and School Services Division) concerning the importance of delivering a science program in a manner that honours Inuit epistemology are likely to strongly influence the school's ethos for such an initiative. If a principal and an instructional leader advocate such a stance, their viewpoint is likely to influence individual teacher's orientations to two-way science teaching. The third structure, the exosystem, refers to environmental influences that do not directly involve the developing person, or teacher in this case, but even so influence the setting in an indirect manner. As an example, the community's or school division's aspirations for science and the support provided by community members and regional school division are likely to impinge on school-based policy decision making and implementation. Again, a school working collaboratively with its community in regard to its instructional and philosophical orientation is likely to be more successful in providing two-way experiences for its students. Finally, the structure most removed from the individual teacher, the macrosystem, refers to societal and cultural ideologies and laws that impinge on the individual. In the context of this inquiry, Nunavut's cultural inclusion policies, curriculum agenda, and teacher education protocols are likely to influence the school's response to science as a curriculum area.

Of importance to this inquiry is the acknowledgement that, as Bronfenbrenner suggests, supporting processes within these overlapping environments are 'engines' for development. As well, Bronfenbrenner (2005) proposes that these engines are context-, time-, and process-dependent. This implies that the factors that influence a teacher's and school's ability to successfully deliver a science program that harmonizes traditional indigenous knowledge and contemporary science cannot be generalized but, instead, are multi-system in nature and unique to each setting. That is, in fostering successful science curriculum delivery one must take into account teachers' personal attributes, the context in which the development takes place, the time at which the development process is occurring, and the processes each person experiences. When one considers the principles of *Inuit Qaujimajatuqangit*, successful science delivery and school development that honours local epistemology is likely to be a product of a variety of system elements and processes,

but critical to this development will be strong collaborative relationships and consensus decision making among teachers, administrators and the school community for a common purpose. Simply put, things need to "come together" just at the right time for an individual teacher or school community in seeing the realization of such an aspiration. Similarly, individual or multi-system factors can neutralize any attempt to work towards this aspiration.

These suggestions are endorsed by research in other areas of development. For example, Rutter's research in resiliency extends this understanding of the influence of bio-ecological attributes on development (Rutter, 1987, 1997). He suggests that both "risk" and "protective" factors contribute to an individual's development. Risk factors are personal attribute factors or processes in the individual's environment (e.g., low science-teaching interest and efficacy for teaching science in a manner that honours local epistemology) that contribute to negative trajectories in development. Aligning his work with Bronfenbrenner, Rutter suggests that protective factors are the "engine" processes possessed by an individual (e.g., positive self-concept) or in an individual's environment (e.g. committed colleagues and school community) that contribute to positive outcomes and result in personal development. Risk and protective factors, again, are suggested to be person-, context-, and time-dependent. As might be expected, development is likely to occur where risk factors are minimized and protective factors are maximized. Yet, again, maximizing protective factors does not necessarily foster positive developments in all.

The ideas posited by Bronfenbrenner and Rutter would suggest that understanding the processes that influence science delivery honoring Inuit epistemology is best investigated within a research inquiry where one is able to examine the personal attribute and environmental processes at the classroom, school, and divisional levels, and possibly territorial level, as well as the interplay among the processes that influence teachers and school communities in the delivery of science. Such is the focus of this research and development project inquiry. This study recognizes the increased complexity of the factors influencing science program delivery in traditional Aboriginal settings, especially where the aspiration of the local school community is to learn science in a manner that honours Inuit history, knowledge, traditions, values, and beliefs in order to strengthen the education

and identity of each learner. The section that follows describes the context and methodology of the project.

Chapter Two: Context of the Study and Methodology

2.1 Goals and Theoretical Framework of the Project

This study endeavours to support Inuit communities in northern Qikiqtani region of Nunavut in the realization of their goals for science education. The project sequence will, in its entirety, (1) establish the current situation in science education in Kindergarten through to Grade 7 in the three communities, and (2) identify science education developmental aspirations for stakeholders within the communities and potential contributors and constraints to the achievement of these aspirations. Further components of this research and development project will endeavour to (3) implement mechanisms for achieving identified aspirations, and (4) evaluate the effectiveness of such mechanisms so that the project overall will serve as a pilot study for school-community development projects in other Nunavut regions and Aboriginal settings internationally.

The research inquiry employs an action research methodology. In line with such a research methodology, the inquiry is an ongoing three-step spiral process (Lewin, 1951). The first reconnaissance phase of this project is focused on understanding the starting point processes influencing science delivery through teacher and school-community perceptions and reflections of their past and current experiences. As well, it identifies aspirations for science education in these settings and possible constraints and contributors for attaining these aspirations. The second phase identifies and implements mechanisms for fostering development based upon these initial understandings. Finally, the summation in the third phase goes on to evaluate the effectiveness of mechanisms designed and responds to the evaluative outcomes. Based upon a synthesis of all of these phases, this summation provides insights appropriate for enhancing the achievement of place-based curriculum development efforts in other Inuit, and potentially, Aboriginal settings. As purported by Bevan-Brown (1998), the overall aim of this research is motivated by the researchers to better inform and benefit Inuit students and their teachers in seeing Inuit aspirations for

education realized. In all cases, the methodology for the overall research project is informed by participatory action research conducted in Aboriginal communities of the Northern Territory of Australia which drew upon the collective aspirations of each Aboriginal school community (that is, its' teachers, students, parents, administrators and supporting elders) as researchers in collaboration with the authors to identify common goals, implement strategies for achieving these goals, evaluating the effectiveness of efforts to achieve set goals, and, finally, responding to the evaluations with further courses of action (Kemmis & McTaggart, 1988). Further, the project overall, endeavours to critically identify and change patterns of action existing in local institutions, including Aboriginal schools, in response to locally identified goals and, by so doing, is emancipatory as well (Kemmis & McTaggart, 1988).

2.2 Context of the Project

This research and development project is based in three Inuit communities in the northern Qikiqtani Region of Nunavut. The relative political infancy of Nunavut and the risk factors likely to impede the realization of its science education aspirations (see Lewthwaite, 1992) prompted the University of Manitoba's Centre for Research, Youth, Science Teaching and Learning (CRYSTAL) to approach the Nunavut Department of Education in January 2004 to support a research and development project in science education. The three communities were identified by the Nunavut Department of Education and Qikiqtani School Service Division as being a logical site for the development project. Identification was based on the geographical situation of the communities (both in terms of proximity to one another and their remoteness from other communities in Nunavut); the communities' aspirations to work toward a science program that honored community epistemology; and the high level of Inuktitut language use in the school and community. The three school-communities involved in this research and development project include a Kindergarten to Grade 6 school in one community; a Kindergarten to Grade 7 school in a second community; and a Kindergarten to Grade 8 sector of a Kindergarten to Grade 12 school in a third community. Within the context of the goals of this study, the differences among the communities included the following: (1) the degree to which the school community is presently supporting the inclusion of Inuit perspectives within the school curriculum; (2) the

mechanisms that are currently being used to incorporate Inuit perspectives within the school curriculum; (3) the amount of instruction in Inuktitut and traditional knowledge that occurs within the school; and (4) the number of Inuit teachers within the school.

2.3 Data Collection Methods in the Reconnaissance Phase

Three data collection methods were used in the preliminary, reconnaissance analysis. These all took place between April and June, 2004. First, formal and informal interviews and conversations were conducted in Inuktitut or English (depending on the respondents' preference) with a total of over sixty science education stakeholders within each of the three school communities. As suggested by Bishop (1996), the formal interview was more of a conversation, while the informal interview was more of a chat. The second method involved the use of PATHing, a full-day discussion and negotiation process where stakeholders collectively identify through discussion and negotiation aspirations; strengths; weaknesses; and steps towards achievement of goals. This process (Figure 2) involved principals, teachers, parents and other community members including elders and members of the District Education Authority. The third method involved the use of a focus group to verify the outcomes of the initial two stages of the study and to further elucidate factors influencing the science education aspirations of the school communities. This group consisted of two members of the research team and one project teacher-leader from each of the three communities.

In these three methods a variety of data sources have been employed in order to triangulate data and increase reliability and validity of results; that is, to ensure confidence in the findings (Bogden and Bilken, 1998). All interviews were audio-recorded. Transcribed sections of the conversations, where possible, were verified as accurate. As suggested by Bishop (1996), in all cases the formal interview because of the relationship of the researchers to the students and teachers was more of a conversation, the informal interview was a chat based upon the need for collaboration between researchers and researched in constructing the final story as evidenced in the vignettes and themes that are to soon follow. The study, drawing upon multiple sources of information (students, teachers, and background literature), includes a multi-perspective analysis generating themes from the relevant players and the interaction among them. Overall, the researchers

seek to make sense of the respondents' personal stories and the ways in which these stories intersect (Glesne & Peshkin, 1992). The authors sought to understand behavior from the respondents' own frames of reference accepting that there were multiple ways of interpreting experiences (Bogdan & Biklen, 1992) but expecting that within these experiences common themes would be identified.

2.4 Development of the *Science Delivery Evaluation Instrument for Nunavut Settings*

Finally, a validated instrument, the *Science Delivery Evaluation Instrument for Nunavut Settings* (SDEINS) was developed specifically for this study. This instrument was developed from September to November, 2004 This instrument was not only used at the starting point of the project to gather statistical information from participating teachers about their perceptions of the state of science education for two-way learning, but it was also used during the project to determine what progress the teachers perceived the school was making in this journey. Instruments are teacher-response questionnaires often used in school-development studies because they provide statistical data that determine whether development is actually taking place (Stewart & Prebble, 1992). They are regarded as an economical and accurate means of collecting data because of the limited time required by teachers to complete them and, yet, they provide valid and reliable data (Ibid, 1992). The teacher response statements or items, as they are commonly called, are answered by teachers selecting from a 5-point Likert-type scale where 1 usually means teachers strongly agree with the statement and 5 means teachers strongly disagree with the statement. Once completed, mean scores for each item and combination of items can be calculated. The instrument can be completed at different stages of the development project to determine if perceived changes are occurring. These data, based upon the perceptions of teachers and the changes they perceive are occurring, can also be used as a foundation for staff discussion and reflection on how the development process is progressing. Because of the potential benefit this instrument and the means by which it was developed may be to other researchers, the development of the instrument used will be now discussed in detail. It is important to note that the development of the instrument is based upon the preliminary discussions with the stakeholders in the yet to be discussed Reconnaissance Phase of the project which will be presented in the next chapter. Essentially, the instrument in its final form will contain a list of statements that teachers of science can answer that, overall,

summarize all of the factors or conditions stakeholders will identify as impediments or contributors to achieving the goals for science education identified during the initial consultations. Its development was guided by the following considerations:

1. Consistency with existing instruments. Although many of the factors influencing science curriculum delivery in this context are unique, consideration was given to the physical layout, dimensions, and scales existing in other learning environment instruments. The *Science Curriculum Implementation Questionnaire* [SCIQ] (Lewthwaite, 2001), in particular, provided a practical example on which to model the format of the SDEINS.

Figure 1: PATHing at one of the Qikiqtani Schools

2. Economy of use. Because of the time constraints imposed on teachers and school community members, it was essential to ensure that the instrument would require a relatively short time to complete and process and be available in both Inuktitut and English. In order to ensure this, the instrument would ultimately contain no more than five items or response statements for each of the factor scales identified.

3. Recognition of Bronfenbrenner's theory and the guiding principles of *Inuit Qaujimajatuqangit* as critical descriptors for understanding human behaviour and fostering social development. Bronfenbrenner regarded human behaviour and development as a

function of the personality of the individual and the environment. Both the environment and its interaction with the personal characteristics of the individual were recognized by Bronfenbrenner and Lewin as potent determinants of human behaviour and development (Bronfenbrenner, 1979, Fraser & Tobin, 1998, Lewin, 1951). Similarly, the principles of IQ identify processes such as planning, support and collaboration as fundamental aspects of social development in Nunavut schools.

Each of the factors influencing science program delivery identified in the initial consultative phase (to be addressed fully in Chapter 3) was placed on an 'Instrument Items' list. In all, 78 items identified in this phase were developed as items to be considered for the instrument. These items included both teacher specific characteristics such as their knowledge of Inuit culture and external or environmental attributes such as teaching resource availability or elder's support. The list was not categorized or ranked; it simply listed all the specific factors that had surfaced during the initial consultative phase. The next step in the development of the *Science Delivery Evaluation Instrument for Nunavut Schools* item list was to eliminate some of the repetitive statements. Repeating items that were identical or differed in only a word or two were eliminated from the clusters. As an example:

Item 77. *I have a good background knowledge for teaching science from the perspective of Inuit culture and values.*

And Item 42. *My background knowledge is good for teaching science from the perspective of Inuit Qaujimajatuqangit.*

This procedure reduced the number of items on the Item List to 58 items. As the factors influencing implementation were identified, they were modified so that they would be appropriate for a teacher-response questionnaire. That is, a teacher would be able to answer or respond to the statement in the context of their classroom or school environment. As an example, one teacher-parent had mentioned in the consultation:

"Many teachers would like to teach science integrating both Inuit Qaujimajatuqangit, but they don't feel prepared to and don't have the support they need. School community members are ready to help out if they are asked."

In order to change it into an item appropriate to the intent of the questionnaire it was modified to:

Item 9: *I want to teach science integrated with an Inuit perspective.*

and:

Item 12: *Our school community supports us in teaching science in a way that integrates science with an Inuit perspective.*

It was anticipated that many of the items would repeat themselves or, at least, belong to general groupings or categories of factors known to influence science program delivery. The identification of these groupings and classification of items was seen as the next critical stage of the instrument development. For these reasons a focus group consisting of seven people, each representing a different sector of the primary science education community in Nunvaut, was established. The focus group included three Inuit and one non-Inuit primary teacher with strong IQ and western science understanding, an Inuit principal and school advisor, and a researcher in instrument design. This group identified common groupings of factors. The items were easily identified as being resident within one of nine general clusters. Several of these categories (for example resource adequacy; provision/availability of professional support; staff interest; staff time availability; administrative leadership and commitment) commonly identified as factors influencing school development (for example, Fullan 1992, 1993, 2002). Most of these categories were primarily school culture or environmental attributes and failed to address the personal attributes of professional knowledge and professional adequacy/confidence consistently identified in consultative studies. Although "teacher capability in dealing with the task at hand" is commonly identified as a factor influencing curriculum implementation (fullan, 1993, 2002), this description does not specifically identify perceptions of professional adequacy (self-efficacy) and multidimensional aspects of teacher professional knowledge as identified by Aikenhead, 2001; Baker, 1994; Shulman, 1987) as individual, critical conditions contributing to or inhibiting effective science delivery. As well, although the factors influencing science program delivery in mainstream schools has been well-explored (for example, Lewthwaite, 2001), some factors influencing science delivery were specific to the factors identified as significant in minority or marginalized settings (Lewthwaite, Stoeber & Renaud, 2007; Wood & Lewthwaite, 2008). These included the English-Inuktitut capability of students; the pedagogical capabilities of teachers teaching science to students with poorly developed language capabilities in either their first or second

language; the role of community support in supporting the teaching of science from the perspective of *Inuit Qaujimajatuqangit* and the capabilities of teachers in being able to not only teach from an *Inuit Qaujimajatuqangit* perspective, but to teach this in a "two-way" manner integrating a western science and *Inuit Qaujimajatuqangit* as advocated by those interviewed in the consultative phase.

The SDEINS in its initial form contained 59 items that were categorized by the focus group into nine categories or dimensions contained within the questionnaire. Six dimensions (1) Resource Adequacy, (2) Time, (3) School Priority for a Two-way Science as a Curriculum Area, (4) Community and Professional Support and Opportunity, (5) Language Capabilities of Students, and (6) Student Interest and Attitude toward Two-way Science) are regarded as environmental or extrinsic factors influencing science program delivery. Three further dimensions (1) Professional Adequacy, (2) Professional Knowledge and (3) Professional Attitude and Interest) were regarded as teacher personal attribute or intrinsic factors influencing science program delivery.

In order to statistically validate the initial instrument, a large participation of schools and teachers was required. The questionnaire, in Inuktitut and English was distributed to nine schools in the Qikiqtani Region of Nunavut. Seven of these nine schools were predominantly staffed by Inuit teachers who taught in the northern Baffin dialect. It was predicted that these nine schools would provide a response from at least 100 teachers. Request was made for the questionnaire to be completed by all teachers that taught science in either Inuktitut or in English. To identify the underlying dimensions of the SDEINS, a principal-components analysis was performed. All nine schools with a combined total of 88 teachers completed the questionnaire; 29 in Inuktitut and 59 in English giving a strong indication of the cultural background of teachers within the Qikiqtani region. To ensure the statistical validity of the instrument it was essential that each dimension (or factor) contained only items associated with each other and that each dimension was unique. To determine this and given the exploratory purpose of this analysis, a promax oblique rotation of the factor loadings was performed to assess the degree to which the dimensions are associated with one another.

Before presenting the results, it is prudent to address the issue of sample size. While the sample in this study is clearly much smaller than what a "rule-of-thumb" would

suggest (e.g., at least 100 subjects, 5 subjects per variable), there are a few reasons why these findings are nonetheless, at least worth noting. First, and foremost, given that this teacher-response questionnaire was designed specifically for a minority group, the sample reflects a relatively small population such that a much larger sample becomes less feasible to the point of being unavailable. Second, most of the items statistically loaded strongly on a single factor that yielded a clearly interpretable factor structure that was consistent with theoretical expectations. Third, similar factor structures were obtained from other approaches (e.g., varimax rotation).

Out of the 59 items in the initial version of the SDEINS instrument , five items were removed from the analyses as the responses for each of the 5 items showed no variability. The remaining 54 items reflected seven dimensions that collectively accounted for 92% of the total variance. The specific dimensions and their item loadings are shown in Appendix 1. To facilitate interpretation of the factors and to produce a more concise scale for future use, a smaller subset of four or five items from each of the seven factors was chosen. Each item was selected on both empirical (i.e., a strong loading on its respective factor) and theoretical grounds (i.e., conceptual relation to it respective factor while distinct from the other factors).

The largest factor, which accounted for about 29% of the total variance was interpreted as Pedagogical Capability (Cultural). This factor reflected the degree to which teachers felt that they could effectively teach science from the perspective of *Inuit Qaujimajatuqangit*. This factor included items such as "I (we) feel prepared to teach science from the perspective of Inuit values, beliefs and knowledge" and "I (we) have a good knowledge of ways to teach science that integrates contemporary science with an Inuit perspective". While the first factor reflected the teachers' ability to teach, considering their cultural perspective, the second factor, Content Knowledge (Cultural), consisted of items that refer to the teachers' knowledge of cultural content with items such as "I (we) have a good knowledge of both the contemporary science and traditional knowledge we want students to learn" and "I (we) have a good background knowledge for teaching science from the perspective of Inuit culture and values". Pedagogical Capability (General) was the third dimension based on items such as "I (we) have a good understanding of the science ideas we are to teach our students" and I (we) am (are) a confident science

teacher(s)". The fourth factor contained items such as "There is enough time to teach science" and "I (we) work together in the development of our science program", which reflected School Priority (General). In the next factor, items such as "I (we) have the time to teach science from the perspective of Inuit culture and values" and "The school community places a strong emphasis on learning science from the perspective of Inuit culture and values" clearly represented School and Community Priority (Cultural) for *Inuit Qaujimajatuqangit*. The sixth factor focused on Resources with items such as "The school is well-resourced for the teaching of science" and "I (we) have people who can support the teaching of science from the perspective of Inuit culture and values". The seventh and final factor, Teacher Interest, was based on items such as "Science is a subject that I (we) want to teach" and "I (we) want to teach science integrated with an Inuit perspective" which contains items for both general science teaching and also teaching from the perspective of *Inuit Qaujimajatuqangit*.

The correlations between the factors are listed in Table 1 below. The numbers presented indicate the degree of relationship between factors; higher numbers meaning a positive relationship between factors. Overall, it appears that while a few factors appear to be moderately associated with one another, none of the correlations were strong enough to suggest that any two factors could be considered as a single construct. The strongest relationship between factors was found with Content Knowledge (Cultural) and School and Community Priority (Cultural) (r = .24). This indicates that although these two constructs are somewhat related, given their cultural focus, their reflection of ability level and interest are quite distinct. Looking at both the factor loadings (Appendix 1), and their correlations (Table 1), what is perhaps most interesting is the clear distinction between a general and culture-specific focus. For example, the correlation between Pedagogical Capability (Cultural) and Pedagogical Capability (General) was .18 suggesting that those teachers who felt more confident in their teaching science from an Inuit perspective may not have been among those with similar perceptions with respect to teaching science with a general focus. In a similar manner, the level of priority given to teaching science with a general focus did not always correspond to that with a specific focus on *Inuit Quajimajatuqangit*. These outcomes are important because they verify the complex knowledge base necessary for teaching in a cultural setting such as Nunavut where communities advocate a school

learning experience that is additive; that is affirms for a learning experience of both cultural and contemporary science knowledge.

Table 1: Correlations between Dimensions of SDEINS

	1 Pedagogical Capability-Cultural	2 Content Knowledge - Cultural	3 Pedagogical Capability - General	4 School Priority – General	5 School and Community Priority - Cultural	6 Resources	7 Teacher Interest
1	1.00	.11	.18	.09	.13	.10	.19
2		1.00	.12	-.01	.24	.13	.03
3			1.00	.09	-.02	.00	.11
4				1.00	.02	-.05	.18
5					1.00	-.16	-.01
6						1.00	.08
7							1.00

Based upon the outcomes of this statistical analysis four items with the highest factor loading values from each scale have been used in the development of a *Science Delivery Instrument for Nunavut Schools* which is presented in English in Appendix 2. The seven scales have been developed with the intent of gauging teacher's perceptions on a 1 (Strongly Disagree) to 5 (Strongly Agree) scale in areas that are identified as major impediments or contributors to science program delivery in Nunavut settings. The instrument, when answered by teachers, provides data to give an indication of where teachers and schools are perceived to be, and by so doing, provide developmental information for collaborative action to the schools involved in this study. Mean (average) calculations were performed to identify general trends in perceptions for each scale and each item. Standard deviations were calculated to determine the degree of consistency amongst respondents for each scale and each item.

The chapter that follows outlines the outcomes of the initial Reconnaissance Phase of the study. Although the outcomes of this stage also contributed to the development of the *SDEINS,* the chapter focuses on detailed information gained from the application of the

instrument and the interviews and conversations that took place during the reconnaissance phase.

Chapter Three: Outcomes of the Reconnaissance Phase

3.1 Outcomes of the Initial Interviews and Conversations

As detailed in Chapter Two, formal and informal interviews and conversations were conducted in Inuktitut or English (depending on the respondents' preference) with a total of over sixty science education stakeholders within each of the three school communities between April and June, 2004. The focus of the conversations was on aspirations for science education. The questions asked included: (1) When students are being taught science at this school, what do you want to be taught? That is, what do you want them to learn? (2) How do you want it to be taught? (3) Can you see what things stop this from being the way it is now? and (4) What needs to happen to make it be this way? As well, a full-day discussion and negotiation process where stakeholders collectively identify through discussion and negotiation aspirations; strengths; weaknesses; and steps towards achievement of goals. Again, the same questions were used in prompting consideration of aspirations. Stakeholders included for each school the teaching staff, principal, members of the District Education Authority, superintendents of Qikiqtani School Operations and, in a few cases, senior students and elders in the community. Finally, a focus group was used to verify the outcomes of the initial two stages of the study and to further elucidate factors influencing the science education aspirations of the school communities. Again, the focus group included three Inuit and one non-Inuit primary teacher with strong IQ and western science understanding, an Inuit principal and school advisor, and a researcher in instrument design.

The formal interviews and conversations were used to (1) authenticate and elaborate on the data collected from the SDEINS applications, (2) elicit stakeholder aspirations for science education, especially in regard to the intentions of *Inuuqatigiit* in the context of science education, and (3) identify through stakeholder comment perceived risk and protective factors for the delivery of contemporary science from an Inuit perspective. The common theme, without exception, advocated for a science education experience that

combined the views of "both worlds"; that is, combined the knowledge, values and skills of both Inuit ways of knowing and ways Inuit come to know and western science. Again, this "both-ways education" that combines the knowledge, practices, values, beliefs, and ways of knowing of both the community of scientists and Inuit culture is known by elders within the Igloolik region as *piqusiit tamainik katisugit.* Stakeholders indicated a high regard for and in many cases an obligation to see science that integrated traditional (cultural) and contemporary science knowledge and practices. Three comments are representative of this theme:

> For a long time we would put away our knowledge [at school] and the way we do things and it wasn't important. For my children I want that to change. I want them to be raised to proud of who they are and learn things that are important to their lives in the future, both if they live here or away. They have to learn both ways. (Inuit teacher and grandparent).
>
> I was told for so long [through schooling] what I knew wasn't important. That has changed but it still needs to change for better. There are things we need to learn but there are things [about or culture] we need to be reminded are important, not just about what we know but the way we do things. (Inuit Local Education Authority member).
>
> Teaching with reference to both [contemporary and traditional knowledge] just strengthens the richness of the experience provided for students. It's not a matter of being obligated in doing so. One without the other just reduces the richness of experience for children. (Non-Inuit Program Support Teacher).

These comments were characteristic of many stakeholders who indicated that the high regard for teaching science in a manner that honours local epistemology was essential in schools. Implied within these comments is the desire to see a re-positioning of the knowledge and process aspects of *Inuit Qaujimajatuqangit* alongside of contemporary Western science thought and practice ensuring its validity within the classroom. There is an assertion that stakeholders are unwilling to see their children experience science educational success at the expense of their cultural and psycho-social well-being (Fordham, 1988) affirming McKinley's (2000) comments that curricula must begin to acknowledge local indigenous communities and their knowledge, values, beliefs and pedagogies as thoughtful and purposeful cultures.

The follow-up interviews, conversations and meetings provided a more thorough and accurate understanding of both the school community aspirations towards science delivery and likely contributors and impediments to science delivery within these northern Qikiqtani schools. Although there were some minor variations among the communities, both in terms of aspirations and perceived risk and protective factors for achieving these aspirations, common themes were clearly evident. For the remainder of this chapter, two perceived protective factors and four perceived risk factors will be presented and discussed. The factors seen to be likely supportive of these goals were (1) interest in teaching with reference to an Inuit perspective and (2) the likelihood of the communities' positive involvement in such an endeavor. The factors seen likely to impede these goals, or risk factors, included (1) teacher capability in teaching with reference to an Inuit perspective, (2) the adequacy of physical and human resources, (3) the language background of students and ESL capabilities of teachers, and (4) leadership and direction at the school, divisional and territorial level. These factors will now be examined in detail.

Protective Factors Influencing Science Delivery from an Inuit Perspective

1. Interest in teaching with reference to the Inuit perspective.

The conversations quickly indicated that stakeholders within these settings aspired to teach science, or at least deliver science, in a manner that acknowledged community epistemology. Although there was an acceptable level of interest in teaching science, the follow-up conversations and interviews revealed there was equally if not more interest in seeing science taught with reference to an Inuit perspective. Unlike a previous northern study where interest in teaching with reference to local epistemology was the exception (Lewthwaite, 2005a), Qikiqtani stakeholders indicated a high regard for and even an obligation to see science that integrated traditional Inuit and contemporary science knowledge and practices. Five comments are representative of this advocacy:

> Learning about our own culture is important, and I don't want us to turn our back on that [knowledge] that is valuable for our students. It's who they are. [At the same time] it's really important to integrate this knowledge [with non-traditional knowledge]. Students will benefit from both. They'll feel better about themselves as Inuit. (Inuit Grade 1 Teacher).

> We want an education that brings the best of both worlds to our students. There are some things best learned in the classroom and some things best learned from elders. Both ways have their benefits, and that's what it should be like. Bring the best of both worlds. Try to combine the two. (Inuit Elder & DEA Member).
>
> I know it's just required of me here [teaching with reference to traditional knowledge in Nunavut]. IQ is supposed to guide the way I way I teach. It was clear when I accepted the position and for the most part it was the experience I looked forward to. You want to see a blend [of the two knowledge systems] in your teaching. Not one over the other – just blended as best you can". (Non-Inuit Grade 4 Teacher).
>
> Teaching with reference to both [contemporary and traditional knowledge] just strengthens the richness of the experience provided for students. It's not a matter of being obligated in doing so. One without the other just reduces the richness of experience for children. (Non-Inuit Program Support Teacher).
>
> I really enjoyed the elders' stories [in the topic of weather]. I hear the [traditional] stories from my mother but there are more and about different things [referring to these stories are specific to science phenomena]. It makes what we learn interesting. (Grade Seven Inuit Student).

These comments were characteristic of many stakeholders who indicated that the high regard for teaching science in a manner that honours local epistemology is commonly fostered by both Nunavut government expectation, an environmental macrosystem factor, and teacher personal interest and motivation, an individual personal attribute factor. No stakeholder adversely referred to the expectation that curricula should be taught with reference to an Inuit perspective. It would appear that this interest is the most significant supportive factor likely to influence any effort to develop science programs that honour local epistemology. As Fullan (1992) suggests, change is more likely to occur when there is interest and identified need for change.

2. *School community supportive factors*

Stakeholders in each of the three school communities referred to existing mechanisms that were available for supporting the incorporation of traditional knowledge into science education. Three major sources of traditional knowledge were identified. In one community, elders work within the school as Cultural Specialists and are available for use by teachers upon request. In all three schools, funding is available for teachers,

individually and on their own initiative, to invite elders or members of the community into their classroom as instructional providers. In another of the three communities, elders have been interviewed to canonize traditional knowledge (IQ). This information has been recorded and incorporated into an electronic database that is available for educators. The third community has commenced videotaping elders' accounts of traditional knowledge. Although these forms of information were available, most stakeholders suggested it was being under-utilized, especially in integrating Inuit knowledge and the knowledge of contemporary science.

Risk Factors Influencing Science Delivery

Rutter suggests that risk factors are those personal attribute and environmental factors that impede development. If these three communities aspire to develop science programs that provide students with collateral learning experiences in science, four factors were perceived to potentially impede this development process.

1. Teacher capability in teaching science from an Inuit perspective.

As might be expected the most commonly cited concern about teaching science from an Inuit perspective was teacher capability to do so. Teachers shared a concern about their level of confidence and knowledge of both contemporary science and traditional Inuit knowledge and process (IQ). Clearly, teachers perceived their knowledge and understanding of contemporary science knowledge more favourably. As previously mentioned, teaching to the intent of *Inuuuqatigiit* is beyond the ability of most Qallunaat (non-Inuit) teachers as it deals with traditional Inuit knowledge (Berger & Epp, 2005). Conversation often explored teacher perceptions of what was required of them in teaching from an Inuit perspective. Although *Inuuuqatigiit* calls for teachers to teach *from* an Inuit perspective, most teachers used words such as *blended*, *integrated*, *with reference to* and *in the context of*. All of these responses are quite different from what is implied in *Inuuuqatigiit.* Two comments that expressed this distinction follow:

> I try to incorporate as much IQ as I can into my lessons [from an Inuit perspective]. I get students to add from their experiences too. Students respond well to this. Only some have really strong experiences to add to the conversations. (Grade Four non-Inuit Teacher).

> I find that just about every experience I have here I can build into my teaching. You just feel like you have more credibility, and I'm more satisfied with the job I'm doing. I'll never be able to teach it from an Inuit view, but I can work towards making my teaching more culturally relevant. Some areas aren't too bad, like the biology and stuff. For me it's hard with weather and things because I haven't had much exposure to this topic (both contemporary and traditional) and can't make the connections for students. (Grade Six non-Inuit Teacher).

Clearly for most teachers, teaching collaterally was not possible because of the inadequacy of their knowledge of traditional epistemology and, for some, the inadequacy as well of their contemporary science knowledge. As suggested by Christianson (2004), the inadequacy of traditional Inuit knowledge and understanding of the entire IQ perspective was also an issue for some Inuit teachers.

> Sometimes you are teaching and you come to a barrier [because you don't know any more about the traditional knowledge]. You want to say more to your students but you have no more to say. (Grade 5 Inuit Teacher).

> I find my own experiences are not that strong. I know lots of things but not in some of the areas in the curriculum. We do themes like plants and there is much I need for my students to learn from the elders and not me. Other areas are easier. It really depends where your experiences have been. (Grade Two Inuit Teacher).

As well, Inuit teachers identified that they teach science from an Inuit perspective. To teach from a Western science perspective can be very difficult as the following comments suggest.

> Our cultural upbringing really has a lot of effect on how we teach science. English and Inuktitut - the culture, our way of doing things, not the language - are quite opposite. The way English teach gets confusing. Science is not a barrier, the English way is. (Grade 1 Inuit Teacher).

> They can teach science very well as it relates to the way they were brought up. Curriculum guides confuse our way of thinking. (Inuit Principal).

Several teachers identified that teaching science which acknowledges Inuit perspectives is likely to be best and most realistically facilitated by utilizing other physical and human resources within the school community.

> The foundations of IQ appear to be pretty straight forward but they aren't. You can know things about the local community and the culture but presenting it in a way that fits with the principles of IQ isn't easy. I think the elders on staff [Culture Specialists] understand the IQ perspective and can present things much more meaningfully. (Grade Seven non-Inuit Teacher).

> We are able to use the elders a lot in our teaching. Being able to teach a topic and then get their perspective on the same idea. When we did weather I looked more at the characteristics of air and ways we measure weather conditions whereas they looked at traditional ways of understanding and reading weather. That went well. I think that's an ideal way to get the Inuit perspective. (Grade Seven non-Inuit Teacher).

> We are older and our experiences are much bigger [than the younger Inuit teachers]. (Inuk Elder within the community).

It is apparent from the comments made by stakeholders that although interest for teaching "two-way" is an important supportive factor, there are associated factors that need to be addressed before teachers can teach collaterally.

2. Adequacy of physical and, to a lesser extent, human resources.

As identified by Berger and Epp (2005), the adequacy of relevant resource materials appropriate for Nunavut, especially the Qikiqtani region, were seen to be critically important for the teaching of science from an Inuit perspective. Some teachers recognized there were resources available that to some extent linked to their teaching goals. Most, however, identified the need for resources that made connections explicit in terms of traditional Inuit knowledge and contemporary science.

> You have a sense of what it should look like in a unit of work, but there is nothing available that merges this for me. I just don't have all of the time to do this [as a newer teacher]. Maybe in time, but, not now. I can't get it through my mind that there has been teaching going

> on here for years and those resources to draw from have not been put together. (Grade 7 non-Inuit Teacher).

Several commented on the value of older resources developed by the Department of Education of the Northwest Territories and other resources developed for secondary science topics. Teachers that taught in Inuktitut repeatedly emphasized that the lack of resources for their students was a critical aspect needing immediate attention. The presence of elders within the school to assist with the traditional knowledge integration was seen to be very valuable and advocated by some teachers in schools where elders were currently not employed. Mechanisms for making use of community elders within the classroom as cultural knowledge specialists in some communities were established, in others they were not.

> The Culture Specialists within the school are pretty well available whenever we make the request. It's great to have that support there. I think it is one of the most positive things about working in this school. (Grade 5 non-Inuit teacher).

3. Language background of students and teaching of English as an Additional Language (EAL) competencies.

Non-Inuit teachers repeatedly mentioned that a major factor influencing the effectiveness of their teaching in all curriculum areas was their students' English language competencies. Teachers identified their need to not only possess a knowledge base that equipped them to teach science collaterally but also to teach students whose first language was Inuktitut. As Berger and Epp (2005) identified, teachers acknowledged the need for strategies for teaching content areas such as science to English as an Additional Language (EAL). Many teachers recognized that science was a difficult curriculum area to teach because of the terminology used in contemporary science. Despite this, teachers often cited that the first hand experiences science provides open the door to language development both in Inuktitut and English. Again, teachers frequently mentioned the value of the Government of Northwest Territories science resources that provide instructional support for science topics from a language development perspective.

4. Clearly identified educational, in particular, science curriculum direction.

Teachers often conveyed frustration and a need for clear educational leadership in the area of instructional orientation relative to the incorporation of traditional knowledge, specifically those orientations representative of the principles of *Inuit Qaujimajatuqangit* that would facilitate two-way or collateral teaching. Although there is a requirement for classroom experiences to reflect Inuit perspectives, making this a reality was perceived to be the responsibility of individual teachers provided with minimal guidance.

> You're really on your own journey as a teacher. We [as teachers] do talk about the way we would like to see it happening, but you are on your own. As a school it isn't a priority. You are always dealing with other issues and the way you teach sometimes ends up at the bottom of the deck. There is a requirement for the IQ orientation, but I look for some guidance as to how this comes about in my classroom. (Non-Inuit Grade 4 Teacher).

Other studies have shown that change in instructional practice is largely a reflection of the emphasis placed on instructional improvement through the instructional leadership provided by school principals and superintendents (Lewthwaite, 2006a). Clearly, teachers would identify that they, individually, can make some progress in seeing two-way learning occur, but for school-wide and divisional change to occur, this needs to be assisted by senior teachers, principals and superintendents as instructional leaders. It is they who are critical to fostering the development of strong collaborative relationships and consensus decision making and action for a common cause among teachers, administrators and the school community.

Teachers commonly mentioned that the absence of a Nunavut science curriculum that affirmed a culture-based science education experience was a critical factor limiting their effectiveness as teachers. Many remarked that the absence of a more detailed science curriculum gave them a great deal of liberty in what they explored with their students. However, particular topics, like the seal, tended to be used by teachers at each grade level. Many followed the guidelines set by the Alberta, NWT, or the Council of Minister's of Education's (1997) *Common Framework of Common Learning Outcomes*, commonly referred to as the Pan-Canadian Science Framework. Although *Inuuqatigiit* provides curriculum guidance to teachers, a more detailed science curriculum for Nunavut that corresponded to the Pan-Canadian Science Framework yet made explicit opportunities for

the Inuit perspective was the preferred curriculum guidance advocated. As well, typical of most Kindergarten to Grade 8 schools, no apparent formalized leadership for science education either from a science teacher-leader or senior administrator was currently encouraging science development according to the aspirations of the school community.

3.2 Summary of the Introductory Reconnaissance Phase

The factors identified and perceived to be either risk or supportive influences on the realization of a two-way science orientation are illustrated in Figure 2. Although the factors are listed as isolated spheres, it is obvious from this study that there is interplay among these spheres, especially in terms of how environmental factors may influence teachers' and a school's ability to provide students with two-way learning opportunities. Of particular importance is how evident the principles of *Inuit Qaujimajatuqangit* need to be incorporated in order to see the realization of goals. The principles likely to be most closely connected to this include (1) the principle of decision-making through discussion and consensus (*aajiiqatiginniq*); and (2) the principle of collaborative relationships or working together for a common purpose (*piliriqatigiinniq/ikajuqtigiinniq*). The illustration also assists in identifying the key priorities to address if the aspiration of providing students with a science experience that honours Inuit epistemology in this development is to be realized. In order to harmonize science learning with their life-world culture some priorities in this project were able to be identified. They included:

1. Ensuring that policy that places priority on instruction that honours two-way learning is supported through to implementation by supportive measures by educational leadership at the school and divisional level;
2. Ensuring that the strong collaborative relationships and consensus decision making among teachers, administrators and the school community for a common purpose is encouraged throughout the development process;
3. Ensuring that any professional development and resources developed focus on language development for in Inuktitut and in English for ELA learners through engaging science experiences;

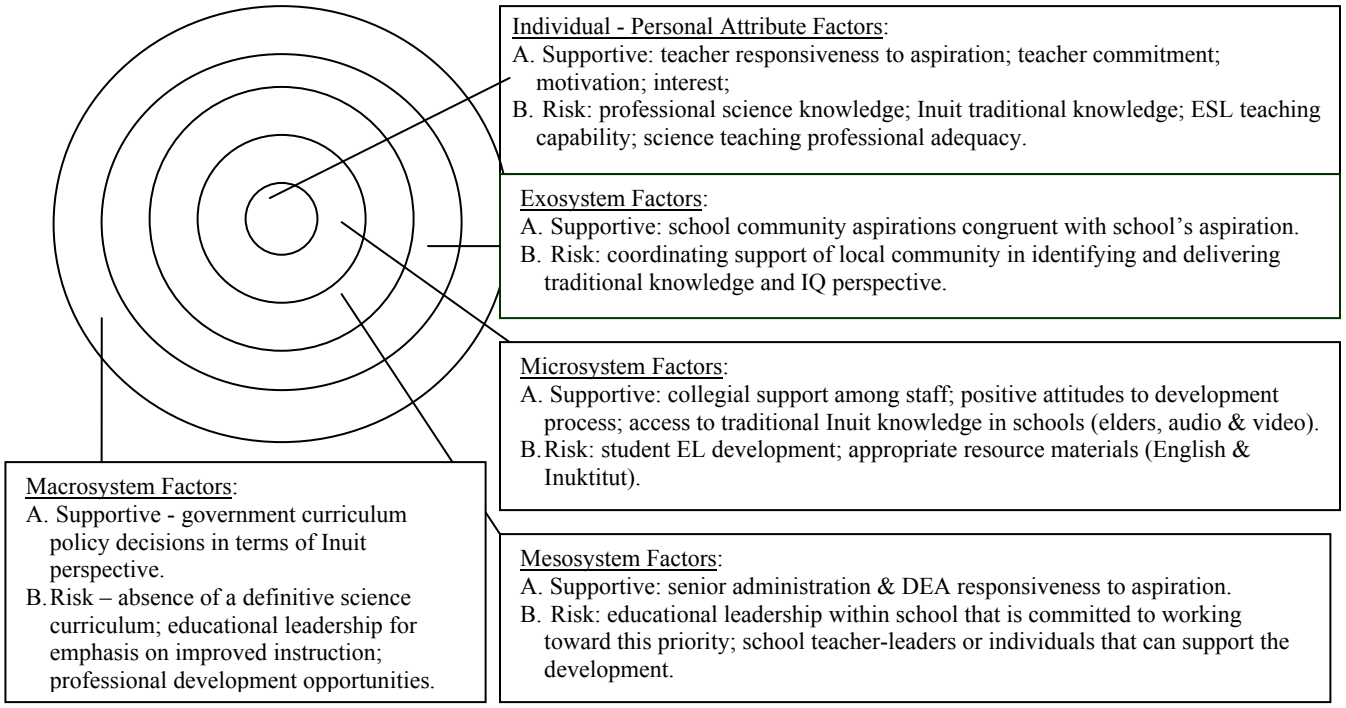


Figure 2: Factors perceived to likely constrain or contribute to the delivery of science programs that honour traditional epistemologies in Qikiqtani schools

4. Developing the most appropriate physical and human resource base for integrating traditional knowledge into a science program. This human resource base might include the use of school-based culture specialists, audio-visual and audio recordings of community members, and teachers themselves; and
5. Identifying how traditional Inuit knowledge and contemporary science knowledge development opportunities, potentially in alignment with the Pan-Canadian Science curriculum framework, can be fostered.

The next phase of this study focused on consultations with the individual schools to establish, implement and evaluate agendas for development in accordance with the aspiration of developing science programs that honour local epistemology while taking into consideration the priorities listed above. It was envisaged that the resources and programs developed and the processes used and identified as constructive in achieving these goals at the school and classroom level, especially in regards to the principles of *Inuit Qaujimajatuqangit*, could be used as examples for other Nunavut schools of how contemporary science and traditional Inuit knowledge and process can be integrated.

Chapter Four: Mechanisms Implemented to Meet Community Aspirations

4.1 Resource Development

Over the past four years (January 2006-2009) members of the Centre for Research, Youth, Science Teaching and Learning (CRYSTAL) have been working with each of the three school communities to collaboratively develop with teachers (both Inuit and non-Inuit) and community members, especially elders knowledgeable in *Inuit Qaujimajatuqangit*, place-based learning materials that are consistent with the community's aspirations for science education and are aligned with the Pan-Canadian Science Protocol. These resources, in both English and Inuktitut, are made available to all Nunavut teachers on-line through http://www.umanitoba.ca/outreach/crystal/nunavut.html. CRYSTAL members work collaboratively with individual or teams of school teachers and school teaching staff collectively in modelling appropriate teaching practice and monitoring student progress as a result of their 'two-way' learning experiences. The initial PATHing included an opportunity for the communities to determine what topics they deemed as important for development. Not surprisingly, topics focused primarily on the natural environment. Examples included Weather (Sila) and Sound (Nipiq). As well, both Inuit and non-Inuit teachers volunteered to assist in the development of these topics based upon their having interest in the topic under development and knowledge of the topic from a Western Science and/or *Inuit Qaujimajatuqangit* perspective. The researcher then works with the teacher to assist in the development of the unit so it will purposely attempt to blend or bring into comparison the views of both worlds, without treating either as inferior. Usually the teacher and researcher together conduct elders' interview often facilitated by a translator to develop better understandings of the IQ appropriate to the context under study. An important source of information for this project is the database of elders' interviews archived as digital English translation recordings at the Government of Nunavut Igloolik Research Institute. The CRYSTAL researchers spend in total two, three week terms in the three communities each year assisting teachers in the development of and classroom implementation of the resources. The developed lessons and units developed are trialled and modified based upon student response to the activities developed.

For example in the study of 'Weather through the Seasons: Sila' (Appendix 3), students learn about the origin of lightning and thunder as weather events from both a

western science and IQ perspective. First, students learn about Sila, a personification of weather and a great, divine and vengeful spirit responsible for all weather events and other forces of nature. It is taught to be respected. Embodying this understanding of Sila and its vengeful nature is the story of the origin of lightning and thunder. Students learn through annotations of the elders' stories that lightning (ittutuuqtuq) and thunder (kallik) have their origin in the actions of two girls from their communities. Although there is minor variation among the three communities, the story is told that when they were young, the girls were always being bullied and teased. They were often depressed and sad because they were being bullied by others. They did not know why this happened to them. To get away from this, they walked up to a little mountain above the town. They built little houses with the rocks that were around them. They enjoyed playing alone away from the others that were bullying them. They wished they could become something else so they could get back at the others. The older sister asked the younger sister if she could, what would she like to become. Was there something she would like to become so she could pay back or get revenge by becoming something else? The younger sister started singing. "ALIQAAK, ALIQAAK, SUUNAUVINUK." [Aliqaak aliqaak: what are we?]. She sings that she wants to become some kind of an animal. While she is singing, the older sister asks her what she would like to become so she could get revenge. She asked her if she would like to become a caribou. The younger sister said no. Did she want to become a polar bear? The younger sister said no? What about thunder [ittutuuqtuk]? The little sister stops singing and she says yes. So, during the night the girls very quietly collect seal skin and seal oil. They also collect yellow ingnitt [flints for striking to make sparks] from the Salmon River and take them up on the mountain. One girl shook the skin and oil and the other starts striking the rocks. They did this with much energy. This was the cause of the thunder. As well, the striking made sparks [umma] that made the oil ignite. This called the lightning. There was also rain and this came from the girls peeing. They wanted to pay back for being badly treated. It rained, thundered, and there was lightning. The lightning struck the tent of the people that were bullying them. It went down the pole of the tent that was made of whale bone and this electrocuted the children that were bad. The girls were satisfied that they had done this. After this, they did not return to the town. The younger sister became lightning and the older sister became thunder.

Inherent within this story is the vengeful nature of Sila as manifest in lightning and thundering and its response to behaviours that cause its unsettlement. Teachers are encouraged to use both the IQ and western science information provided about lightning and thunder to provide a bi-cultural exposure and to discuss aspects of the story that prompt student questions, thus facilitating as Jejede (1995) asserts, collateral learning. Again, both knowledge systems are seen to be valuable and significant to our understanding of and cultural place within the world. Since this resource is in both English and Inuktitut, both Inuit and non-Inuit teachers are supported in providing a dual perspective on this topic. As well, learning summary sheets have been developed to encourage teachers to focus on key learning aspects associated with the topic. As an example, the unit on Sila requires students to provide the traditional Inuit names of anthropomorphic winds (such as the nagging she-wind nagiq), the direction from which they come, and the weather conditions they bring. Finally, the in-service support provided to teachers once the units have been developed in English and Inuktitut assists them in identifying possibilities for their own teaching of these topics and ways by which they can encourage student engagement and learning in the topic under study.

4.2 Guiding Principles of the Units

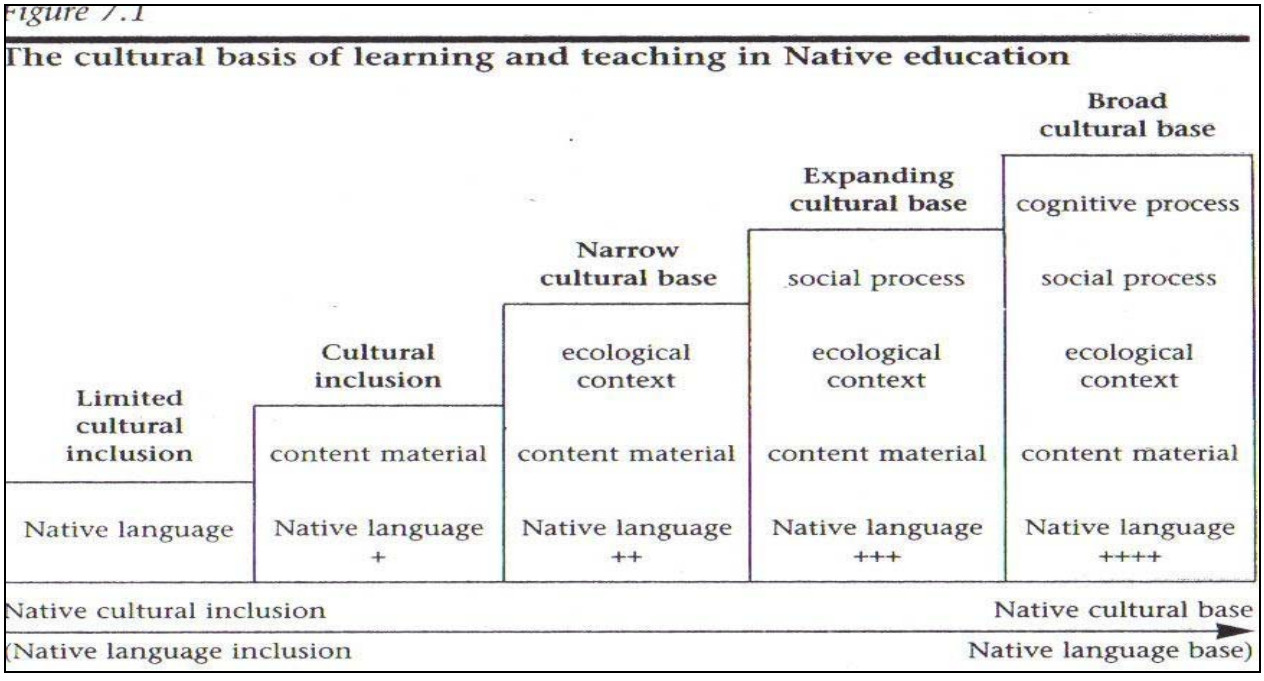
The stakeholders of the project identified several guiding principles that are used in the development and delivery of the units. These principles were established at a meeting of representatives from each community when the overall project was being conceptualized. The principles have their origin in a variety of sources, one primarily being the knowledge and experience of all stakeholders (teachers both Inuit and non-Inuit, science education professors, elders). Many of these foundations are identified in the forward to *Inuuqatigiit: The Curriculum from the Inuit Perspective* (Government of the NWT, 1995). Again, these foundations of preferred pedagogy for Inuit students are noted to be embedded within traditional and contemporary Inuit society. They include:

- Provide two-way learning experiences by integrating Inuit knowledge, ways of knowing, beliefs and values and contemporary scientific knowledge, processes and attitudes.

- Draw upon traditional and contemporary Inuit cultural examples as contexts for student learning.
- Include the local community and its people in students' learning opportunities as the classroom is an extension of the school and local community
- Foster language development in Inuktitut and, where required or encouraged, English.
- Use locally recognized pedagogical practices to promote student learning.
- Use science experiences as a rich context for promoting literacy and numeracy skill development.
- Use diagnostic and formative assessment to inform planning and teaching and monitor student learning.
- Engage students by starting lessons by providing first-hand experiences for students or drawing upon common experience.
- When using story to engage students, use the interrupted-story-line as a vehicle to prompt first-hand investigations.
- Deliberately promote scientific attitudes of mind (curiosity, problem-solving, working to end) through thoughtful independent consideration of questions and challenges posed.
- Move from the experiential, first-hand experiences to the psychological; that is, after providing concrete experiences assist students in making sense of experiences by using purposeful strategies to promote understanding such as role plays, illustrations and analogies.
- Assist students in their consolidation of ideas only as an extension of the initial experiential and psychological learning experiences.
- Within the lesson and throughout the unit, move from concrete to more abstract ideas.
- Provide opportunities for student-initiated and directed investigations.
- Provide opportunities for students to make connections among science and all other learning areas.

- Foster student independence, creativity and curiosity by providing opportunities for students' ideas and questions and follow-up opportunities for problem-solving and investigation.
- Provide students the opportunity to make connections between what they are learning and career opportunities.

It is noteworthy that this list is constantly being modified according to the research teams' ongoing understanding of what contributes to positive learning outcomes for Inuit students. A further framework identified as useful, especially for assisting non-Inuit educators, including both non-Inuit teachers and CRYSTAL researchers in adopting a broad culture-based perspective in their teaching, is advocated by Arlene Stairs (1995). This framework is illustrated below (Figure 3). Stairs' model is of value to non-Inuit in understanding the various school and classroom practices that can be acknowledged in developing and implementing a culture-based program. It is noteworthy that her model goes beyond the incorporation of language and culturally-relevant materials. She advocates that teachers use socio-cognitive pedagogical processes to assist students in their learning. Although the research team had some preliminary understanding of these processes prior to the commencement of this project, it is the knowledge of these processes, in particular, that is constantly being refined as more is learned about effective teaching practices for Nunavummiut .



4.3 Identification of School-Based Teacher Leaders

Based upon the first author's experience with fostering and identifying characteristics of successful school-based curriculum developments (Lewthwaite, 2006), it was deemed to be essential to identify a teacher or administrator at each school who could carry on the role of a teacher-leader for the project at the individual school level. These were not to be financially paid positions, but they would provide the opportunity for teacher-leaders to be a part of the development project and, if required, represent the project at regional, territorial, national and internationally conferences. The individuals selected for each of the three schools included a non-Inuk teacher who had taught at her school for over twenty years, an Inuk teacher who had taught at her school for twelve years, and an Inuk teacher who was in her first year of teaching at her school. They were all endorsed by their principals and colleagues to have the characteristics regarded as consistent with effective teacher leaders (Lewthwaite, 2006). They were all interested in and motivated to see the project succeed and were willing to be a part of the project from its initial conceptualization to its end when the final evaluations were completed. They had the respect of their school community. They also possessed the knowledge of both western science and *Inuit Qaujimajatuqangit* central to the topics to be developed. They also could lead in teacher development. They were able to model good teaching practice and, at the same time, assist people in their teaching and expect fellow teachers to carry out their responsibilities associated with the goals of the project.

Chapter 5: Outcomes of the Project

5.1 *SDEINS* Teacher Development Outcomes

The *Science Delivery Evaluation Instrument for Nunavut Settings* instrument previously discussed in Chapter Two is the major means of monitoring progress and promoting staff discussion in terms of where development is occurring at each school and where further improvement is necessary. In this section, only the quantitative data are included, and the follow-up discussions with teachers are consistent with the trends shown in the data. Consistent with the use of instruments such as the SDEINS, the focus of the SDEINS is to use the collected numerical data as a foundation for staff discussion and determine if teacher responses to these data are consistent with the statistical data (Lewthwaite, 2005). Examples of data collected from two of the schools participating in the development project are shown below. These two schools are chosen because they best elucidate the complexity of factors influencing progress in the achievement of the school-community aspirations for science education. In the first school in 2005, the school had a full Inuit staff, including principal at the commencement of the project who all taught in Inuktitut and currently has, because of a variety of unavoidable reasons, moved to having a non-Inuit principal and several non-Inuit teachers. Figure 4 represents the outcomes from the survey being completed by ten teachers in this school in the first school year of the project in January, 2005 and the third year of the project in May, 2008.

This school's data is presented because it helps to show the complexity of the multi-system factors commonly impeding the achievement of an Inuit school community's aspirations for science education, especially as a result of the high staffing turnover that occurs within northern schools. In both cases, the graphs represent the mean (on a scale of 1 (strongly disagree) to 5 (strongly agree) of the perceptions of factors identified as influences on the achievement of the common aspiration - a science program that honours *Inuit Qaujimajatuqangit*. Although a considerable amount of effort has been expended in this school community to assist the school in moving towards a greater inclusion of science teaching from the perspective of *Inuit Qaujimajatuqangit*, it is evident that teachers' perceptions of the progress towards this end in all dimensions other than Resources evaluated by the SDEINS have had minimal success. In fact, in the areas most central to

the development project (Cultural Capability, Cultural Knowledge and School and Community Cultural Priority), there has been a decrease in teachers' perceptions of progress made.

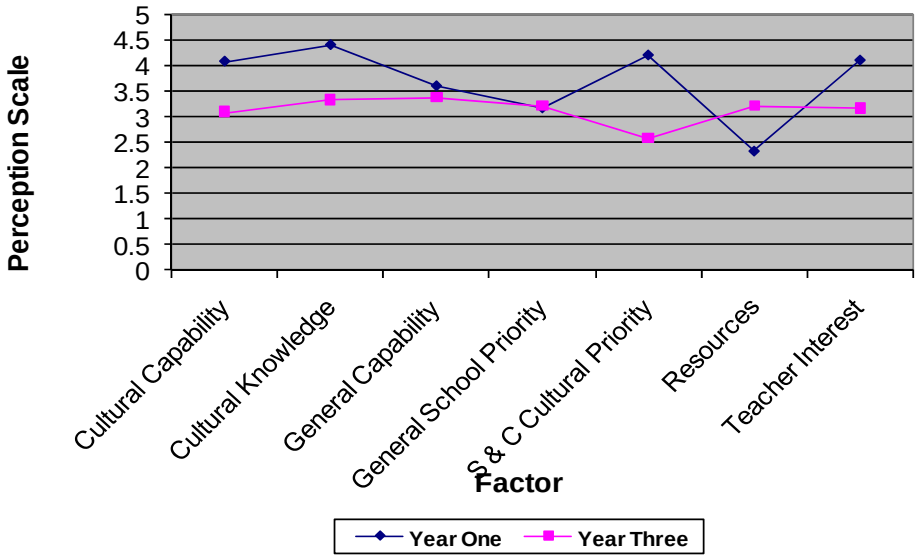


Figure 4: SDEINS School A Comparison January 2005 and May 2008

There were several inferences made from these data, and discussions with staff collectively have substantiated these inferences. Of greatest importance is staff acknowledgment in response to these data that the staff changes at both the principal and teacher level during this time period because of a loss of Inuit teachers and principal and replacement with southern teachers had brought with it an orientation to teaching across the curriculum, and science curriculum delivery specifically that has placed less emphasis on *Inuit Qaujimajatuqangit*. We suspect that school practices such as the content of curricula, pedagogical practices and language of instruction have unintentionally denied the inclusion of those aspects of Inuit culture that have value and are important to Inuit children. From the principles of IQ perspective, the breakdown of a collaborative vision among school community members as a result of staffing changes is likely to be the most critical aspect negatively influencing the initial aspirations for the school community. The principles of

pilimmaksarniq and *piliriqatigiinniq*, which encourage the participation of the community as a full and meaningful partner in educational development activities, have largely been ignored in the re-establishing of the importance of Inuit knowledge, values and processes within schools and assist in re-establishing Inuit priorities for Nunavut schools and classrooms.

In the second school, the data gathered from the SDEINS and conversations with fifteen teachers and a principal show, in contrast, evidence of development in a positive direction (Figure 5). The data collection from the SDEINS in this community, as well as the third, has been more positive in terms of the achievement of the intended goals of this development project. Although staff turnover is a problem experienced in all other settings as well, the focus on the efforts to foster the inclusion of *Inuit Quajimajatuqangit* has not been jeopardized because of there have been only one or two changes in school administration and senior teachers. Of particular importance to this latter school community has been a stable administrative staff supportive of the CRYSTAL-CCL efforts and the committed support provided for teachers by a Learning Support Teacher who has lived in the community for several years and advocates a 'combining of two-worlds' orientation to teaching and learning.

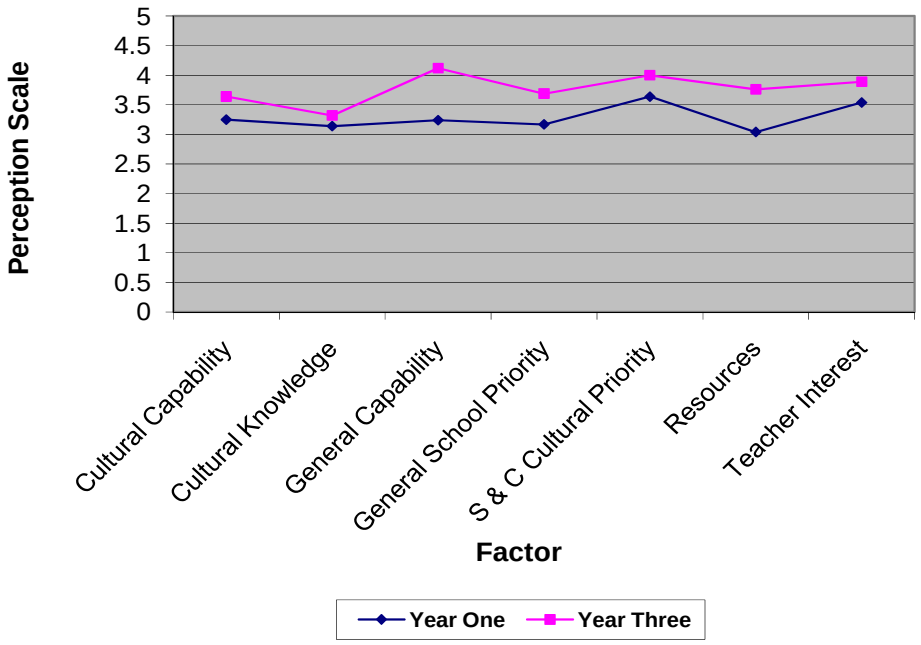


Figure 5: **SDEINS School B Comparison January 2005 and May 2008**

5.2 Student Outcomes: Intent and Methodology

It was anticipated that the learning experiences provided for students currently, and through the CRYSTAL efforts, would help identify classroom-based pedagogical and interactive processes that influence students' perceptions of their own school success. Although this stage of the project is ongoing, preliminary data collection in April and May 2007, May 2008 and September 2008 primarily based upon conversations with children and teachers and observations of successful classrooms, provides ample evidence to make some preliminary assertions about classroom pedagogical and interactive processes influencing student success. These assertions are valuable to many, especially teachers in these communities and, potentially, Nunavut schools in general. This latter outcome is the focus of this part of the summary report. That is, what do students and teachers of these students

identify as the pedagogical and interactive processes that influence Inuit students' perceptions of their own school success?

It was decided by the research team to identify through student perceptions what students perceived as success and what they identified as classroom interactive processes contributing to their ongoing success as learners. This CCL-funded part of the research is informed by the ideas and explanations of culturally-responsive teaching; defined as using the cultural knowledge, prior experiences, frames of reference, and performance styles of students to make learning encounters more relevant to and effective for them (Gay, 2000). Two research and development projects in particular, one based in Canada and the other in New Zealand, have provided an invaluable platform for this study. As well, one document, *Inuugatigiit: The Curriculum from the Inuit Perspective* (Government of the Northwest Territories, 1996) written for Inuit educators by Inuit educators provides considerable insight into the classroom and interactive processes influencing Inuit student learning. The document outlines traditional Inuit practices for teaching and how these are translated into contemporary classroom practice. All three publications or projects are similar in that they seek to inform improvement in educational success in response to what students are saying about their learning in Aboriginal settings, especially where educational success has been thwarted by a variety of factors, in particular, the marginalization of Aboriginal culture from the formal education landscape. First, Kanu (2002, 2006) engaged Aboriginal students of inner-city Winnipeg in conversations to identify the pedagogical and interaction patterns that have resulted in negative and positive learning experiences for these students as learners. In this analysis she focused on determining the curriculum materials, teaching strategies, and classroom processes that influenced student learning. By developing an understanding of the processes that supported or inhibited student engagement and learning, Kanu was able to assist teachers in developing effective teaching and classrooms that reduced the rupture between home culture and school. Second, Bishop and colleagues (2003) in New Zealand in their *Te Kotahitanga* project have been able to identify, through their conversations with Grade 9 and 10 Māori students a variety of practices that contribute to both positive learning environments and student success in learning. By so doing they have been able to develop what they call an Effective Teaching Profile for Teachers of Māori based on operationalizing interactional and reciprocal practices that

students believe address and promote their educational achievement. Both projects are similar in that they attempt to determine from the perceptions of Aboriginal students within mainstream settings what teaching practices contribute to their success as learners. Both studies place authority on students' ability to identify and communicate their understanding of mediators influencing their learning. This authority is then used to question the protocols of the mainstream classroom and in response promote a dynamic and synergistic relationship between home and community culture and school culture (Ladson-Billings, 1995). This questioning ultimately and purposely 'problematizes' teaching by upsetting the orthodoxy of classrooms by encouraging teachers to ask about the nature of student-teacher relationship, the curriculum and schooling (Ibid). By creating this disequilibrium it demands that educators seek resolution of these issues so that their classrooms move towards becoming more culturally responsive as they employ a culturally preferred pedagogy. As suggested by Gay (2000) culturally responsive teachers respond to the cultural knowledge, prior experiences and performance and learning styles of students to make learning more appropriate and effective for them. They teach to and through the strength of their students.

Such an advocacy challenges traditional educational practice in jurisdictions such as Nunavut. Typical of most Indigenous peoples, Inuit in Nunavut presently participate in a school system that has been drawn from the dominant culture, in their case southern Canadian school system models. Although Inuit staff work in the schools, especially elementary schools, the majority of teachers, principals and school operations administrators are non-Inuit and the curricula and pedagogy of classrooms is based on southern models. Because of this, school practices such as the content of curricula, pedagogical practices and language of instruction have both intentionally and unintentionally denied the inclusion of those aspects of (Inuit) culture that have value and are important to (Inuit) children (Bishop & Glynn, 1999). At the heart of such a system and its thinking is a belief or, at least, an assumption that western ways are superior and Aboriginal culture and specifically students may bring deficits to classrooms, not assets. Not only is their background experience and knowledge of limited importance, but also their cultural foundations for promoting learning (Ibid, 1999). Deficit thinking, or theorizing as it is referred to, is the notion that students, particularly low income minority

students, fail in school because they and their families experience deficiencies such as limited intelligence or behaviors that obstruct the leaning process (Valencia, 1997).

Paradoxically, "culture-based education" is identified by the territorial government (GN) as one of the foundational principles for school development in Nunavut. Culture-based educational policy is based upon acknowledging the strengths of students and their cultures, not deficits. The GN policy requires the activities of organizations, including schools, in Nunavut communities to create, preserve, promote, and enhance their culture, including arts, heritage and language. This policy is based upon the principle that culture in all its expression, provides a foundation for learning and growth, and that the GN should support individuals, organizations and communities to promote, preserve and enhance their culture (GN, 2004). The underlying premise of culture-based education is that the educational experiences provided for children *should* reflect, validate and promote the culture and language of the Inuit of Nunavut. These experiences should be reflected not only in the management and operation of the school but also in the curricula and programs implemented and pedagogies utilized. It assumes that students come to school with a whole set of beliefs, skills and understandings formed from their experience in their world, and that the role of the school is not to ignore or replace these understandings and skills, but to recognize the teaching practices and understandings within the cultural context and affirm these in classrooms (Alaska Science Consortium, 2003). Although culture-based education may be rhetorically premised as the foundation of Nunavut classrooms, what would classroom environments and teacher practices look like that are, indeed, reflective of Inuit students' preferences?

As purported by Bevan-Brown (1998), the overall aim of this phase of the research is motivated by the researchers to better inform and benefit Inuit students and their teachers in seeing Inuit aspirations for education realized. Both Kanu's and Bishop and colleagues' projects grounded in the domain of culturally responsive pedagogy previously mentioned have provided a foundation for both the research questions and methodology central to this study. That is, what do Inuit (or in their case First Nations and Māori students perceive as educational success, and what teacher specific and learning environment characteristics and processes contribute to this success? In answering this question a variety of data sources have been employed in order to triangulate data and increase reliability and validity of

results (Bogden and Bilken, 1998). These sources of student data include (1) completion of a questionnaire in English or Inuktitut by a total of 36 Grade 5 to 8 students in two of the communities, (2) individual interviews with 24 Grade 7 and 8 students in three communities, and (3) group interviews with 39 students from three Grade 7 and 8 classes from three communities. In both the questionnaire and interviews, the questions asked focused on students identifying (1) the last time they felt they had been successful in school, (2) what the teacher does to help them to learn, (3) what is happening in their classroom when they are learning best, and (4) what they would change about their teacher's teaching or what is happening in their classroom to assist them in learning. As well, six teachers (2 Inuit, 1 First Nations, 1 Indo-Canadian, 2 Caucasian) identified by their teaching peers, principals and CRYSTAL researchers as successful classroom teachers in regards to creating positive learning environments were observed repeatedly over three CRYSTAL researcher visits to the schools. This included approximately ten hours of classroom observation for each teacher. Interactions (1) between teacher and individual students, (2) teacher and groups of students, and (3) among students were observed. Incidents were noted that contributed to positive outcomes in learning such as two students working together to coming to a conclusion about how a task should be completed. Furthermore, eight teachers (6 being non-Inuit) who were completing their teaching term were interviewed and asked to identify, from their point of view, teacher, student and classroom characteristics that promoted the creation of positive learning environments and facilitated engagement and learning. Finally, in two of the schools results of the interviews with students were shared with all teachers (nine in one school and twelve in the other) at a staff meeting and teachers were asked to similarly respond to students' responses to teacher behaviors that influenced their learning. As suggested by Bishop (1996), in all cases the formal interview was more of a conversation, the informal interview was a chat, and based upon the need for collaboration between researchers and researched in constructing the final story as evidenced in the vignettes and themes that follow. In all cases, researchers looked for consensus among the conversations among respondents. This was achieved by each researcher individually making note of key elements identified by students and teachers. The researchers then shared these key elements using student and teacher anecdotes to support these elements. Commonalities that resonated between the

students, teachers and, subsequently, researchers were then listed. What is reported herewith is limited to where consensus was evident among students or teachers and between teachers and students.

Since the purpose of this aspect of the research is to describe what students identify as educational success and the classroom based pedagogical and interactive processes that influence students' perceptions of their own school success, the results from the data collection will be organized around these three headings. Again what is reported primarily focuses on comments where consensus was evident among students or teachers or between teachers and students. Although several more emerging themes are evident from this data analysis, the lack of consensus limits their inclusion in this paper. Kanu (2002) suggests that these themes are likely to be manifest in students' home and community culture, and some attempt is made to these connections in the accounts that follow, especially by drawing upon the assertions made by Inuit educators in *Inuuqatigiit: The Curriculum from the Inuit Perspective*. Again, since the current project is within the context of science, many of the comments made refer to science-related topics.

5.3 Student Perceptions of Success

It was evident through the questionnaires, individual conversations and group conversations that students' perceptions of educational success, without exception focused upon their identification of achievement of "working towards an educational end" or assisting someone in working towards an educational end in some first-hand experience. The focus of comments was on the satisfaction received from something being completed or accomplished individually or collaboratively through effort, much more than any mention of the external formal evaluation of the completed project. Performance was evaluated primarily by the physical product and the knowledge that effort had been required to work to that end. As examples, the "product" often included mastering a series of mathematics problems, completing a poster or model, or assisting others in their efforts to work to completion. Praise from a teacher or peers was always valued and helped students to identify the completion of the product, but students most commonly were able to identify when they had persevered and individually worked to that end, implying that students were able to self-evaluate. Comments and illustrations of their views of success include:

Interviewer: When was the last time you felt successful at school?
Elijah (pseudonym): The turbines [wind rotators]. Mine worked good. It went around fast.
Interviewer: Why did you feel successful?
Elijah: It wasn't easy. You had to work at it. We tried this, then this, working to make it go and it went. Then we tried some more and it went better.

Elisapee: When you help someone [with math] and then they can do it because you helped.
Interviewer: Why did this make you feel successful?
Elisapee: They didn't get it and then because you helped them and they didn't give up, they were really happy. You worked together to make it ok.

Shane: We made the [string] telephones and ours worked. You could tell they weren't all working. We changed it and got it to work well in the end.

Eli: I worked on the [model of the] village. It was just like the real village long ago, but very small. We made it really close to what it was like. It took a long time but we made it. I felt proud.

James: We do the story-writing and then we drew a picture. [Another student] could read my story and she could see the picture. It was the first time someone reads my story. I was happy and wanted to do it [again] in the afternoon.

These repeated comments were confirmed by Tuqqassie, a well-experienced Inuit teacher.

> We want our students to persevere and see the result of their work. They need to know that they can do something on their own. Being helped is ok, but they need to know they can do it on their own. It is the way our culture works. You have to be able to persevere, and be encouraged as you persevere. They can get frustrated but they have to be able to work it through in their own mind and not give up. That is what is important.

This teacher's comments emphasize the importance of student's persevering to an end and being affirmed as they work to the end, not simply being judged for their performance removed from the actual process of working to the end. As well, students are not only working on tasks that are attainable in terms of completion, but also have a degree of open-endedness in terms of the end result. Students are not simply following a set of steps to all arrive at the same conclusion or end. Instead they are required to show some initiative and perseverance and independent thinking to arrive at an end result. What was evident overall from students and teachers is that end results that focus on assigning achievement scores based on knowledge and understanding 'correctness' are much less important than the actual completion of the task. It is suggested by the authors that students' sense of success

is culturally situated; that is, within their culture success is also defined in terms of working to end. This is affirmed by comments in *Inuugatigiit: The Curriculum from the Inuit Perspective* (Government of the NWT, 1996) where it is emphasized that 'doing of things', task completion, and developing a sense of accomplishment from task completion is an integral component of the Inuit learning process. Accompanying this process, it is imperative that children see a positive attitude and hear positive feedback as they progress.

Often in subjects like science the focus for teachers is on developing student understanding of a conceptual area or having the right answers, whereas for students their sense of accomplishment is likely to come from completion of the activities that provide students with the foundational experiences that support their learning of science ideas. Within a subject such as science, the Middle-Years curriculum begins to shift focus from initial first-hand experiences to the understanding of science ideas. Associated with this is the likelihood that many teachers will want to emphasize knowledge development at the expense of first-hand experiences. Since students greatest sense of satisfaction apparently comes from working to an end, teachers must be aware of the significance of providing learners with attainable opportunities promoting first-hand experience that require students to persevere to an end. As well, since success is nearly always recognized by students themselves and their peers by persevering to completion, teachers need to give consideration to assessment practices and what emphasis they place on marks and scores for evaluating students performance as opposed to performance evaluation of working to end. Students are unlikely to hold a view that 'a mark' has much value or should have more value than their personal perceptions of having worked through something to end.

As Bishop and colleagues (2003) suggest, success for Aboriginal students is typically defined by the dominant culture. In Nunavut schools it is possible, even likely that success is defined differently by teachers from the south. Terms of reference need to be challenged since the very pedagogic process will hold these definitions as a central value. If the terms of success are to be culturally determined, there needs to be repositioning of how teachers see and evaluate success. The comments from students would suggest that achievement by students is acknowledged primarily through their evaluation of their ability to work to an end and their sense of satisfaction reinforced through the acknowledgement of others that they have worked to an end in a satisfactory manner.

5.4 Student Identification of Interactive Processes Influencing Their Success

Students were able to identify a variety of classroom interaction patterns primarily influenced by the classroom teacher that contributed to a positive learning environment. It is not surprising that since the majority of responses came from students themselves, the interactive processes influencing students perceptions were those that teachers contributed to either directly or indirectly. Similarly teachers suggested that they themselves were primarily responsible for contributing to a positive learning environment over time. Bishop and colleagues (2003) suggest that through their research, many teachers of Maori identify that someone outside the teacher's area of influence such as the school administration, the community or the students themselves are responsible for the development of a positive learning environment. That is, where teachers perceive their classroom environment to be a negative environment for fostering learning they attribute the cause of this to elements other than themselves. Such beliefs typically manifest themselves in a 'me and them' frustration mentality. Although such a "shifting blame" mentality may have some grounds, teachers who position themselves and accept their part in the relationship are likely to make more progress in establishing positive learning environments. That is, teachers who have a personal understanding that they can bring about change and are responsible for bringing about change in terms of interaction patterns in classrooms are likely to have much more success. As two southern teachers leaving the north suggested:

> You have this idea that things are going to be quite utopic [here in the north] and that isn't what I faced half way through the year [when I arrived]. I had in my mind the way things should be, and I was going to move towards that end. It took me that whole year [to work towards this and I didn't achieve it], and if I [had] achieved this end it wouldn't necessarily have been the best result. I guess I just wanted a well-managed classroom where everything went my way, or at least the way I thought was best. Paul

> When I look back [over my time here] what has changed most is me; just how I see the purpose and goal of education. For students it's mainly about what we are doing, and for me it was always the end result- learning this, reciting that- I just had to become much more focused on the *way* we did things – not just the end result. Seeing them [the students] as individuals and their interests and abilities – that made the biggest difference – not just a whole class with me as a teacher. Esther

Both of these teachers were able to talk at length about how they as teachers had worked towards establishing more positive ends primarily through their changed relationships and interactions with students, especially in regard to the processes that underpinned the development of positive learning environments. In contrast, one teacher who saw the problem as inherent within the nature of her students and the culture of community asserts:

> It never seemed to get to the place where I wanted it to. Just for students to work independently and co-operatively – at least for even a short period – they [the students] were just unable to. Unless I was in charge and very structured it wouldn't work. Pamela

Students, themselves were able to identify teacher behaviours that supported the development of positive learning environments.

> I didn't know which one [of the teachers in Grade 6] I wanted this year. Everyone knows they are very nice to you. They make you work, but they are nice. They care. Wayne.
>
> She [my teacher this year] doesn't just have to have things her way. Last year [the teacher] was strict but that doesn't mean I enjoy it or learn more. Elisapee
>
> She tells us she cares about that we learn and we <u>want</u> to learn. That's her job and our job is to try hard to help us to learn. She says that all the time and it's true. I know sometimes she's mad at us and that's ok. We try hard. Jacob
>
> She can bother me, and it is because she cares. We think that she cares about everyone the same way. [A student] doesn't come to school and she cares about that. It doesn't matter what it is. We know the [whole] class is important. I hope next year [at the high school] that's what we get. Joeli

Consistently, students made distinctions between classrooms that were very structured and teacher-directed and those classrooms where the classroom environment was co-constructed and reflected students' perceptions of a positive learning environment. As one teacher said:

> I don't know how well I'll do teaching down south again. Here I have had to work with my students to make it work. It's about reflecting their needs and interests and I think I'm used to it being pretty much on my terms. It's what I want to have in my classroom [down south] but I'm concerned that this might not be the attitude of the teachers I'll work with [and will prevent me from responding to my students]. Esther

Teachers and students did not negate the role of a teacher as authority, but all emphasized the role of the teacher as working with students towards facilitating a common vision for the learning conditions of the classroom. As one teacher who has lived in the north for several years suggests:

> Students may know you and of you out of the classroom and the school, but until they are in your class they don't really know what you are all about. That can make the start of the year difficult. But, I focus on them telling me what they think my responsibilities are and them telling me what their responsibilities are. We write these on a wall poster. We always return to these. We try to live by these. Sharon

Sharon's comments are reflected in the comments of nearly all students. She works towards establishing an open dialogue amongst her students to identify what each person's expectations are and how these expectations become the foundation for defining what a positive learning environment might look like. Both she and her students are demonstrating their high expectations for a secure, well-managed learning setting. There is a focus on two-way communication and an open dialogue that speaks truthfully of expectation, disappointment and successes for teachers and students. Sharon's comments are strongly embedded within the IQ principles of *tunnganarniq* (respecting others and relationships), *aajiiqatigijnniq* (ensuring all aspects of community development are fostered through decision making through collaboration and consensus), *pilimmaksarniq* (development through practice and action ensuring members of the communities are full and meaningful partners community and social development activities) and *piliriqatigiinniq* (working together for a common cause) (Arnakak, 2001). Again, these principles may be quite foreign to teachers who see their role from a much more teacher dominated and directed stance. In contrast to this, these students and teachers see positive learning environments as classrooms where negotiated expectations are clear and both teachers and students are accountable. As many students and teachers in one school suggest:

> We all know what is expected of the other. If an individual student doesn't comply, even the other students will try to bring them on board. As a last resort we will seek administrative support. Note I said WE – it starts with us as a class and then it'll go outside the class if necessary. Greg (teacher)
>
> I like it that we do [the decisions together]. I don't like it when one student gets it [singled out and disciplined by the teacher]. I like it better when we work on it together. We all know what we are supposed to do [including our behaviour]. Elisapee (student)

Again, these teachers' comments are affirmed by the Inuit educators in *Inuugatigiit: The Curriculum from the Inuit Perspective* (Government of NWT, 1996) where they assert that children need to be treated with respect and included as contributing individuals as part of a partnership to the overall success of classrooms. Parents and children want a positive atmosphere for their children where students can feel good about their progress.

The primary focus of the conversations was to try to elucidate the pedagogical practices that influenced students learning. In this analysis the researchers attempted to identify through consensus in low-inference teacher behaviours that influenced student engagement and learning. As suggested by Murray (1999) low-inference behaviours are specific and observable teacher behaviours that help students to learn. The following behaviours were consistently identified by students and teachers. They are not presented in a priority list.

The Importance of First Language Use and Effective Oral Communication

It is not surprising that since most students and teachers were in classrooms where student first language is Inuktitut, but teachers are not of the majority language and are unable to communicate in students' first language, effective oral communication was deemed a major factor influencing student learning. Similar to Kanu's findings (2002), effective teachers are able to communicate clearly to students or use strategies to explain, even if it requires others' assistance.

> He speaks fast. He is kind of mumbling (sic) too. I don't know why he doesn't speak so we can listen and learn. Wally

> It's like he tries to make us not learn. I want to learn but I can't learn because I can't listen to what he says. Joeli

> She tries to read to us in Inuktitut and uses our words [from the resource material]. That makes me listen and I can hear to learn. Thomas

Clear communication typically was considered to be manifest in simple, uncomplicated expectations that were often accompanied by visual representations or modelling. Within the context of science, two comments were specific to this characteristic.

> She shows us what to do rather than just telling us. The words are there but when the words are with the thing we do it makes sense. She doesn't go on and on. Esther

> I can follow the books we use in science. I like the pictures because you can see what it looks like. Then the words she says make sense. Thomas

And, as their teacher suggests:

> We use [name of a science series]. The language is appropriate and it is supported by wonderful visual images that support their carrying out the activities. It's visually sequenced so even if I speak clearly and slowly they can see what I am saying. Even gesturing and pointing [at pictures] becomes a means of talking. Chad

Teachers often referred to the frustration they experienced in communication science ideas and the difficulty in communicating to students whose first language is Inuktitut. As well, they suggested strategies used to communicate effectively.

> You try to get across an idea, like the other day with the idea of a vibration. They need to experience it first and then you try to show the meaning of the word. This worked well when I use my hand to show a vibration or drawing it on the board. But, Jeff [a teaching assistant and bilingual Inuk] was in the room and he explained it to the students and you knew that they understood it right away. Chad.

> You become thankful pretty quickly that some students are bilingual and can assist you in communicating ideas. We [the class] just need to accept that I can't talk to them in their language but we can use others in the class to get across ideas. Joel

Similarly students were able to recognize the influence of this language barrier as a frustration in their learning.

> I can learn but when there' no Inuktitut I don't learn well. [Another student in the class] will help us to learn our way [in Inuktitut] so you don't feel like you are not smart. Sometimes you learn by seeing [the teacher do it]. Sometimes you have to hear it to learn. Freda

Freda's comments were not uncommon. She recognizes that her learning is sometimes impeded because her first language is not the medium of instruction. But, where it is used mainly through a bilingual conduit her learning is not impeded.

> I learned lots last year (in a bilingual classroom). This year I don't learn as much. I find it more hard because there is no Inuktitut. Wayne.

Wayne's comments similarly expose the challenge for students in classrooms where they have to make the transition to another language of instruction.

Multiple Instructional Strategies

Associated with the previous point is the importance of teachers using multiple instructional strategies to support student learning. It is probable that the most common statement by teachers and students was associated with how they tried to communicate ideas, especially when the learning was associated with abstract ideas. Students commonly referred to learning through an instructional sequence that involved the teacher first modelling, often repeatedly ensuring students visualized what was required to be learned. This finding is similar to Kanu's (2002) who suggests that there is a strong link between learning by observation and then imitation. The classroom observations of effective teachers often revealed this modelling was done in silence and then, second time around, with a limited verbal account of the procedure or explanation. Following this, teachers would then provide opportunity for students to independently provide an explanation or carry out a task and if necessary, seek teacher help or the help of a peer. As examples two students made comment of how a string telephone worked:

> We had done it [made the telephone] but didn't know how it worked. She showed the picture of the things moving [vibration] and how the sound travels. We did the acting [role play] and you could see how the sound goes through [the string]. She made us draw this our own way and I could explain it to [another student in Inuktitut]. Simon

> Sometimes it's hard to understand [in English] and we might have [learning support teacher] in the classroom and that helps but together with the pictures and other things [role plays] we can get it. She wants us to get it. Joelie

It is quite evident that tangible visual representations through modeling that support abstract ideas are valuable as is the opportunity for students to hear and provide explanations in their first-language. Most importantly multiple approaches to assist students in their learning were most commonly cited as ingredients for fostering learning. Again, these comments are endorsed by *Inuugatigiit: The Curriculum from the Inuit Perspective* (Government of NWT, 1996) which emphasizes the importance of observation and imitation and ultimately through repetition, practice and progression becoming confident enough to do something independently.

Allowing Time and Initial Support for Completion and Mastery

Since students perceive success to be commonly associated with accomplishing a task through to end, students commonly cited that an effective teacher commonly provides repeated opportunity and the time necessary for students to work through to end. Where

students faced difficulty teachers were able to provide initial support in order alleviate possible frustration and instead boost initial confidence.

As one Inuit teacher suggests:

> You can't do it for them, but they must have some initial success and persevere. We worry about students that are too depending on us, but that can't change overnight. Once they see more success in themselves they are willing to do more on their own. It's like blooming – if we feed them encouragement through their little successes it gets better. Tuqqassie.

This comment was affirmed by several students. For example:

> She'll [non-Inuit teacher] show us how to do it. Many times she'll show us. Then we try. She'll help us or we help each other. It will take time. She makes us do it on our own but first she will show us how. She can explain but showing me is [more] better. She can go away then. Tanner

Tanner's comments reiterate the comments made by *Inuugatigiit: The Curriculum from the Inuit Perspective* (GNWT, 1996). Provide short verbal instructions in a calm, positive, respectful voice and model tasks ensuring you provide time for students to learn. Eventually children are expected to do the whole task from beginning to end, but must have a sense of achieving progress as they work towards the end (p. 14)

Individual Attention to Support Learning

Building upon previous comments, students repeatedly made mention of the importance of someone, usually teachers being near students and observing them completing tasks with repeated assurance of them doing something properly. These comments were typically associated with mathematics where students were asked to complete something on their own. When asked about their most recent examples of success students often referred to completing numeracy or literacy-related tasks. As identified by Kanu (2002) students often required some form of temporary framework or scaffolding, at least until they were able to develop the skills to learn independently. Repeatedly classroom observations showed that these effective teachers or peers were supportive of other's learning through provision of direct guidance and assurance.

> In math we mainly work alone or groups after she has shown us how to do it. I like it when she shows us first and then helps us as I need help. You can get mad when it doesn't work, or you just want to stop but she can be there to help. Wayne

Local Contexts and Resources

Consistent with the community's aspirations for science education, students repeatedly responded positively to teachers and their inclusion of the local context as examples in their teaching. The underpinning mandate for the CRYSTAL initiative is to honour community aspirations for a two-way learning experience that advocates Inuit cultural knowledge and processes as thoughtful and purposeful (McKinley, 2001). The development of the resources is based upon the premises of culture-based education and the legitimization of local language, knowledge and processes (Bishop & Glynn, 1999) detailed previously in this paper and a foundation of education in Nunavut. Of particular importance to students was hearing the stories from elders or members of their community, especially in their first language.

As two teachers suggest:

> Hearing about people they know immediately evokes response from them. They can relate to the stories and their experiences. There is a significant sense of pride associated with hearing of stories most relevant to their lives. Elaine

> My experiences in this community are limited. But, every experience I have seems to translate into a story and students respond so well to this. Especially when it has to do with someone they know or a place they have been. Susan

Strongly embedded with these comments is the imperative importance of seeing the use of local context in supporting student learning. The underlying premise of culture-based education is similar to what is advocated in place-based education. Place-based education is rooted in place; that is, the organizing focus of the school is on the local socio-cultural, ecological setting. In place-based and culture-based education the role of schooling is to provide a secure, nurturing environment that reflects the culture of the community and promotes the participation of educational staff, students, families and the community in making decisions about learning. Teaching is grounded in what students are familiar with; actualities rather than abstractions. It emerges from the particular characteristics of place. It draws from the unique characteristics and strengths of the community and, thus, does not lend itself to duplication or replication. It promotes the use of community resource people and is inherently experiential drawing upon the opportunities provided by the local context and its people. As one non-Inuit teacher suggested:

> I had taught in a northern setting before, but here we have culture specialists available in the school to augment our teaching. I'll be teaching a topic and realize that there are points of view that can be addressed by the elder, so they come in. I get them to talk about a specific thing and it goes so well. [The District Authority Director] said he heard his son [who is my class] being taught about the weather from both me and the elder and thought that this way of having us both contributing was the ideal for his son. I tend to agree. It means both of us contribute to the learning. Ian

Ian himself could see the benefit of students experiencing 'two-way' learning. As well, as a teacher he is seen to be effective by the school community in that he draws upon the local community as a resource in a variety of ways, in particular in the inclusion of community members and their knowledge and skills in contributing to student learning. He also was able to address the tension that many teachers experience in drawing upon community members.

> Unfortunately using the Culture Specialists is not seen by everyone as a positive move. Some people have trouble believing the [elder's visits] are worthwhile and so they don't make the effort. Some people believe the money could be better spent elsewhere. I believe having them here [in the school] shows we respect that [traditional] knowledge and think it's important.

Inuugatigiit: The Curriculum from the Inuit Perspective (Government of NWT, 1996) asserts the importance of learning being embedded within the experience base of students. Inuit want learning to be just as meaningful today for today as it was in the past. It does not mean that learning only deals with the traditional and historical, but it must begin with the life of the child and their community (p. 14).

Reciprocal Learning

Several teachers reported that they found that making provision for students to share of their skills, experiences and knowledge in contributing to the classes learning was a significant strategy in promoting learning and a positive learning environment. Teachers, especially those non-Inuit, emphasized that they quickly realized that encouraging students to help each other was an important and positive vehicle for promoting learning.

> You learn pretty quickly that you don't have to be everywhere at one time. The students need individual support and they're quick to call upon their friends to help them. Chad

> It seems somewhere this year I realized that each student had something to contribute. Without expecting it, you'd be doing something and then, suddenly, they

> [referring to a quiet student or students] would have something to say and you would just sit and listen. I'd think if only I knew each of them really well I'd be able to draw upon that more. (Paul)
>
> He [our teacher] knows we can all do things [some better than others] and he'll get us to show the others or help each other. [A student's name] helps me in math and I help him with the words. We know we can help each other. He'll get us to help and we don't just need to use him. Wayne

Novel Opportunities

An interesting theme recognized by students was a sense of the unexpected and less orthodox experiences students might be introduced to as a result of their teachers' efforts. This comment was mentioned repeatedly in one schools' conversations and clarified through conversations in a further school.

> We work hard in her class and we don't expect anything. But she does these things that she doesn't need to do for us. I know she cares. Elisapee
>
> We sometimes wonder if she's planning something. She always lets us know when she's proud of us but then she brought a cake. We felt proud. Rebekah

As is mentioned in *Inuugatigiit: The Curriculum from the Inuit Perspective* (Government of NWT, 1996), students want a positive learning environment where there is fun, laughter and a sense of anticipation. Embedded within these comments are suggestions that students see a teacher that provides these novel and unexpected opportunities provides evidence to students that a teacher cares about their progress and is willing to tangibly honour their collective successes.

5.5 Effective Teaching Profile for Inuit Students

As stated earlier, the data collected from these multiple sources provides evidence of some prevalent themes associated with student perceptions of success and teacher- specific and culturally-determined classroom characteristics that influence student learning. In all cases, ideas presented are limited to those comments held consistently by teachers and students. These preliminary themes assist teachers in giving consideration to their own teaching practices and environments, primarily as a starting point for reflection upon whether their own classroom practices are responsive to the voice of their own students. As mentioned previously a culturally-responsive teacher should be able to 'problematize' their teaching

and question the nature of the student-teacher relationship, the curriculum and schooling in general. At the focus of this consideration are teacher perceptions of the source of problems if they are evident within their classrooms. Are problems located within the nature of students and their culture or are problems manifest in their own interactions and relationships as teachers with students? If they are located within their interactions and practices within classrooms, are they willing to respond so they are able to work towards the establishment of a positive learning environment?

Similar to the work of Bishop and colleagues, based on the comments made by students and the information collected from teachers and Inuit educators (Government of NWT, 1996) an effective teaching profile for teachers of Middle-Years Inuit students is presented herewith.

1. Effective teachers give consideration to how their students define educational success. They consider what their students perceive as success based upon recognition of where students themselves are proud of their achievements. Accordingly, they reposition their efforts to acknowledge success from students' terms, especially in giving regard to perseverance and working through to an end as opposed to simply evaluating the product and placing greater regard on the evaluation outcome. Accompanying this attribute is ensuring that the experiences provided for students have 'working to end' opportunities based upon practical, first-hand experiences.

2. Effective teachers re-consider what they believe to be the attributes of a positive learning environment in response to what their students identify as a positive learning environment. They re-position themselves in their role and interactions with students in developing a more co-operative, co-generated learning environment. They are caring, consistent, interested and connected teachers.

3. Effective teachers communicate to their students that they care about students' educational success and that students can succeed. They do not see deficits in their students. They communicate that they work to foster that success and that they want to succeed and are committed to fostering students' success. They are willing to enter into

conversations about what they can do to foster their students' learning. As Noddings (1996) suggests caring is manifest in actions: it delights, challenges, responds and affirms.

4. Effective teachers allow room for the use of students' first language in the classroom. They respond to how students seek to understand their instructions and develop new strategies and protocols such as using the human resources available to them, including other students and support workers in the classroom to communicate in students' first language.

5. Effective teachers communicate clearly and concisely with their students. Their communication in English is abbreviated and direct. It simplifies rather than complicates.

6. Effective teachers foster learning by using multiple instructional strategies such as direct instruction and modelling. They re-consider and change their pedagogical practice in light of how students respond to their teaching.

7. Effective teachers allow time and provide individual support to promote student learning. They develop an awareness of the pace at which their students work and need to complete work satisfactorily and the amount of individual attention they require in their learning.

8. Effective teachers establish reciprocal learning opportunities within their classroom. They recognize that others can contribute to the overall learning and will promote students to both seek out and provide support in learning as the need arises.

9. Effective teachers use local contexts and resource materials in their teaching. They do not believe that they are the central figure able to contribute to their students' learning. They attempt to use the local community and the resources within it to support students and their learning. They legitimize the knowledge and practices of the community by endorsing it within the classroom, especially through narratives about local people.

10. Effective teachers recognize that they *can* and *must* change their teaching to help students learn. They don't believe that students must learn the teacher's way and that the student-teacher and student-student interactions need to be controlled or defined by the teacher, but, instead, see the processes influencing student learning as opportunities to change their teaching to better suit their students. They make adjustments and even transformations to the orthodoxy of their practice to provide for the inclusion of practices reflective of the home culture (Harker, 1979).

What is noteworthy in this list of characteristics of effective teachers is the relative importance of place-based resource materials, especially those in students' first-language. From this study, it is evident that although place-based teaching resources are important supportive factors for effective teaching, the use of such resources is only part of the amalgam of an effective teacher profile. Stairs (1995) identifies in her culture-based model for teaching in Aboriginal settings (see Figure 3, p. 47) a variety of processes that need to be considered. It is noteworthy that the use of place-based content material is but one consideration. Stairs places even higher emphasis on the use of the ecological context (human resource and environment) and social and cognitive processes as essential elements for successful teaching in Aboriginal settings. This study would similarly support that the use of place-based resources similar to those developed and implemented through this project are only one dimension of contributors to fostering student learning. Students in this study assert that many of the factors influencing their learning are primarily associated with the social and interactive processes occurring within their classroom.

5.6 Summary Comments for Student Outcomes

This portion of the report has its origins in identifying through the voices of Middle-Years Inuit students what they perceive as educational success. Further, it gives consideration to what students primarily identify as the teacher specific and classroom characteristics that contribute to this success. It becomes quite evident that as much as the voices of the respondents contribute to an understanding of student success and contributors to success, the narratives paint quite vivid descriptions of teachers who have responded to their students and their backgrounds to create pedagogically preferred practices for creating

positive learning environments. Central to prompting these changes and successes are teachers who have deeply considered what they can do to best support the development of classrooms to foster student success. As two teachers suggest:

> You come north to teach and you want the experience to be different, not just in the community but in the classroom. Somewhere along the way I realized that the real [positive] experience here was to be gained by not living my southern life in the north, but instead responding to the opportunities [this community] offered. It was the same in my classroom. I wanted it to be different, but I had to be the one to respond. I knew the education would be different. I wanted it to be more reflective of this community and the students and their lives. I made some progress, but it needs to be the focus of all [the schools' teachers] of our conversations. How can we respond better to what our students are telling us about their schooling and learning? I know we don't ask that enough. If we did we would be making much more progress. Esther.

> If I look back at my first year here and compare it to how I teach after four years, I can see that my students haven't changed from year to year but I have. I want them to know I care about them, but also really care about their learning. I want them to do well and to do it well. I'm not easy on them but I also show I care. My approaches have changed. I try to give each student care and concern and let the class know we need to work together in our learning and that learning is really important. I'm more focused on them, not just what they do. I think they know that and that's why it works. Sharon.

At the heart of these changes is a regard by teachers accepting that *they* are the central player in fostering change, first in themselves in shifting power relationships and working collaboratively towards an environment where practices reflect the culture in which students are situated. Second, by changing their teaching practices so they assist students in their learning. For Middle Years students in the northern Qikiqtani, this study suggests that students *are* very aware of what *can* contribute to their learning. Culture-based education *should* and *must* reflect, validate and promote the culture and language of the Inuit of Nunavut. These experiences must be reflected not only in the management and operation of the school but also in the curricula and programs implemented and *pedagogies* utilized. Such is the nature of culturally responsive teaching; using the cultural knowledge, prior experiences, frames of reference, and performance styles of students to make learning encounters more relevant to and effective for them. Such is the challenge the outcomes of this study place on the educators of Inuit Middle Years' students.

Chapter Six: Summary and Implications

6.1 Summary Comments

This summary report has reported on several phases of a multiphase science education development project in three Inuit communities in the northern Qikiqtani Region of Nunavut, Canada. Although the Canadian Council on Learning (CCL) funding for this project is confined to only the development, implementation and evaluation of the influence of place-based resources developed in Inuktitut, it is believed by the participants of this project that because of the dissemination forum provided by CCL, the overall summary provided in this report should be a cumulative project outlining the chronology of the project and its overall findings.

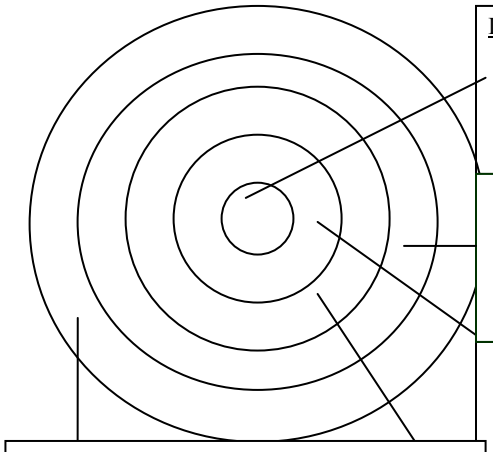
With the establishment of Nunavut and, ultimately, the *Education Act*, the territory faces the challenge of reversing assimilation and regaining a sense of identity especially within the processes that influence the education of their children. It is critically important that "culture-based education" is identified by the Government of Nunavut (GN) as one of the foundational principles for ongoing school development in Nunavut. The GN policy requires the activities of organizations, including schools, in Nunavut communities to create, preserve, promote, and enhance their culture, including arts, heritage and language. This policy is based upon the principle that culture, in all its expression, provides a foundation for learning and growth, and that the GN should support individuals, organizations and communities to promote, preserve and enhance their culture (GN, 2004). The underlying premise of culture-based education is that the educational experiences provided for children should reflect, validate and promote the culture and language of the Inuit of Nunavut. These experiences should be reflected not only in the management and operation of the school but also in the curricula and programs implemented, the processes by which these are developed and, finally, but not least of all, the pedagogy of classrooms.

The outcomes of this study provide considerable input into understanding the processes that impede and contribute to the realisation of education programs that combine the views of both worlds. In this summation, it is important to emphasize that although this

project attempted to 'combine the views of both worlds' in science education, it also attempted to combine the views of both worlds in achieving these goals through two process development models, Bronfenbrenner's bio-ecological model and *Inuit Qaujimajatuqangit.*

As CRYSTAL has worked over the past four years with these school communities, we have developed a deeper and broader awareness of the factors influencing programs that honour school community aspirations and the consequence of such programs on Nunavut students. We have also become more acutely aware of the inherent value of these two perspectives in understanding and assisting in the development process. Bronfenbrenner's bio-ecological view allows an encompassing overview which shows all the various influences both internal and external to the individual teacher that can add to or impede on her development. In regards to science education in Inuit settings, this model provides stakeholders a way of seeing the multitude of factors at all levels of society that may be preventing their educational aspirations to be reached. Although it assists in identifying these factors, it is does not provide insight into the relative magnitude of these factors nor the interrelationship among these factors and their influence on the realization of project goals. It does not suggest means by which progress can be made towards upsetting existing colonialist structures and progressing towards new means of strategizing. While it is important for all in society to be aware of the parameters through which systems operate, a Bronfenbrenner perspective potentially further perpetuates and reinforces beliefs of subordination as marginalised people exist and operate under a more dominant system. Whereas *Inuit Qaujimajatuqangit* clearly advocates for autonomy and freedom and to be in charge of one's own well-being and destiny, Bronfenbrenner's model, when used solely as a lens of identifying system factors influencing development, does not appear to advocate in any way for this autonomy and freedom. This model appears to show that one will always be at the mercy of such parameters of control. It illuminates but, potentially, provides no vehicle for resolving issues of domination and marginalization. We believe this highlights the strength of *Inuit Qaujimajatuqangit* because it is continuously seeking for ways to remove those parameters of control by placing development in the hands of collaboratively operating school communities. In order to avoid the future disappointment of what occurs in Nunavut classrooms, *Inuit Qaujimajatuqangit* seeks to ensure that school

communities are continuously pro-active, assertive and if necessary creative to ensure we are controlling what goes into the curriculum materials and the outcomes of such curriculum implementation. Although IQ is a body of knowledge and a synthesis of the unique cultural insights of Inuit into the workings of nature, its application goes beyond content inclusion of Nunavut science classrooms. More importantly *Inuit Qaujimajatuqangit* denotes traditional principles that are to be incorporated into all aspects of or used in the development of Nunavut policy and practice, including school governance and curricula and, possibly most importantly classroom interactions and pedagogy.



Individual - Personal Attribute Factors:
A. Supportive: teacher responsiveness to aspiration; teacher commitment; motivation; interest;
B. Risk: professional science knowledge; Inuit traditional knowledge; ESL teaching capability; science teaching professional adequacy.

Exosystem Factors:
A. Supportive: school community aspirations congruent with school's aspiration.
B. Risk: **coordinating support of local community in identifying and delivering traditional knowledge and IQ perspective.**

Microsystem Factors:
A. Supportive: collegial support among staff; positive attitudes to development process; access to traditional Inuit knowledge in schools (elders, audio & video).
B. Risk: student EL development; appropriate resource materials (English & Inuktitut).

Mesosystem Factors:
A. Supportive: senior administration & DEA responsiveness to aspiration.
B. Risk: **educational leadership within school that is committed to working toward this priority; school teacher-leaders or individuals that can support the development.**

Macrosystem Factors:
A. Supportive - government curriculum policy decisions in terms of Inuit perspective.
B. Risk – absence of a definitive science curriculum; **educational leadership from division for emphasis on improved instruction in line with culture-based pedagogy.**

Figure 6: Factors influencing two-way science implementation in Qikiqtani

Despite these limitations, the value of Bronfenbrenner's bio-ecological model is seen in how it provides a convenient lens to systematically identify potential multi-system factors impacting on science program delivery. It provides a foundation for developing mechanisms that accentuate the protective factors and mitigate the risk factors. Unlike *Inuit Qaujimajatuqangit,* it does not provide practical examples of processes or mechanisms that can guide development but instead assists in the identification of constraints and contributors to achieving success. It would appear that 'both-ways' are very valuable for

understanding and fostering school and classroom development, and not just in science education.

When both Bronfenbrenner's bio-ecological model and *Inuit Qaujimajatuqangit* are applied to the understanding of what has been realized from this project, a variety of conclusions can be made. Most importantly, it is evident that a broad amalgam of factors influence a school community's ability to accomplish its goals for curriculum enactment. The results indicate that although teachers may be the critical agents in the curriculum implementation process, teacher professional adequacy, knowledge, and interest are but one dimension in the complex matrix of factors that influence primary science delivery that combines the views of both world. This matrix is not limited to some of the more salient features (resource adequacy, time, professional support) that are commonly cited as impediments to effective science program delivery (Harlen, 1997). Figure 6 illustrates the factors seen to contributing to or impeding such aspirations within the communities involved in this study. It is noteworthy that some factors may be contributors in one community and impediments in the next. As an example, a critically important factor is whether educational leadership within the school is committed to working toward this priority. As well, school teacher-leaders or individuals that can support the development are exceptionally important contributors to culture-based education realization.

The illustration identifies a few critical factors (which are bolded) that are typically impediments to the achievement of culture-based education aspirations, especially factors largely ignored that reside within the meso, macro and microsystems. In very practical terms, of particular significance was the perceived role of school community leadership provided by the principal or curriculum leaders within the school who were willing to work with the District Education Authority's aspirations in influencing science curriculum implementation and program delivery. The project continues to assist the school communities in achieving their goals but is more aware of the critical role played by senior administrators and lead-teachers in working collaboratively to ensure the achievement of the project's goals. Of particular importance is ensuring that newly-appointed principals understand their role and responsibility in assisting District Education Authorities achieve project goals. As suggested by Goddard and Foster (2002) northern [Aboriginal] schools are commonly characterized by conflicting understandings between imported educators and

indigenous parents reflected in the significant linguistic, cultural and world-view differences between the dominant national society and the minority society of the community. Within the context of this ongoing study, of particular significance is the importance of the principal in working with the District Education Authority in influencing science curriculum implementation and program delivery consistent with community aspirations and place-based policy requirement; and not simply serving the administrative responsibilities expected by the education hierarchy. Curriculum focused leadership and a school culture that advocates collaborative curriculum development in science in conjunction with the support of family members to enhance educational opportunities for students are clearly strongly influential in positively influencing the attainment of these goals. The extent to which place-based educational opportunities for each school's children are realized will largely be based on the degree to which the principles of pilimmaksarniq and piliriqatigiinniq are enacted and stakeholders work collaboratively towards commonly identified aspirations.

Although the degree to which place-based educational opportunities are enacted at the classroom level is largely dependent on teacher personal attribute factors such as interest, capability and knowledge, the actual experiences that foster student learning and engagement go beyond the use of place-based materials. More importantly are likely to be the social and pedagogical practices teachers adopt in their classrooms. At the heart of these changes is regard by classroom teachers accepting that *they* are the central player in fostering change, first in themselves in shifting power relationships and working collaboratively towards an environment where practices reflect the culture in which students are situated. Northern Qikiqtani students *are* very aware of what *can* contribute to their learning. Culture-based education *should* and *must* reflect, validate and promote the culture and language of the Inuit of Nunavut. These experiences must be reflected not only in the management and operation of the school but also in the curricula and programs implemented and *pedagogies* utilized. Such is the nature of culturally-responsive teaching; using the cultural knowledge, prior experiences, frames of reference, and performance styles of students to make learning encounters more relevant to and effective for them. Although place-based resources contribute to a teacher's ability to provide meaningful learning experiences for Inuit students, there is much more to being an effective teacher in

Inuit settings than the use of relevant place-based resources. Teachers must consider the orthodoxy of their practice and modify their practice to allow for the social and interactive practices of their classrooms to be more reflective of the home culture their students represent.

6.2 Further Research

The overall focus of this research and development project has been to understand the processes influencing the development and implementation of place-based science education programs in Nunavut schools. The study has also endeavored to evaluate the effectiveness of these programs in terms of understanding how they influence student learning. It is apparent from this study that a variety of system factors influence the development and implementation of place-based science education programs at the community level.

The researchers and school communities represented by this research suggest the following major foci for future research and development projects. These foci primarily address understanding the processes and mechanisms that can assist in bringing about shifts in the orthodoxy of Nunavut schools and evaluating the influence of these changes on student educational outcomes.

- What management changes can be made at the Government of Nunavut level to ensure that 'culture-based' policy is enacted at the school and classroom level? What mechanisms are needed to ensure that these changes are realized at the school level? What is the influence of these changes on student learning and educational success in general?
- What mechanism can be implemented to ensure appropriate culturally-preferred practices are enacted at the classroom level by teachers, especially teachers not familiar with Inuit culture and its processes? What is the influence of these practices upon student learning and educational success in general?
- What mechanisms can be implemented at the territorial level to support the recruitment and development of teachers that have the capacity to respond to the preferred learning styles of Nunavut students? What is the influence of these practices upon student learning and educational success in general?
- Considering that most Nunavut classrooms are staffed by non-Inuktitut speaking teachers, what is the impact of the placement of an Inuktitut

speaking classroom assistant in each classroom as a supportive factor for mediating social and pedagogical interactions in classrooms?

- What mechanisms can be enacted using new-educational technologies to provide support for teachers in developing and implementing place-based educational materials across Nunavut? Furthermore, what is the impact of these efforts in terms of supporting students in their learning?

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Appendix One

Principal-Component Loadings for the SDEINS

	Factor					
Item Number	Pedagogical Capability – Cultural	Content Knowledge - Cultural	Pedagogical Capability - General	School Priority - General	School and Resources - Community Priority - Cultural	Teacher Interest
4	**.94**					
8	**.94**					
22	**.93**					
59	**.93**					
56	.93					
55	.93					
58	-.87					
25	.78					
35	**.76**					
12	.71					
33	.71					
6	-.64					
28		**.95**				
20		**.95**				
46		**.95**				
57		.95				
30		**.95**				
52		.90				
21		.78				
54		.72				
47		.66				
15			**.86**			

34	**.86**				
23	.82				
5	.80				
11	**.79**				
26	.73				
1	**.73**				
50	**.66**				
3	.59				
16		**.94**			
24		**.94**			
32		**.94**			
14		**.94**			
7		-.81			
29		.54			
42			**.92**		
2			**.90**		
36			**.89**		
37			**.75**		
18			**.73**		
13			.72		
53			.69		
51			.64		
48			.50		
49				**.83**	
38				**.68**	
11				**.49**	
45				**.43**	
17				**.41**	
39					**.87**
31					**.80**
27					**.72**

9							**.49**
Eigenvalue	15.5	8.4	7.3	7.1	5.1	3.3	2.6
Cumulative Variance (%)	28.8	44.4	57.8	71.0	80.5	86.6	91.5

Note: Loadings in **bold** represent items upon which the factors were interpreted and were retained for the final version of the SDEINS.

Appendix Two

Science Delivery Evaluation Instrument for Nunavut Schools

School Name: _____ Grade Level(s): _____

There are 28 questions in this questionnaire. Although you are encouraged to answer it on your own, you can decide to answer it (1) with a few other teachers or (2) as a whole school staff.

The sentences in this questionnaire all have to do with the teaching of science from the Inuit perspective. Students in Nunavut are encouraged to learn contemporary science within the context of Inuit history, values, traditions, beliefs, and, where appropriate, language (Department of Education, 2005). Students are encouraged to develop their understanding of both traditional and contemporary science knowledge. Learning of one and not the other limits the richness of the science learning experience provided for students in Nunavut schools. Instead science should be a blend of contemporary and traditional science knowledge built within the context of Inuit Qaujimajatuqangit (IQ).

Answer each question by circling the answer that you feel best describes your school in its ability to teach science that integrates both contemporary and traditional Inuit knowledge within the context of IQ. Be honest in your response. By answering them honestly you will help the school to identify how it might improve in its development to assist in improving the science experience it provides for its students.

Circle:
- SD if you *strongly disagree* with the statement.
- D if you *disagree* with the statement.
- N if you *neither agree nor disagree* with the statement
- A if you *agree* with the statement.
- SA if you *strongly agree* with the statement.

1.	I feel prepared to teach science from the perspective of Inuit values, beliefs and knowledge.	SD D N A SA
2.	I am supported in my effort to teach science from the perspective of Inuit culture and values.	SD D N A SA
3.	I have a good knowledge of the both the contemporary science and traditional knowledge we want students to learn.	SD D N A SA
4.	I have a good understanding of the science ideas we are to teach our students.	SD D N A SA
5.	I have the time to teach science from the perspective of Inuit culture and values.	SD D N A SA
6.	The school community places a strong emphasis on learning	

	science from the perspective of Inuit culture and values.	SD D N A SA
7.	The school has a formalized plan for what science topics are to be taught at each grade level.	SD D N A SA
8.	I have a good knowledge of ways to teach science that integrate contemporary science with an Inuit perspective.	SD D N A SA
9.	The school community supports me in teaching of science in a way that integrates science with an Inuit perspective.	SD D N A SA
10.	I have a good knowledge of the science ideas I am to teach from the perspective of Inuit culture and values.	SD D N A SA
11.	I have a good knowledge of the science content we are to teach.	SD D N A SA
12.	I have a positive attitude to teaching science from the the perspective of Inuit values, beliefs and knowledge.	SD D N A SA
13.	There is leadership from the school administration for the teaching of curricula such science from an Inuit perspective.	SD D N A SA
14.	I have a good knowledge of the strategies that are beneficial for helping students learn science.	SD D N A SA
15.	I have a good knowledge of local culture as it relates to the teaching of science.	SD D N A SA
16.	Our school administration supports the teaching of science from the perspective of Inuit culture and values.	SD D N A SA
17.	I have good background knowledge for teaching science from the perspective of Inuit culture and values.	SD D N A SA
18.	I am a confident science teacher.	SD D N A SA
19.	My students are interested in learning science from the perspective of Inuit culture and values.	SD D N A SA
20.	There is leadership from the divisional administration for the teaching of curricula like science from an Inuit perspective.	SD D N A SA
21.	The equipment I need to teach science is readily available.	SD D N A SA
22.	I have the skills to teach science from the perspective of Inuit culture and values.	SD D N A SA
23.	School community members help me to teach science from the perspective of Inuit culture and values.	SD D N A SA
24.	I am adequately prepared to teach science from the perspective of Inuit culture and values.	SD D N A SA
25.	I have a good understanding of the contemporary science knowledge that students are to learn.	SD D N A SA
26.	I am committed to teaching science from the perspective of Inuit culture and values.	SD D N A SA
27.	I have the resources and materials I need to teach science from the perspective of Inuit culture and values.	SD D N A SA
28.	I get the opportunity for science professional development as a teacher.	SD D N A SA

Thank-you for answering this questionnaire!

Sila: Weather Through the Seasons

A Two-Way Science Learning Unit for Inuit Elementary Students

Centre for Youth, Research, Science Teaching and Learning
University of Manitoba

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

September 2008

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Acknowledgments

The development of this resource for northern teachers and students especially in the northern Qikiqtani region has been made possible through the granting agency Canadian Council for Learning and Natural Sciences and Engineering Research Council. Their support has ensured that Inuit students are provided with the opportunity to learn about their culture, especially when they study science, in Inuktitut.

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As well, the school communities of Quluaq School In Clyde River, Ullajuk School in Pond Inlet and Atuguttaaluk School in Igloolik are thanked for their support in the development of the learning activities outlined in this booklet.

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Guiding Principles of the Unit

- Provide two-way learning experiences by integrating Inuit knowledge, ways of knowing, beliefs and values and contemporary scientific knowledge, processes and attitudes.
- Draw upon traditional and contemporary Inuit cultural examples as contexts for student learning.
- Include the local community and its people in students' learning opportunities as the classroom is an extension of the school and local community
- Foster language development in Inuktitut and, where required or encouraged, English.
- Use diagnostic and formative assessment to inform planning and teaching and monitor student learning.
- Engage students by starting lessons by providing first-hand experiences for students or drawing upon students' common experience.
- When using story to engage students, use the interrupted-story-line as a vehicle to prompt first-hand investigations.
- Deliberately promote scientific attitudes of mind (curiosity, problem-solving, working to end) through thoughtful independent consideration of questions and challenges posed.
- Move from the experiential, first-hand experiences to the psychological; that is, after providing concrete experiences assist students in making sense of experiences by using purposeful strategies to promote understanding such as role plays, illustrations and analogies.
- Assist students in their consolidation of ideas only as an extension of the initial experiential and psychological learning experiences.
- Within the lesson and throughout the unit, move from concrete to more abstract ideas.
- Provide opportunities for student-initiated and directed investigations.
- Provide opportunity for students to make connections among science and all other learning areas.
- Foster student independence, creativity and curiosity by providing opportunity for students' ideas and questions and follow-up opportunities for problem-solving and investigation.
- Provide students the opportunity to make connections between what they are learning and career opportunities.

Cross-Curricular Applications

This unit is developed with an emphasis on developing oral and written language skills within the context of weather, a topic invaluable to Inuit. The activities that are recommended encourage student expression of their experience in written, visual and oral form.

The unit has strong connections to appreciating the importance and diversity of weather conditions we experience within Nunavut, both within an historical and contemporary context. Particular emphasis is placed on understanding Sila, a life-force Inuit associate with weather. Students are encouraged to consider how weather conditions change, influence our lives and can be measured and understood. The focus on weather in this unit is inextricably linked to our knowledge about how weather conditions result and influence our lives. Focus is placed on students monitoring the weather and noting patterns and trends in weather leading to an understanding of the seasons. Finally, the unit looks at changes we are experiencing in weather patterns and the growing concern over climate change and its potential influence on the north.

Students are encouraged to explore through observation and measurement the variety of weather conditions within their immediate context, especially with the assistance of persons within the community who have experience and expertise in the suggested activities, both in traditional and contemporary knowledge. Stories about extreme weather conditions from community members can help to develop a rich understanding of weather and a greater sense of their own language and culture. There are obvious connections to mathematics and personal health and well-being. Teachers are encouraged to focus on students monitoring the weather and looking at patterns and trends in collected data. As well, the focus on the impact of weather upon our lives provides students with an appreciation of how our lives in the north are constantly influenced by weather conditions. The activities suggested are starting points. Broaden the focus by adding stories and activities of your own or from the experiential base of your community.

Conceptual Ideas and Progression

The recommended sequence for supporting student conceptual development of the phenomenon of weather is suggested below. For the most part, the activities and the conceptual and skill development embedded within the activities is sequential. Lower elementary experiences and ideas primarily focus on experiencing and communicating these experiences. Upper elementary experiences focus on understanding and investigating these experiences and appreciating applications of this understanding to their students' everyday world. It is suggested teachers address the following key ideas:

Lower Elementary (Grades 1-3):

- We have words to describe the weather we observe.
- Weather influences our activities and the activities of other living things.
- Inuit have very specialized words to describe weather conditions such as wind
- When we talk about the weather we are talking about the air conditions and learning about SILA.
- We can make instruments to measure the weather.
- We have access to many accurate sources of weather information: temperature.
- We have access to many accurate sources of weather information: wind.
- We can monitor the weather. When we are monitoring the weather we are measuring different conditions of the air over time.

Upper Elementary (Grades 4-6)

- There are reasons from an Inuit perspective to explain why weather and seasons are the way they are.
- There are also scientific reasons to explain why the weather is the way it is.
- We can predict what the weather will be like.
- Most people have memories of severe weather.
- We need to be prepared for severe weather.
- Seasons are what we call times of year with more regular predictable weather and behavioral patterns.
- There are local beliefs about what causes the seasons.
- There are also scientific reasons for the cause of the seasons.
- There are suggestions that weather patterns are changing. This is what is called 'climate change'.
- Climate changes affect living things. Sometimes these changes cause extinction.
- Human beings are contributing to climate change.

Skills Development

This unit emphasizes that the learning of science ideas is inextricably linked to the development of the processes of science. As asserted by the Northwest Territories Elementary Science Primary Program Guide, the legislated curriculum for Nunavut schools, science experiences should provide opportunity for the development of conceptual understanding within the context of relevant investigative experiences. Although individual scientific process skills may be emphasized in specific activities, they are to be supported more holistically in teacher-facilitated or student-directed inquiry.

The skills to be developed are expected to be appropriate to the level of the learner. These skills and a typical developmental sequence are outlined in detail in the NWT Primary Program Guide. Attention is given to providing students with first-hand experiences that promote skills such as:

Observing	Communicating
Classifying	Measuring
Predicting	Planning Investigations
Inferring	Interpreting Information
Recording	Formulating Investigative Questions

These skills involve coordination between cognitive and muscular skills, often referred to as psychomotor skills. Handling and manipulating equipment require not just the physical ability to perform a task but also the intellect to know how to measure or observe accurately. It is anticipated that by the end of upper elementary a student might be able to, with assistance, conduct a scientific investigation. This unit provides opportunities for students to work physically and cognitively towards this end.

Attitudes and Beliefs Development

An explicit goal in the development of this resource and the other resources being developed in this Qikiqtani project and the accompanying professional development provided for teachers is to use these as a vehicle to contribute to student 'success' in science. Although success in science is often attributed to measurable outcomes such as knowledge acquisition and development, the intent of this development project is much more encompassing. It extends this notion of success to investigate the influence of 'two-way' learning experiences on students' perceptions of success in their personal attitudes and beliefs.

What does success in science mean to Inuit students? It is anticipated that students will experience success in a variety of ways, beyond the border of knowledge into the domain of attitudes and beliefs. Attitudes are regarded as states of mind, behavior or conduct regarding some matter, as indicating opinion or purpose. The program of study suggested in the activities that follow will foster student curiosity and creativity, and openness to new ideas of thinking. As well students will develop confidence in their perceptions of self as students of science. Similarly they will develop confidence as evidenced in risk-taking and their effort to conduct science investigations. Their participation in the processes of science will foster their perseverance, precision and objectivity in solving scientific problems. As members of a team they will develop in their respect for and ability to work co-operatively towards purposeful goals with their peers.

Above all, it is anticipated that students will develop a more positive sense of themselves as Inuit in contemporary society as they learn about the inextricable link between science and the world in which they live. It is anticipated that students will see science as part of their life trajectory both in future formal and informal settings as a result of science study that advocates 'two-way' learning.

Curriculum Applications

In this context, the conceptual knowledge base and essential skills identified by these curricula are paired with Inuit cultural values, beliefs, and heritage to become the cornerstone of the learning provided in this unit. Both the Pan-Canadian and NWT curriculum address the concept of Weather at Kindergarten, Grade 1-2 and Grade 5-6. Consequently, this unit addresses both lower and upper elementary learning objectives. It is suggested that teachers of Grade 5-6 use many of the Grade 1-2 (Lower Elementary) introductory activities as starting points for the Grade 5-6 learning objectives. The specific learning outcomes for the NWT Curriculum and Pan-Canadian Curriculum are not detailed here.

The General Learning Outcomes for both these levels include: Students will learn through investigations how sounds differ, how sound is created, how it travels and is influenced in its travels, and how it is sensed and measured.

Lower Elementary**:**

- Name and describe weather conditions.
- Identify and make equipment that is used to monitor weather.
- Monitor and note patterns in weather conditions.

Upper Elementary:

- Develop local understanding of the causes of weather conditions.
- Demonstrate an understanding of factors that cause weather conditions.
- Identify cultural and technological innovations that allow us to monitor and predict the weather.
- Understand how the sun influences seasonal change.
- Understand what is meant by climate change, its consequences and how humanity influences it.

Things to Consider in Preparing to Teach the Unit:

In order for you to foster the development of the conceptual knowledge base and essential skills paired with Inuit cultural values, beliefs, and heritage in this unit give consideration to the following:

Your students' capabilities and interests:

- What will be the language of instruction? If the language of instruction is English, how can you include and affirm Inuktitut in your instruction?
- Will students be keeping a written learning log? Again, will it include and affirm Inuktitut?
- What contexts suggested are likely to be of most interest and relevance to your students?
- Should the investigations suggested be teacher- or student-directed?

Your capabilities and interests:

- Consider the conceptual knowledge base, essential skills and Inuit cultural values, beliefs, and heritage affirmed by this unit. Where will you find the teaching challenging?

- What personal experiences, knowledge and skills can you bring to this unit? The unit provides opportunity for your strengths to be incorporated into the unit

The capabilities and interests of your teaching context:

This resource has been developed with consideration for northern especially the Qikiqtani region and its students. How can you work collaboratively with the school community to see the intentions of the unit a reality? Who are the individuals that can assist in ensuring ***Inuit Qaujimajatuqangit*** is incorporated into this unit.

About the Activities

Select a Starting Point:

Although a sequence of instruction has been provided for this unit of study your starting point will be a reflection of your students' backgrounds and interests. Upper elementary teachers are encouraged to start with the lower elementary activities.

Select Knowledge, Beliefs & Values to Develop:

Again consider the interests of your students especially in terms of their Inuit Qaujimajatuqangit background.

Select Appropriate Skills to Develop:

Consider the investigative abilities of your students. What investigative skills are most appropriate for your students? The investigations suggested could either be teacher-facilitated or student-directed depending on the capabilities of your students. What is most appropriate?

Develop an Instructional Sequence:

Use the information provided in previous sections of this resource to assist in developing a coherent instructional sequence. The list of activities is only a suggestion of what might be addressed. Focus on the General Learning Outcome: *Students will learn through investigations: the characteristics of weather, how weather is monitored and influences our lives, why it results, causes of the seasons, what is meant by climate change, its consequence and how we influence it.*

Activities

Lower Elementary: Grades K-3

We have words to describe the weather we observe

What you need

A board space to list and illustrate the daily weather conditions.
A wall space to compile a list of weather terms in both English and Inuktitut that are based on students observations
Daily Weather Report Log Sheet

What you do

- It is common practice for us to talk about the weather. For Inuit, words relating to weather are common and are associated with the word SILA – synonymous with the air, atmosphere or weather. For example, SILATTIAVAK means the weather is good and SILATTIAVAUNGITTUQ means the weather is bad.
- Provide a daily opportunity for you and your students to talk about the weather. These initial daily experiences which teachers often do with their students at the commencement of the day provide the foundation for many of the activities that follow. It is encouraged that you make the opportunity for a few minutes to talk about the weather each day and through the day, especially if the weather conditions change. The importance of students experiencing first-hand different weather conditions and linking words to these experiences is essential in assisting them in understanding that weather is a description of what the air is like at any given time and that patterns in weather conditions are associated with the seasons. It is likely that even during this unit of study students will be experiencing a seasonal change as evidenced in changes in temperature, wind conditions or precipitation.
- Although students have likely walked to school, provide students on a daily basis over a few weeks with time to experience first-hand the weather conditions as a class. This might mean escorting the students outside onto the school steps or an open area where they can observe the weather. Try to use the same time each day because, again, students may see changes in the sun's position over the few weeks the observations take place. Ask students to:

Look:

- Is there a sun in the sky? Is there a moon in the sky? Can they see the sun or moon in the distance? Where is it?
- If not, is it hidden by clouds? Is it totally hidden or partly? Is the sky clear or cloudy?
- What do the clouds look like? Do they look the same as they saw yesterday?
- Do they see anything in the air right in front of them, like fog, rain or snow? Was it like this yesterday?
- Can they see any evidence that it's windy? Are the power lines moving? Are birds like the ravens having trouble flying? Is anything being blown around by the wind? Is it windier today than yesterday?
- Emphasize that some things that relate to the weather can be seen: cloudy, sunny, windy although we don't see the wind, we only see what it does to objects. Also ask students to observe the behavior of animals such as human beings, ravens and dogs. In what ways is the weather influencing the activity of these living things?

Listen:

- Get students to close their eyes and listen? Can they hear rain? Can they hear wind? Can they hear sounds that people or machines are making? Would they be hearing these same sounds all year? Or, will some of these sounds only be around for a while because of the season we are currently in? If it is calm, can they hear things from a distance? If it is windy, can they hear the same things that they heard when it is calm?
- Emphasize that we can listen to the wind and rain. We can also tell when it's cold because sounds travel better in really cold, calm conditions.

Feel:

- Get students to make note what the air feels like against their skin, either on their arms of face. Does it feel cold, extremely cold or warm? Can they feel the wind? Can they feel the rain, fog or snow?
- Emphasize we can feel whether it's cold or warm, windy or if it is and raining or snowing. We can feel whether it is sunny or not

Smell:

- Get students to close their eyes and smell the air. Can they smell the rain? Can they smell the fog? The snow if it is snowing? The wind?
- Emphasize that we can smell the air, especially if there is moisture in the air like rain or mist.

- Return to the class and decide as a class what words best describe today's weather. An example of a description is often best illustrated by having an object at the front of the class that you want the students to describe. A good object to choose is an orange. How do we describe it? We can describe its appearance from observation, its feel against our skin, its smell through our nose. Similarly we can describe other objects like the steam coming off of a bowl of recently boiled water. Can we smell the steam? Feel it? Hear it? See it? In the same way how would we describe today's weather?
- Write and illustrate the weather conditions on the board- wall as these descriptions are made and decided upon as a class. If you are an English speaker gain the assistance of someone to ensure that the weather words have an Inuktitut equivalent beside them, possibly accompanied by a picture as well. Watch the use of the word sunny. Use the words clear or not cloudy as sunny only has any seasonal value.
- Write words in Inuktitut and English on the wall space that students are using to describe the weather in both languages if possible. Words commonly used are:

Very windy	Clear	Partly Clear
Little wind or breeze	Cloudy	Raining
Calm	Foggy	Drizzle
Snowing	Cold	Very Cold
Warm	Hot	Sunny

- Once these descriptions have been completed get students to enter their descriptions using words and illustrations on the weather log template. Note than in the template students are asked to illustrate what they might be able to do today after school dependent on the weather conditions. As students are completing their weather log ensure students share their ideas with others.
- Complete this process on a daily basis having students compare the weather conditions from day to day, and, if desired, during a day if the conditions are changing. Get them to some resolution of what might be a 'good weather' or 'bad weather' day.
- Note that the descriptions are all qualitative. No quantitative measurements are used at this stage.

What you look for

- Can they use a variety of words to describe the weather?
- Do students understand that when we are talking about the weather we are talking about the air conditions at that time?
- Do they understand that the weather can be observed, but we can also smell, hear and feel the weather?
- Can they deduce what a 'good weather' or 'bad weather' day is?

- Do they have an idea that weather can affect our life by influencing our decisions about the activities we do?
- Can they record information on a chart?

My Weather Diary

Date	Cloudy or Clear?	Very Windy, Windy or Calm?	Very Cold, Cold or Warm?	What will I do today after school?

Weather influences our activities and the activities of other living things

What you need:

Stories related to weather, seasons and activities.
Observations from diaries
Templates

What you do:

- Over the last few days students should have been observing weather conditions on a daily basis. These preliminary observations and the first entries in their Weather Diary should help them to appreciate that weather influences their lives.
- Read a story or two that show evidence activities are influenced by the weather.
- The template that follows asks students to complete sentences with word explanations and illustrations. It is presented in a way that draws from students' prior experiences in understanding that their activities are influenced by the weather. Complete this template first ensuring students draw upon their own experiences in making explanations and illustrations. Ask students to share their ideas with others as they complete their work. Ask students to explain why these differences in behavior occur.
- Once completed ask students how other living things respond to weather conditions. It might be that as you continue to do your daily monitoring and data entries in their Weather Diary you ask students to observe the behavior of animals such as human beings, ravens and dogs.
- Ask students to illustrate a picture that shows their impressions of what animals like human beings, dogs and birds do in various weather conditions. Again, encourage students to share their stories as they draw their pictures. Ask students to explain why these differences in behavior occur.

What you look for:

- Can students identify the relationship between activity and weather and explain why these relationships occur?

Weather I Do It or Not!

Use words and pictures to describe what you would do on days when it is:

The Weather	Words to Describe	Drawing
A Hot Summer day		
A Cold Summer Day		
A Blizzard in Winter		
A Warm Day in Springtime		

What do Animals do in These Weather Conditions?

It is a hot summer day in your town. There is a light wind. Draw a picture of what people and other animals like birds, dogs and other wild animals are doing on this day.

It is a cold winter day in your town. There is a very strong wind. Draw a picture of what people and other animals like birds, dogs and other wild animals are doing on this day.

Inuit have very specialized words to describe weather conditions such as wind

What you need

A variety of objects that belong to one common group – types of shoes, types of candies, types of writing tools
Plastic bags with many objects in them – pencil, pen, shoelace, stones, string,
Story about the wind

What you do

- Start the class by showing students 5 objects that belong to the same group. Get them to provide the name for each object. Are these names exactly the same? No.
- Now ask students to think about what they have in common. Provide students to think to end before they volunteer and answer. Call upon one student to volunteer an answer and another to verify. Are there alternative answers?
- Do again with another common group but this time add and object that does not belong. Again, call upon one student to volunteer an answer and another to verify. Are there alternative answers?
- Provide students with plastic bags that contain many different objects. Get them to place the objects on their desk and place objects that belong to the same group into categories. Get them to name these categories or get their friends to name these categories and justify their placement.
- Emphasize that we can have objects that have different names but they belong to the same group. This is the same for weather. There are many different types of wind as an example. Because wind influences our lives because of traveling and hunting, we have a variety of words to describe wind.
- Read the story about types of wind. Ask students to complete the table that describes each wind. An English equivalent is also provided.
- Get students to provide an illustration of what it would look like outside in these conditions. Maybe they might wish to draw a flag on a pole to illustrate their idea or two show how well they would be able to see in winter (visibility).
- Possibly you may wish children to demonstrate through acting what it would be like to be outside walking in these different winds.
- Having looked at words associated with wind you may wish to look at words associated with clouds and temperature.

What you look for

- Can they name the different types of wind?
- Can they relate the wind type to how it affects their environment?
- Do they understand why Inuit have so many different names for wind?
- Can they suggest the reasoning behind the gender of winds? Do they think this description is accurate?

Inuit have very specialize words to describe weather conditions such as wind

Wind names are listed below. Draw a picture to show what the wind would do to a flagpole or something outside.

Name of Wind in Inuktitut	Name of Wind in English	Picture of the Wind
	Calm	
	Breeze	
Anurajuktuk		
Anuraaqtuk		
	Very windy	
Anuraaqtuvigjuaraaluk		

Direction of Wind	Name of Wind	What kind of weather?
From Northwest	Avanngarniq	
From South	Uqquqsuq	
From Baffin Bay	Niggig	

Describing Winds: Based on an interview with Joelie Sanguya of Clyde River

It has always been important to know and understand the wind. The strength of the wind and its directions can help you to know what is ahead.

The wind is ANURI. We know the wind can have different speeds or forces. When it is calm it is IKULLIAQTUQ. A little bit of wind or a breeze is ANURAJAAQTUQ. If the breeze is a little stronger and begins to ripple the water and drift the snow it is ANURAJUKTUQ. More than this and it is windy or ANURAAQTUQ. There will now be drifting snow and waves on the water. If its very windy we would not travel if we had a choice and now the wind is called ANURAAQTUALUK. There would be very limited visibility and you would not be able to see. Only sometimes there has ever been severe or gale-force winds that are very destructive and this is ANURAAQTUVIGJUARAALUK.

We also have names for the directions of the winds. Depending on the direction of the wind the weather conditions will change because the air is coming from a different place. The coldest wind is from the northwest wind or AVANNGARNIQ. Especially in winter it is cold.
If the wind comes from Baffin Bay it is called NIGGIG. This wind usually brings moisture like fog or mist. The wind from the south-east from the Atlantic Ocean does to. If it comes from the south it is a warm wind and this is called UQQUQSUQ. This wind is important to Clyde River because we are the south of an inlet and this wind moves the ice away.

I remember in winter one time we went to Eglington Fjord to pick up fish with komatiq and skidoo. At night we made an igloo for shelter and during the night there was a very warm breeze (UQQUUJUMIK ANARAAQTUQ). This warm breeze was from the south so it was UQQUQSUQ. During the night the side of the igloo facing the south wind melted. I had never seen this wind do this during the dark season when it is so cold.

The words we have for wind are for Clyde River. They are likely different in another community.

Describing Winds: Based on an interview with Michel Kupaaq Piugaattuk IE-182.

The winds were very important to understand. They were influenced by SILA.

I have not heard about the east and the west direction, but for the north and the south winds were said to have SILA's spirit. The north wind was UANGNAQ. The south wind was NIGIQ.

The north wind's person was said to be a woman, while the man is the south wind. This was because of how they behaved.

The north wind was the harsh wind. It could make travel difficult and sometimes impossible. It would create drifts and we knew what wind had made these drifts. The drift caused by UANGNAQ was a hard tongue-shaped drift called UQLURUQ.

UANGNAQ was the prevailing wind. It was usually always there.

In the years past, the woman of course did not have any panty hose so what they did was to remove their footwear and get onto the bed platform and settle down in a squatting position. Because the north wind is the woman the storm can rage throughout the day. When night falls the wind will recede, that means that the woman had removed her footwear.

As for the south wind, it is said that men continue to be active even in the middle of the night, so when the south had been blowing throughout the day consistently, when the man starts to go visiting other shelters in the middle of the night, the wind will get much stronger at that time.

This wind will often bring moisture and new snow and smooth things over. Things will be settled.

These two winds were important. They had their own personalities.

When we talk about the weather we are talking about the air conditions and learning about SILA

What you need:

Watching the Weather activity.
Elder's story about SILA.

What you do:

- Over the last several days students should have been observing weather conditions on a daily basis. Use this information for students to answer the questions that follow on the Watching the Weather sheet that follows. There are many more questions that could be asked, but, at this stage, the focus has been placed on students answering questions based on the information in the chart. Other questions to consider might be whether there was a day the weather was bad? Good? What makes for a 'good weather' day? A 'bad weather' day? Although this activity doesn't directly support the learning of this objective, it does get students focusing on patterns and trends in the data collected. It also assists students in realizing that their daily activities can be influenced by the weather.
- The idea that weather is a description of air conditions is difficult to understand for students although they are likely able to realize that Inuit respect and take notice of the air, sea and the land. Their knowledge of SILA is likely in the familiar category. It is suggested that for younger elementary students this idea is introduced but not expected to be fully grasped conceptually. They need to think of themselves being in different environments to grasp any sense of what air conditions mean because for most students air is absence of anything. Air is believed to be empty space, when in fact it may contain water, dust particles, and gases such as oxygen and nitrogen. As well it is moving. A good simple way to help students understand that when we talk about weather conditions we are talking about the current air conditions and need to compare air conditions to water and soil or ground conditions. Students can do this by considering what it would be like if they could shrink or be miniaturized and be 'in' the water, or 'in' the soil or 'earth' or 'in' the air. Get students to think about shrinking themselves to the size of a pea and think about what it would be like in these different locations. What would they see? What would they feel? What would they smell? What would they hear? It is likely that they will have no trouble describing the water environment, but they may have trouble with the soil/earth and water environment. The template that follows requires students to think of

themselves in different environments and this might help in organizing their descriptions and illustrations. Assist them by considering:

What would they see right in front of them?
Would it be light or dark?
Would anything be moving?
Would they smell anything?
Would they feel anything on their face?

- Finally finish by reading the elder's story about SILA. Preferably, have someone come in to talk to your students about SILA. SILA has many human- and male-like dimensions and is synonymous with air and weather. The stories provide opportunity to not only more about Inuit cosmology but also values associated with respect for what is regarded as special. The earth-eggs are a geological reality in the north, often found near glaciers and exposed by erosion along coasts (check this site to learn of their origin in NZ - http://en.wikipedia.org/wiki/Moeraki_Boulders)

What you look for:

- Can they understand and appreciate the significance of SILA?
- Can students comprehend that their environment does change as they move to these locations?
- Can they comprehend that there is a difference among a water, liquid and air environment?
- Do they provide any detail that suggests that the water and air environments are fluid, whereas the rock environment is fixed and solid?

Understanding Weather: Based on an Interview with Zachariasie PANIPPAKUTTUK of Igloolik – IE201.

To understand the weather you need to understand SILA.

SILA is an old word; I am not certain what it is but SILA has to do with anything outdoors including the weather. A child must understand the outdoors and being sent outside to see SILA in the morning was part of the training. Upon returning indoors, we would always be asked how the weather was (SILA). We would say SILAALUK [atmosphere] when we refer to the sky above us or the surrounding.

From the root SILA we can have meaning meanings, for instance SILAITTUQ [absurd] a person who is not very smart. SILA is a huge mass, so SILAITTUQ [is someone who has a small amount of SILA], so it can be summed up as SILAISSUKTUQ, SILATUNGITTUQ [that means the person's thinking ability is very limited]. So it would appear as if one would shrink the SILA to describe this type of an individual. SILATUJUAALUK, [a wise person], or a person with huge SILA, this is the type of an individual is comparable to that of an individual who has a reasoning capacity of the huge mass of SILA.

I cannot fully understand what SILA can really mean. When a person goes outdoors he would say that he went out to SILA. On the hand we can term it as SILALUKTUQ [bad weather] or SILATTIAVAK [good weather].

It also can mean the air that we breathe. We understand when someone says SILATTIAVAK [good weather] or SILALUKTUQ [bad weather], or SILAQAJAANGITTUQ [with-out air]. When someone say that SILAQANANGITTUQ [that means way up in the atmosphere where there is no air]. It is no doubt that it is the whole part of SILA.

SILA could be angry. When there was bad weather it was always believed to be associated with someone breaking a taboo. Taboos are things that cannot be done. Should someone breach a certain taboo, their life would change. Perhaps they would get some kind of an illness or it might have an effect on the game animal that they hunted or it might change the weather because one person had breached a taboo. This was the most common occurrence when certain taboo had been breached. This is what was believed.

Land Eggs and Sila: A story based on an interview with George A. Kappianaq of Igloolik. IE 100

My mother used to tell me about a certain creature that could do anything to other things that resided in the waters. It has fluke like a whale with the upper body as a human with head. She used to mention this creature. It is said that it is a powerful creature. It can penetrate the earth and lives in the water. It is known as "TUUTALIK" [mermaid].

I heard that one was caught. They were afraid that it might take revenge so it was buried same as one would with humans. It was caught as one would with marine animal. I think they should not be caught. The one my mother told me about was a powerful creature one who a man can depend on for help. If you saw one it would look like an ordinary marine animal that can penetrate the earth and travel in the water at the same time.

It is said it is much larger than a human, possibly about the same size as a beluga whale. I have also heard about polar bears that have flukes like a whale, but the body is a polar bear with its fore legs and head. I guess they were from sea eggs. There are square flippers that are all white except that their backs have dark color. You would see on the harp seals back but the black markings are shaped like a diamond. It is said that one should not be caught as they are hatchings from sea eggs.

There are sea eggs that are known as SILAAT [earth eggs]. When they hatch, some are polar bears with square flippers that are white where it is supposed to be black. The fur is very pretty with white fur. They are albinos.

Should one kill one for their skin, this will result in death to whoever caught it before his time. Other misfortunes might befall this individual.

SILA would grieve the lost of her hatching so it was advised against hunting these particular animals. Even if one is tempted to hunt one of these animals you should leave them alone as there are others for the taking.

Grieving Sila: Based on an Interview with George Kappianaq of Igloolik. IE-97

One must also be careful about earth eggs [earthern spheres about the size of baseball to globe-size]. One must not break them or should take very good care of them nor should one take one home. They are much bigger than the bird eggs. The hatching from an earth egg is known as PUKIQ [Albino]. Be it a caribou fawn or a fully grown PUKIQ, it should not be killed because you like the rare species. The reason is that the SILA's [weather's] grieving is said to be powerful.

There are also earth eggs in the water. These will turn to marine animals. Last spring there was an earth egg that was seen in the water in the spring camp. I told everyone that they should leave it well alone. One time my cousin caught an albino yearling caribou in the spring time. What followed was a terrible snow storm. In the past people used to be hit with hard times when a foul weather unexpectedly came upon them which was said to be the SILA's way of grieving.

The eggs that are found in the water are called when they hatch as `SILAAN' [earth eggs]. This covers the bearded seals, polar bears, and narwhales in particular. It is said that when a bearded seal is albino you while be able to see a diamond shape mark on the back between the shoulders of the bearded seals. Should one come across this type of bearded seal no matter how close it may get especially when it appears as if it is not afraid and would splash dive, it is advised that this animal should be left alone. It is also said that in the event that one is caught SILA can make her grieving known in a powerful way.

These animals are very attractive and one would be tempted to catch one of these but they should stay away from them. All throughout the summer I kept seeing a PUKIQ. I kept seeing the same one throughout the summer well into the moon of AMIRAIJAUT [August]. The same caribou herd would get close to the littoral every now and then from the mountainous terrain. This particular PUKIQ was much bigger than the others in the herd. It was white with black marks on the back it was very visible. I have heard that we should not make attempts to catch these types of animals so I did not bother.

This past spring we saw a sea egg in the water on the beach. I told everyone to leave it alone. The water was shallow. It was a large egg. It was in the water resting at the bottom. The water was not too shallow but it was very clear.

I was afraid that someone might try and hook it with a fish hook. I told everyone to leave it alone. Whenever someone came up from the beach I would ask that if they had tried to get it.

What would have happened if someone took it? It would have caused bad weathers with strong winds and unpleasant weather conditions. This is usually the consequences when as earth or sea eggs are broken or the hatchings caught. It was not long ago that there was a terrible snow storm (in summer) when my cousin ARNARJJUAQ caught a caribou yearling that was to become a SILAAT. That summer our region was covered with snow with snow drifts formed right through although the Baffin Island was not affected. It was the cause of that catch according to the information he provided. The words of the elders came to pass at that time. So that's the reason why (PUKIIT) [albinos] should not be caught when there are others around.

I saw a PUKI once. Once in a while it would go down to the beach area with others. It was much bigger than caribous. It was all white including the skin on the leg. The back had darker fur. I watched it whenever it came down. If I had stalked it I would have easily caught it but I chose to leave it alone. This was in summer yet it was all white so it is very clear to see in the dark background.

I am going to say something I have heard from my mother. She used to lecture me on subjects that would ensure I would not experience bad things. It was believed that bad things such as bad weather or scarcity would come for some reason such as they did what they were not to do.

You did not want to grieve SILA by your actions.

Watching the Weather

Look at your Weather Diary and answer the following questions:

1. How many days was the air windy?

2. How many days was the air calm?

3. How many days was it cloudy?

4. How many days was it clear?

5. Which day was the coldest day?

6. Which day was the hottest day?

Draw a picture to show what you were doing after school on a:

Warm Day	**Windy Day**
Cold Day	**Wet Day**

If I Were There

What would it be like if you were made very small and were in these places? What would you see, feel, smell and hear? Draw a picture in the big space and write describing words in the small space.

In The Water of the Sea	In the Rocks on the Hills
In the Air on a Rainy, Windy Day	In the Air on a Clear, Sunny Day
Inside the Stomach of a Polar Bear	In the Shoe of a Student

We can use and make instruments to measure the weather: temperature

What you need

Thermometers – digital and bulb (check with the science teacher)
Wind socks or more
Contact with your local airport
More specialized equipment such as hydrometers, barometers and rain gauges if they are available
Pieces of rectangular card paper about 10 cm x 4 cm
A hole punch
A piece of string
A felt marker
Rulers
Access to television, internet weather reports
Access to a number line, preferably with negative numbers as well.

What you do

- Begin the lesson by showing students a weather report (possibly download from The Weather Network or actual broadcast from APTN) that shows the temperatures of the communities across Canada. Note that there will be a considerable range in temperatures and that the northern communities are likely to be the coldest. At a later stage consideration will be given to why northern communities are so cold.
- Ask students to note the temperatures of communities they are familiar with and record these temperatures as they are presented. If using the internet provide students with access to the Weather Network site and have students select Canadian cities. You may wish to provide students with the map of Canada provided with designated cities and get students to independently determine the temperatures of the cities listed.
- Once completed, ask students to explain what these temperatures represent. Students are quite likely to correctly suggest that temperature is an indication of how hot or cold something is. As objects gain more heat, they get hotter reflected in an increase in temperature. As objects cool, they get colder and this is reflected in a decrease in temperature. Thus when we talk about the temperature in Clyde River we are referring to the temperature of the air in Clyde River, not the water, or the temperature in a house or in our body.
- Introduce students to a thermometer. It is a measurer of heat content, generally the more the heat content, the higher the temperature. In a bulb thermometer, the addition of heat causes the liquid in the bulb to expand causing the liquid to be pushed up the channel in the thermometer. Conversely, if the thermometer is placed in something

cold, heat is removed causing the liquid to contract and to drop back down the channel. Ideally students should all be able to see the thermometer and note how when they place the bulb of the thermometer in their hands, the temperature goes up. If the thermometer is placed in water the temperature drops. If possible provide pairs or groups of students with a thermometer and have them observe the changes in liquid level in various objects.

- A good way to introduce the reading of a thermometer is to show students a number line. Possibly draw a number line vertically on the board and number it to show positive and negative numbers. Use a pointer to show numbers increasing or decreasing and stopping at points at which they have to read, as a class the point at which you stop. Use this exercise to assist students in determining how much temperature drops or increases as you go from 'temperature to temperature.
- Get students to make a 'thermometer' card by using a rectangular piece of card and punch a hole near the top and the bottom. Draw a line from hole to hole and mark points every 1 cm on it in intervals of 5 starting at -30. Try to get to +15 or so, which would provide the typical temperature range for a northern community. Take a section of string at least double the length of the distance between holes and dye half of the string with a felt marker. Loop the string through the holes and tie the string on the back of the card to form a loop. This string should now be able to be moved to show a 'change' in temperature.
- Ask students to make various temperatures in increments of 5 with their thermometer. That is, ask them to move the string so that it measures -25, etc. As they make a temperature, get them to share their results with their peers as a check.
- Continue to provide students with temperatures to make but use numbers that are not multiples of 5, making the process somewhat more challenging to students.
- Finally, provide students with some actual temperatures as listed below and see how well they can create the temperatures required.

Location	**Temperature**
Hot Day in Iqaluit	20 º C
Hot Day in Pond Inlet	15 º C
Hot Day in Toronto	35 º C
Cold Day in Iqaluit	-38 º C
Cold Day in Clyde River	-40º C
Cold Day in Toronto	-19º C

- Possibly students might each make a temperature on their thermometer and not let anyone know the temperature. They then place their thermometer on their desk. They also write their name on their thermometer. From there, students go quietly around the room and write down what they observe each person's thermometer reads. They record the person's name and temperature in their journal. Once all have

completed one-by-one the students read out their temperatures and the other students check to see if they read the correct answer.

- As a final assessment of students' progress, you may wish to have students visit various places in the school in order to measure air temperatures. Can they find the hottest and coldest locations in the school?

What you look for

- Can students read a number line?
- Can students read a thermometer?
- Do they have a sense that some numbers are lower or higher than others?
- Can they relate lower temperatures to lower numbers and colder conditions?
- Can they relate higher temperatures to higher numbers and warmer conditions?

Temperatures across Canada

What are the temperatures in these places today?

Place	Temperature	Hottest to Coldest (1-10)
Iqaluit		
Pond Inlet		
Clyde River		
Montreal		
Toronto		
Vancouver		
Ottawa		
New York		
Chicago		
Winnipeg		

1. What is the difference in temperature between Ottawa and Montreal?

2. What is the difference in temperature between Ottawa and Clyde River?

3. What is the difference in temperature between the hottest and coldest place?

4. What interests you about these temperatures? Do you have questions?

We can use and make instruments to measure the weather: wind speed

What you need

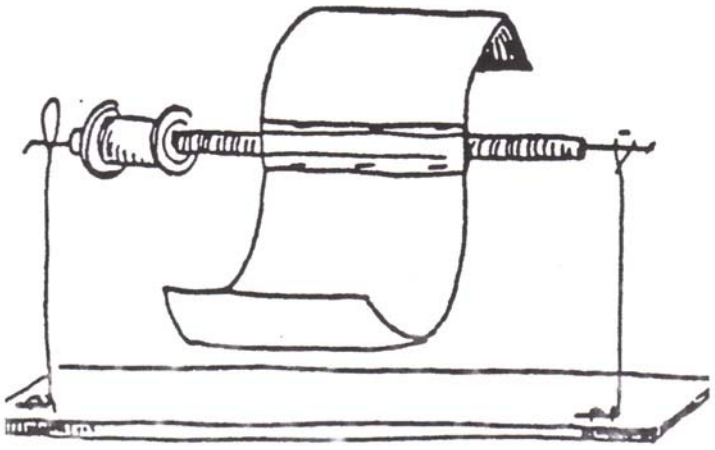
Lots of Plastic pop bottles
Scissors
Long thin pieces of wood
Stick pins

What you do

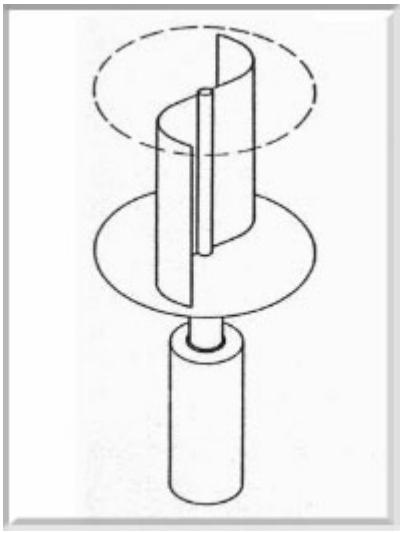
- Over the past few days the children have been noting changes in the wind. You have used words to describe the wind, such as calm and very windy. At this stage children don't need to know that we can measure wind speed but they should be able to recognize that the wind can move and sometimes it moves very fast. Its speed can be observed in various ways. The two activities that follow look at ways we can observe and hear the differences in wind speeds.
- Start by getting students to demonstrate speed as a movement pattern. The students might stand on one side of the class and you describe movement patterns and they have to respond accordingly. Make a game out of it possibly by doing something like Simon Says, be calm air or Gale-force air.
- Follow this with a simple construction activity that shows that the strength of the wind changes the volume of a sound-making object. If they are given a clean bottle, they should be aware that when they blow air across the mouth of the bottle, they can make a sound. The greater the wind speed, the greater the volume. As well, the amount of space in an object influences the pitch of sound.
- It probably is best for students to use the same size plastic pop bottle for this next activity. Students simply cut a long hole in the side of the bottle. You may wish to have a template for a standard size for all, such as a 'wiener-sized' template that is drawn with a marker onto each bottle. Students then secure the bottle onto a length of wood with a thumb tack. They then must plug the space at the bottom of the bottle with plasticine or some form of filler. You may wish to try these with and without the filler.

- Students then can take their objects outside and note any sound made. The stronger the winds the louder the sound. Students might go to various places near the school where there are differences in weed speed to note differences in volume. There is often an eerie quality to the sound, reminiscent of science fiction movies.(http://images.google.ca/imgres?imgurl=http://greatgreengadgets.com/gadgets/wp).
- Students can modify (and they will want to!) these by using different sizes of bottles or different sizes of slits. They should note that pitch is changes by the size of the hole or bottle, but wind speed changes the volume.
- Further to this, take another pop bottle and cut and fold out ‘flaps’ on two or four sides of the bottle as illustrated below. Be careful. Some plastic bottles are quite firm and cutting flaps can only be done with a very sharp blade which may require you to cut the flaps. Again, secure the bottles to a pencil or wood length with a tack but ensure the bottle can rotate freely in the wind or when blown upon. The speed at which it rotates gives a ‘measure’ of what the wind speed is. It is possible to count or measure the wind by coloring one of the flaps an easily observable color and counting how many rotations it does in a set period of time like10 seconds. This ‘count’ becomes a wind speed. This pop-bottle instrument is not much different than an anemometer used at the local airport for measuring wind speed. Students have probably seen this at the airport and may inquire as to what it does and how it works.
- Keep these instruments so that students can measure the wind speeds in the investigation that follows.

- There are many ways to make wind-speed measurers. Anything that moves freely in the wind that gives a ‘measure’ is good as a wind device. Below two further examples are shown. In both cases a hollow tube like a toilet paper roll or pop bottle with the top and botton cut off are cut to make two halves that can be secured to a straw by tape. Then, a skewer or something solid is placed through the straw so that a rotator is made. The rotor can be secured to something like some wire loops (paper clips) secured to pencils to provide a free rotation in the wind. As a matter of interest a spool from thread can be slipped onto the axle and can have a long piece of sting tied to it so that it acts like the reel for fishing line, but in this case winds up when there is a wind. This rotor with its string can now be tied to an object to haul or lift it in the wind.



- Students can also make a vertical rotor using the same materials as illustrated below.



What you look for

- Can students make the connection between wind speed and the differences they see in sound volumes and rotations of their pop bottle instruments?
- Are they able to think about other creative ways to measure wind speed?

We can monitor the weather. When we are monitoring the weather we are measuring conditions of the air over time

What you need

Wind Instruments made – especially the rotators
Thermometer
Planning and data recording sheets
Airport weather contact

What you do

- The purpose of this activity is to provide the opportunity for students to carry out a measurement-based investigation during a school day or a series of days during a school week.
- This is likely to be teacher-directed investigation whereby you decide the intent of the inquiry. It is possible students may have had questions relating to temperatures and wind speeds and these questions become the foundation for their own inquiry. The key is to focus on one or two key questions or statements and decide as a class how these might be answered through the collection of data and analysis of this data.
- Good questions are:

1. What is the warmest time of the school day?
2. What is the windiest time of the school day?

- It is important students answer these questions through systematic data gathering. They need to realize they need to use the same instrument and measure in the same way to get a reliable answer to their question. It is possible for students in groups to collect data every hour or so using the thermometer and wind-measurers. If you only have one thermometer, possibly you can collect this information and the students collect the wind measurements. A template is provided that helps in organizing students' thoughts. As well, a data collection table is provided.
- Possibly, at the start of each hour of the day students collect and record their data. Again, the wind speed is likely to be a simply a count of rotations which is sufficient in answering the question posed.
- Once they have collected the data, students are able to answer these two questions. That is:

1. What is the warmest time of the school day?
2. What is the windiest time of the school day?

Lead the students through to answering the question posed. Although students will have information for answering this question, you may wish to

use this as an opportunity for students to complete graphs for the data collected.

- The obvious follow-up to this first day investigation is to ask students if they think that this is always the warmest or windiest time of day. If so inclined, follow-up this investigation with one or two more days of investigations and in different seasons to determine if there is consistency in their answers across days at different times of year. A further template is provided that looks at a three-day investigation for wind speed and temperature changes. Again, this investigation might be done at different times of the year.
- This monitoring provides an opportunity for students to become aware of the weather monitoring that occurs at the local level at the airport. Ensure you seek out what is occurring at the local level. Your local weather monitor is a valuable resource person and will have had training in weather monitoring and understanding. Compare the data your class collect to that collected at the local level.

What you look for

- Can students understand the reasons for keeping the investigation systematic?
- Do students should initiative in posing questions to be asked and tentative answers for the questions asked?
- Are they persistent, co-operative and accurate in carrying out their investigations?
- Can they record and interpret data correctly?
- Can they make conclusions that answer their initial questions?
- Do they ask further questions for investigation?

Our Weather Investigation Planning Sheet

What is the question we want to answer?

How will we carry it out? Draw a picture or explain what you are going to do to answer the question?

Use this to help you think about how you will carry out the investigation.

What will you change?	What will you keep the same?	What will you measure? How will you measure? How often will you measure?

Our Weather Investigation Recording Sheet

Time of Day	Temperature	Wind Speed

Our 3-day Weather Investigation Recording Sheet

Time of Day	Temp Day 1	Wind Speed Day 1	Temp Day 2	Wind Speed Day 2	Temp Day 3	Wind Speed Day 3

Upper Elementary: (Grades 4-6)

There are reasons from an Inuit perspective to explain why weather and the seasons are the way they are

What you need

Stories from elders- a story is repeated here based on an elder's story from Igloolik

What you do

- Provide students with the opportunity to share stories they have heard that explain why certain weather conditions occur. Within your community are several beliefs that relate to why weather events occur. The information provided by John MacDonald in the appendix is invaluable to this aspect of your teaching.
- Allow students the opportunity to share these stories building upon each other's accounts.
- Read some of the stories provided or invite a community member into the school that can tell some of these stories to children.
- Allow students the opportunity to ask questions and seek answers to their questions.
- Are there things to be learned from the stories? It is likely that most stories provide some opportunity for the learning of cultural values relating to respect for their environment and others.
- Provide students the opportunity to illustrate these stories using the template that follows

What you look for

- Can students recall and provide an account of the stories they have heard relating to weather and the seasons?
- Can students identify things to be learned from the stories told?
- Can students illustrate with detail to the cause of the weather or seasonal change from the stories they have heard?

Grieving Sila: Based on an Interview with George Kappianaq of Igloolik. IE-97

One must also be careful about earth eggs [earthern spheres about the size of baseball to globe-size]. One must not break them or should take very good care of them nor should one take one home. They are much bigger than the bird eggs. The hatching from an earth egg is known as PUKIQ [Albino]. Be it a caribou fawn or a fully grown PUKIQ, it should not be killed because you like the rare species. The reason is that the SILA's [weather's] grieving is said to be powerful.

There are also earth eggs in the water. These will turn to marine animals. Last spring there was an earth egg that was seen in the water in the spring camp. I told everyone that they should leave it well alone. One time my cousin caught an albino yearling caribou in the spring time. What followed was a terrible snow storm. In the past people used to be hit with hard times when a foul weather unexpectedly came upon them which was said to be the SILA's way of grieving.

The eggs that are found in the water are called when they hatch as `SILAAN' [earth eggs]. This covers the bearded seals, polar bears, and narwhales in particular. It is said that when a bearded seal is albino you while be able to see a diamond shape mark on the back between the shoulders of the bearded seals. Should one come across this type of bearded seal no matter how close it may get especially when it appears as if it is not afraid and would splash dive, it is advised that this animal should be left alone. It is also said that in the event that one is caught SILA can make her grieving known in a powerful way.

These animals are very attractive and one would be tempted to catch one of these but they should stay away from them. All throughout the summer I kept seeing a PUKIQ. I kept seeing the same one throughout the summer well into the moon of AMIRAIJAUT [August]. The same caribou herd would get close to the littoral every now and then from the mountainous terrain. This particular PUKIQ was much bigger than the others in the herd. It was white with black

marks on the back it was very visible. I have heard that we should not make attempts to catch these types of animals so I did not bother.

This past spring we saw a sea egg in the water on the beach. I told everyone to leave it alone. The water was shallow. It was a large egg. It was in the water resting at the bottom. The water was not too shallow but it was very clear.

I was afraid that someone might try and hook it with a fish hook. I told everyone to leave it alone. Whenever someone came up from the beach I would ask that if they had tried to get it.

What would have happened if someone took it? It would have caused bad weathers with strong winds and unpleasant weather conditions. This is usually the consequences when as earth or sea eggs are broken or the hatchings caught. It was not long ago that there was a terrible snow storm (in summer) when my cousin ARNARJJUAQ caught a caribou yearling that was to become a SILAAT. That summer our region was covered with snow with snow drifts formed right through although the Baffin Island was not affected. It was the cause of that catch according to the information he provided. The words of the elders came to pass at that time. So that's the reason why (PUKIIT) [albinos] should not be caught when there are others around.

I saw a PUKI once. Once in a while it would go down to the beach area with others. It was much bigger than caribous. It was all white including the skin on the leg. The back had darker fur. I watched it whenever it came down. If I had stalked it I would have easily caught it but I chose to leave it alone. This was in summer yet it was all white so it is very clear to see in the dark background.

I am going to say something I have heard from my mother. She used to lecture me on subjects that would ensure I would not experience bad things. It was believed that bad things such as bad weather or scarcity would come for some reason such as they did what they were not to do.

You did not want to grieve SILA by your actions.

There are reasons from an Inuit perspective to explain weather

In the space below illustrate and describe one of the stories you have heard

What have you learned from this story?

There are also scientific reasons to explain why the weather is the way it is

What you need

Map of Canada with detail of Nunavut, preferably a wall map
Smaller 8.5 x 11 map of Nunavut
10-15 cm circles of white paper that can be written on
A felt pen
8.5 x 11 white paper
scissors

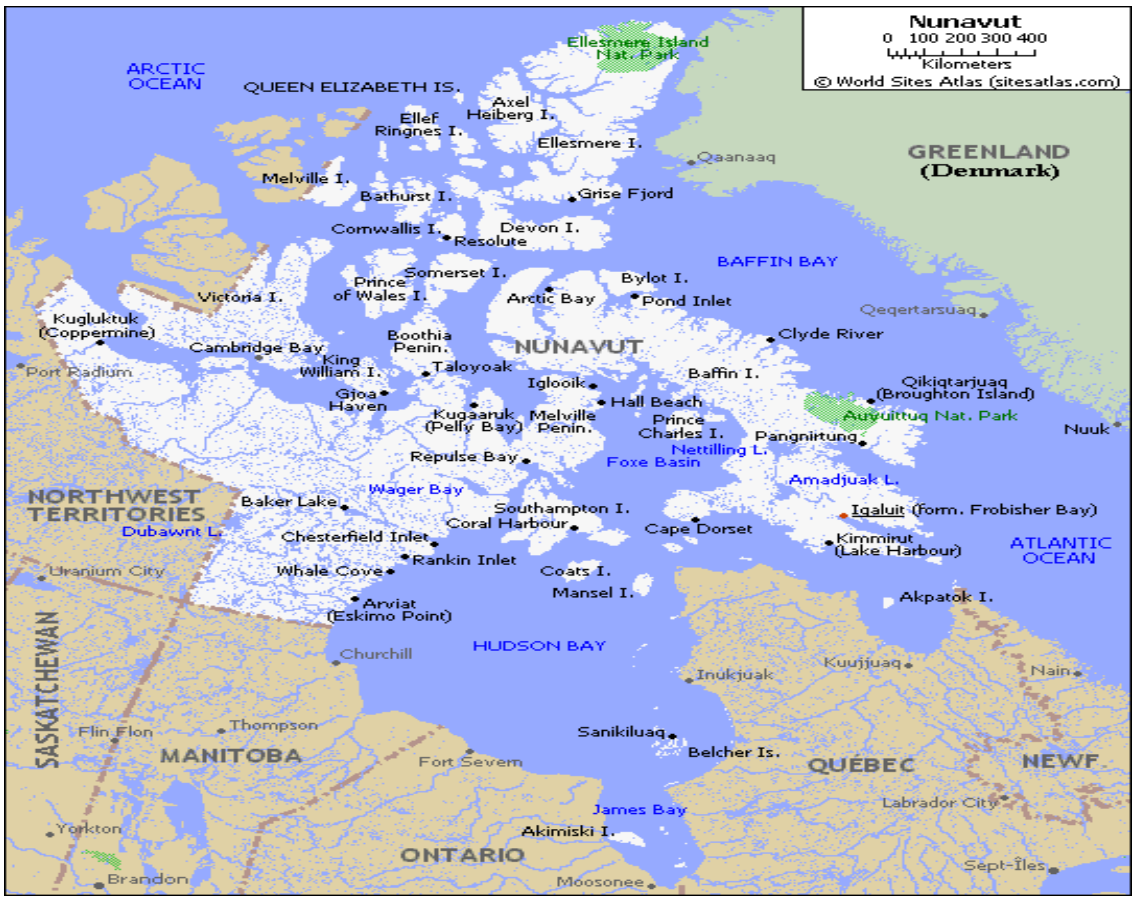
What you do

- The understanding of weather is quite difficult, but the model to be used here is very easy to understand. The seasonal weather is influenced mainly by differences in the sun's energy input because of the earth's tilt (i.e., higher energy input in summer than winter), but local weather conditions are explained by air movement.
- Begin by placing the wall map on the floor. Point out all places of significance and are likely to be either familiar or unfamiliar to students. Show them Baffin Island (Qikiqtani) and the location of communities in Baffin. Show them areas that are water in the summer such as Foxe Basin, Baffin Bay Coronation Gulf and Hudson Bay and the location of the permanent polar ice cap. Emphasize that there are areas that stay ice-free during the winter. Students should be aware that Baffin Bay has areas of open water between Baffin Island and Greenland.
- Take the small white circles and place them on the map. Place one over the Polar Ice cap and others in the Beaufort, Lancaster Sound, Hudson Bay and Baffin Bay.
- Tell students that these circles are like "blankets" and that if you were going to leave them just above the ground in these places what would they be like in the days to come. In other words what is the 'air' like in these areas? They should realize that the polar ice cap area would be very, very cold but dry. On the other hand the Atlantic Ocean near Labrador, Foxe Basin, Baffin and Hudson Bay would be cold and moist.
- Write on the circles with a marker words that describe each area – cold & dry or cold and moist.

- Now begin to move these circles towards your community. What would the weather be like if the air from these areas came to your town? Mention as well that as the air is moving it has a direction. That is, in Clyde River air travels easterly or north-easterly from Baffin Bay and it would bring cold and moist conditions.
- Continue to move circles from one area saying “What would the weather be like if air moved from Foxe Basin to…”.
- You want students to understand that air takes on the characteristics of where it has been and when it moves it takes that characteristic with it.
- The important one is the polar air mass. It brings very dry and cold conditions. It tends to dominate Nunavut weather.
- It becomes more difficult when we identify the ‘dry’ air as a high pressure system and the ‘moist’ air as a low pressure system. Highs are always dry (clear skies) and Lows are always moist (cloudy skies). When they come near each other the air rushes from high to low and this causes winds. You can expect that if it is windy in your community a low and a high are near each other. Pond Inlet tends to sit under polar highs and is thus clear, dry and cold. Clyde River, on the other hand tends to have moist air from Baffin Bay and the northern Atlantic Ocean closer at hand. Since the dry and moist air are closer in contact, Clyde tends to be a windier community. As well, the moist air tends to be warmer than the high arctic air.
- Have students in pairs cut out 6 or 7 smaller golf-ball sizes of white paper and place them around Nunavut, especially Baffin Bay, Hudson Bay, Polar Ice Cap, Atlantic Ocean, Foxe Basin. Using the words moist, cold, cloudy (low) and dry, cold, clear (high) have students write in words on the circles what the air would be like in these areas.
- Provide students with the “What is the weather like” handout that asks students to move air parcels from one area to another. Based on these movements they can deduce what the weather would be like in each community.
- Although this is a generalized model, it helps students to appreciate the movement of air and how each air mass influences our weather patterns.

What you look for

- Can they locate locations like communities and bodies of water in Nunavut?
- Can they logically deduce what the air conditions would be like in various places depending on whether there is open water or not?
- Can they attribute weather changes to the air mass present in area?



What Would the Weather Be Like?

1. Place your circles on

Baffin Bay, Hudson Bay, Foxe Basin, Coronation Gulf, Cornwallis Island, Polar Ice Cap.

2. Write the words moist, cloudy, cold air (low) on 3 of the areas. What are these three areas?

3. Write the words dry, cold, clear (high) on 2 of these areas. What are these two areas?

4. Move the air masses to the places below and write in the chart what the weather would be and what direction the air is moving from?

Air is from	Air moves to	Direction it moves from?	Weather it brings?
Baffin Bay	Clyde River		
Foxe Basin	Igloolik		
North Pole	Resolute Bay		
Hudson Bay	Arviat		
Cornwallis island	Pond Inlet		
Polar Ice Cap	Igloolik		
Atlantic Ocean	Kugluktuk		

We can predict what the weather will be like

What you need

Story about the winds from Joelie Sanguya and the moon from Ilkoo Antutiqjuak
Story from weather data collector, Terry Kalluk in Clyde River
Data sheet for data collection from internet site www.weaatheroffice.gc.ca

What you do

- Start the lesson by asking the class if we went to the gym and had a race, who would win? The students are likely going to have an answer, possibly a very reliable answer. Ask them how they know this? What evidence do they have that this person is the fastest? It is likely they know from experience. When we make an answer at it is based on our past experience, we are making a prediction. You may wish to test their ideas by going to the gym. If the person they predict did not win, maybe they can explain why their prediction was wrong. Did they fail to notice that someone else is getting faster? They weren't noticing. Maybe the person they thought was the fastest was changing and no longer able to run as fast. It is important to observe and note the changes that are occurring around us.
- You may wish to use a further example. Who will be the first to finish math today, or who will come to school tomorrow the earliest, or who will not miss school this month? In all cases we make predictions based upon our past experiences. We are usually right if we have been observant and if the person doesn't change.
- You may also ask student to look at some mathematical patterns. What is next?
- But, what about the weather? Is it changing? Are the weather patterns today changing? Do elders notice any changes in the patterns? The stories give evidence that weather prediction in areas such as Clyde River was based on observations of patterns and trends over time. In this unit our investigations tried to determine if there was a pattern in the daily wind patterns and temperatures. As an example, we would expect temperatures get warmer during the day and cooler as the sun begins to set. As well, in communities like Clyde River, the winds tend to be calmer in the morning and pick up during the day. These trends are observable and supported by observations. The stories presented give evidence that weather is becoming harder to predict. That is, the methods used to predict are not as reliable.

- Read these stories to the students. Allow them to ask questions related to the stories. Are other changes occurring that other members of our community are noticing?
- These questions provide opportunity for your students to talk to community members about weather changes. Possibly an elder might visit the classroom and talk about weather changes or possibly students might be required to ask an older person in their community if they have seen changes in the weather over the years. This conversation provided the foundation for discussing climate change later in the unit.
- In further lessons consider the information provide by the weather data collector in Clyde River, Terry Kalluk.
- Use this information to begin to predict the weather, especially noting what the pressure is doing. If it is increasing it will getting drier and clearer. If it is dropping, it will be getting cloudier and rain or snow could result. Also note the direction of the wind. This will tell you what temperature changes are likely. Remember Joelie's information about winds and temperatures.

What you look for

- Do they understand the idea of a pattern?
- Can they see that information is required to identify a pattern?
- Do they understand what a weather pattern is?
- Do they see why community members believe there are changes in weather patterns?

Patterns Around Us

1. The numbers below show a pattern. Figure out the pattern, write down the pattern and list the next two numbers:

a. 2 4 6 – pattern is the numbers go up by 2 – next are 10 & 12.

b. 1 2 3

c. 3 6 9

d. 5 10 15

e. 16 14 12

f. 30 25 21

g. 25 20 30 25 35

h. 2 7 17 32

i. 1 3 7 15

2. What is a pattern?

3. What are 5 changes are people seeing in the weather patterns?

4. People say it is hard to predict the weather. What does this mean? Why is harder to predict?

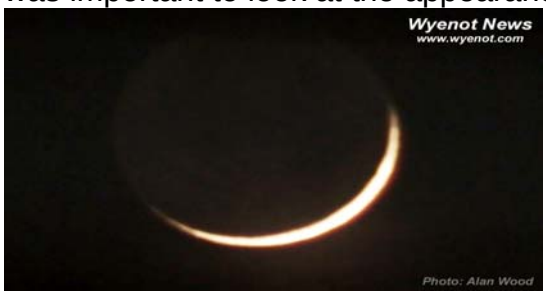
We can predict what the weather will be like

The Moon and Hunting: This is an adaptation of a story told by Ilkoo Antutiqjuak of Clyde River. It is a story repeated across the north.

From an early age I was shown to look at the moon (Taqqiq) and to know what the appearance of the moon meant. In those days we did not live in Clyde River. We lived in our camp near Sam Ford Fjord. There were many stories to be told that had to do with the moon. Sometimes we were told things that weren't stories. It was just important for us to know these things as they would be important in knowing what was ahead.

We did not have electricity or fuel in those days so the moon was very important in the dark season (Tauvikjuaq). For many weeks we would not see the sun, and the moon was our only light. It was during this time that it was very cold and hunting could be very hard.

The moon would tell us what the next month of weather and hunting would be like. We would look for the first sign of the moon after the new moon (Taqqilla). It was important to look at the appearance of the first moon.



We would look to see if it was leaning or not. When the moon comes out, and just before it starts to grow, if it comes out tilted up, there is a saying that goes: ANURIMIK NAKSARTUQ.[It is bringing wind] What it means is that the winds will prevail as the moon gets bigger. If it comes out in almost a vertical position, it is said that the weather will be fair. When it becomes a full moon, it is than called; NAAQQURUKPUQ [full moon]. When the moon starts to fade again, when it gets half they use to say that it is QULLILLUANNGUQPUQ [half moon]. It is shaped like a QULLIQ. That is the way it is usually referred to as.

We would look at the moon and if it was leaning we would still hope that the days ahead would be good for hunting. It was not always a sure thing. Nothing was ever certain, but it did make you hopeful. Today, things have changed. It is hard to predict the weather.

We can predict what the weather will be like

In Joelie's story he tells us that there we can predict the weather based on the direction of the wind. Finish the table.

Direction of Wind	Name of Wind	What kind of weather?
From Northwest	Avanngarniq	
From South	Uqquqsuq	
From Baffin Bay	Niggig	

In Ilkoo's story we are told they were able to predict the weather based on the moon.

Below are pictures of the moon. What do they mean for the weather?

Why do Ilkoo and Joelie say that it is harder to predict the weather today?

Describing and Changing Winds: Based on an interview with Joelie Sanguya of Clyde River

It has always been important to know and understand the winds. The strength of the wind and its directions can help you to know what is ahead, especially if you are traveling by water or overland.

The wind is ANURI. We know the wind can have different speeds or forces. When it is calm it is IKULLIAQTUQ. A little bit of wind or a breeze is ANURAAJAAQTUQ. If the breeze is a little stronger and begins to ripple the water and drift the snow it is ANURAJUKTUQ. More than this and it is windy or ANURAAQTUQ. There will now be drifting snow and waves on the water. If it's very windy we would not travel if we had a choice and now the wind is called ANURAAQTUALUK. There would be very limited visibility and you would not be able to see. Only sometimes there has ever been severe or gale-force winds that are very destructive and this is ANURAAQTUVIGJUARAALUK.

We also have names for the directions of the winds. Depending on the direction of the wind the weather conditions will change because the air is coming from a different place. The coldest wind is usually from the northwest wind or AVANNGARNIQ. Especially in winter it is cold. If the wind comes from Baffin Bay it is called NIGGIG. This wind usually brings moisture like fog and mist and snow. If it comes from the south it is a warm wind and this is called UQQUQSUQ. This wind is important to Clyde River because we are the south of an inlet and this wind moves the ice away. There is also the wind from the southwest – Uangnig – this wind causes Atirusijaqtuq – where there is a lot of drifting snow but it is clear in the sky. This is especially in the fjords and can make travel difficult.

When these winds came you knew what the conditions would be like – weather it would be foggy or cold or warm. But today, it is hard to predict the weather. The winds can change and what we think might come today, might not end up coming. We still know that if there is moisture or snow in the west, like near Igloolik we will get it hear too.

Monitoring and Predicting the Weather: Based on a conversation with Terry Kalluk of Clyde River

There were a few of us from Clyde River that decided we wanted to be airport controllers which involved learning about the weather. The training we took was at Forth Smith, N.W.T. When we first started we had to do all the testing ourselves. There was a small weather station beside the airport and we would read the temperatures, read a barometer that gave us the air pressure and other things.

It was always interesting to find out how high the clouds were from the ground. This was important as planes needed to know when they would break through the clouds as they descended to land the plane. We would fill a large balloon and time how long it would take to reach the clouds and disappear. Because we timed the balloon we could calculate how high the clouds were.

Things have changed though. Now it is all electronic equipment we use. The equipment we use now sends the information to a computer in the airport office. It gives us things like pressure, temperature, humidity and visibility. Every hour we sent this information through the computer to head office and this information gets sent to different weather centres across Canada. You can see the weather data from Clyde River on the weatheroffice.gc.ca website. The weather scientists then take this data and use computers to make a weather forecast. They can predict what the weather might be like for the next few days and again you can see the five day forecast on the website.

The important things to look for are the air pressure and wind direction. If the pressure is dropping a low pressure system might be coming our way and this will bring cloudier conditions and maybe rain or snow. If the pressure is getting higher it means that it will be clearer. In the winter when it is really cold and clear there is a polar high pressure system on us. If it's a low pressure system it likely came from the Atlantic area to the southeast.

You should try to predict what the weather will be like by using the pressures given on the website.

We Can Predict the Weather

Go to the weatheroffice.gc.ca website and find your community. For your community record the information for Day 1 below. Based on this information, especially the pressure and the wind direction, predict what you think the weather will be like tomorrow.

	Day 1	Prediction for Tomorrow (Day 2)
Temperature		
Air Pressure		
Visibility		
Humidity		
Windspeed & Direction		

How did you do?

Now try again. Write down the weather for today (Day 2) and use his information to predict for tomorrow.

	Day 2	Tomorrow
Temperature		
Air Pressure		
Visibility		
Humidity		
Windspeed & Direction		

Compare your forecast to the one on the weatheroffice. Is yours similar?

Most people have memories of severe weather

What you need

Elders' or family members' stories about severe weather
Drawing template that follows

What you do

- There will be no shortage of stories from community members that relate to severe weather. The key to the word 'severe' is that some physical or emotional hardship will be associated with the weather.
- Decide on a way to approach this idea. A likely start is calling upon students' own experiences. Have they experienced severe weather? Where? When? Possibly follow this up by inviting someone to your class that can give an account of an event or events that they are familiar with.
- Students could also ask family and community members about severe events.
- Are there readable stories about accounts that are associated with severe weather, both local and afar?
- Are there movies of severe weather events that are of interest to students that can be viewed?
- Can they access news reports that examine severe weather events?
- It is suggested that each time some information is accessed (guest, article, movie, etc.) students complete the chart attached and summarize the outcomes of the severe weather. They may wish to do an independent study on some type of severe weather such as tornadoes.

What you look for

- Can they list the name of the severe weather event?
- Can they list and illustrate its consequences?
- Can they identify that some of the outcomes of the event could have been averted.

Severe Weather

Draw and describe the severe weather events you have heard about or experienced through the stories heard.

Story One	**Story Two**
Who? Where? When?	**Who? Where? When?**
Drawing:	**Drawing:**
Story Three	**Story Four**
Who? Where? When?	**Who? Where? When?**
Drawing:	**Drawing:**

We need to be prepared for severe weather

What you need

Stories from elders and community members

What you do

- Begin by reviewing one of the stories heard or viewed previously. Get students to consider whether the situation could have been prevented? Was there a bad decision made or was what happened hard to predict? Were there good decisions made that possibly made the situation less serious?
- Use the framework provided to suggest what might have been done to avert the situation. Is it possible that there was no way for these situations to be averted?
- Get students to consider the other stories and situations. How could these situations have been averted?
- Use the grid to evaluate each situation.
- Finally, a start to a story is provided that describes a situation that could lead to trouble for two students. Get the students to change and finish the story **twice** so that it ends up causing trouble taking into consideration first, bad choices and second a good result because of good changes made.

What you look for

- Can students recognize that severe weather can cause serious problems for people if they make poor decisions?
- Can they identify that some of the outcomes of the event could have been averted.

We need to be prepared for severe weather

Severe Weather Event	What Happened?	What was done right?	What was done wrong?	What could they have done?

What did you learn about being prepared for severe weather? Write words and describe what you have learned.

Be prepared for severe weather

Finish this story:

Esther and James are going to go skidooing after school in the dark season when it is windy (ANURAAQTUQ). School has just finished and they decide to go to a place a few kilometers from the town on their own. They run out of the school when the school day ends excited about their ride. **Make one story about the bad choices they make and one about good choices.**

Seasons are what we call times of year with more regular predictable weather and behavioral patterns

What you need

Stories from you community about the seasons

What you do

- Start by having the class sit in 'special month of the year groups'. They are likely to choose their birthday, but they can choose a month for another reason such as an activity such as Stanley Cup playoffs. It is possible some months won't be covered by a birthday so get groups that finish early to do these months as well. Or, decide to do them as a class before students start their own month illustrations. Give each month a piece of paper and ask them to draw and write down what they typically do on their birthday. What activities do they do, especially? Do they play inside or out? What is happening in the community then? What are people doing? What are they wearing? What are they driving?
- Once completed get students to stand in a circle according to months and each group shares with the class what is happening during their month. Go around in a circle and emphasize when it is cooling and when it is getting warmer and how this influences our lives and the living and non-living world around us. Don't necessarily start with January. As well, ensure you go through the twelve months and then start again getting across the idea of a cycle.
- It is important for students to realize that Inuit have very specific and descriptive accounts of the environmental changes that occur around then because of changes in light and temperature. The stories that follow assist in giving students and appreciation of these specifics from two Qikiqtani communities.
- Start by reading one story and as it is read, have students complete a chart that lists the month in Inuktitut and the activity (if given) for each community.
- Ask students why these changes occur. Provide some information that suggests that we know there are observable changes in weather and behaviors for both living and non-living things and that these changes are because of changes in temperature because of the amount and intensity of light received. This latter idea will be covered within a further lesson.

What you look for

- Can students reason that there are observable changes in weather and behaviors for both living and non-living things?
- Can students understand that these changes are because of changes in temperature because of the amount and intensity of light received?

http://museum.gov.ns.ca/mnh/nature/nsbirds/plates/plate11.jpg

What's happening in My Special Month

Draw pictures and write words that describes your special month. What do you wear outside? What are you doing? What are other people doing?

Seasons are what we call times of year with more regular predictable weather and behavioral patterns

Name of Month in English	Name of Month in Clyde River and Pattern Observed	Name of Month in Pond Inlet and Pattern Observed	Name of Month in MY Community
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Months and Seasons of the Year: Based on an Interview with Mark IJJANGIAQ of Igloolik – IE 184.

There are patterns in the year. If you observe you will see them.

January was the month that the moon and the sun competed. We would look to see which one would appear first. We hoped the sun would appear first at this time.

I remember what I heard and indeed I did and still do is to smile at the sun when we saw it for the first time with only half of your face, while the other side of the face must be in a straight face. The reason was that it was going to get warmer once again, so one side of the face that smiles welcomes the warmer temperature to come, while the other still faces the reality that it is going to be cold for sometime longer. I still do that when I see the sun out in the horizon. I pretend to smile at the sun.

February was known as QANGATTAARSAN [the winter/ period when the sun gets higher] that is when the sun has returned and it was starting to get higher and higher.

The next one, the month of March was referred to as AVUNNIT [towards spring/ birth of premature seal pups], and the next, the month of April was called NATTIAN towards spring/ birth of the premature seal pups], that is when the seal pups are being born.

I am not certain about May, I believe it was NURRAIT [spring/ caribou calves], that is when the sun starts to melt the snow, but soon after that there is a period when it freezes everything, this period is called QIRSUQAQ, [or the freeze over], that is the time when the temperatures will plummet to freezing so that the ground that had previously melted will freeze over once again. It is at this time the caribous will give birth to their young. In the past there was a saying that the SILA [weather] does not have a bit of sympathy to the caribous. The reason of course being that when the caribous are giving birth to their young the weather usually gets really cold and the stormy. On the other hand, it is said that the SILA sympathizes with the seal pups. When the seal pups are being born, the weather will get really mild and the snow usually starts to fall blanketing the ground with soft snow. I use to hear often that the seals were adored by the SILA, whilst the caribous were not, even when the caribous had to give birth out in the open and the temperatures would be cold and the weather foul at this time. That is in the period of QIRSUQAQ in May.

Then in June, it is called TIRIGLUIT [early spring/ bearded seal]. This refers to the bearded seals, the [bearded seal pups are called TIRIGLUK] so therefore it is at this time the bearded seals give birth to their young.
For the month of July it is called MANNIIN, [spring/ eggs].

The next one being SAGGARUUT, [summer/ when the hairs on caribous had molted so that the new hair is now very thin].

The next is AKULLIRUUT [summer]. When the hair on a caribou is prime as they are not too thin nor are they too thick, the word means the middle.

September is AMIRAIJAUT [towards autumn/ which is when the bull caribous velvet on their antlers starts to peel off]. This is an indication that it is now well on its way to the autumn.

October is UKIULLIRUUT [autumn/ beginning of winter]. This is when the hairs on caribous are now getting thick with their winter hair, later on in the winter the hairs will get even thicker.

The next is TUSARTUUT [early winter/ when one is able to hear from another camp]. This is the time when the sea has frozen over so it is now possible to visit other camps in which they had not been able to do since the spring, so they are [now able to communicate with each other], thus TUSARTUUT.

Moons and Months of the Year: Based on an interview with Michel Kupaaq of Igloolik

In the past they use to name the month for the Moons in that month. January was called SIQINNAARUT. The next month February was called QANGATTAARSAN. The third month, March was called AVVUNNIQ. April was called NATTIJAN. May, the fifth month was called TIRIKLUK and at that time tents can now be used. The sixth was called NURRAIT. This is June and at this time the temperatures are getting warmer but at times it still get cold even sometimes the ground does not thaw out. It is also at this time that the caribou calves are born. The next one is MANNIK [July]. This is when birds start to lay eggs.

The next is called SAGGARUUT [August]. This is when the hairs on the caribou had molted and replaced with a thin hair. The next is known as AKKULLIRUUT. This is the time the plants called MALIKKAAN starts to uncoil. This period is the mid season where the warm temperatures had reached its peak and it would now start to get cold so that is why the plants MALIKKAAN start to uncoil. At this time the caribou skins are ripe for clothing. When the small lakes start to freeze over this is called AKKULLIRUUT [September] in some regions but for us in this region it is called AMIRAIJAUT [October]. This not only refers to the caribou antler velvets that might start to fall, it is also when the skins of the antlers of the KANAJUIT [sculpin fish] starts to peel off as well.

The next is when the bays start to form ice and the fur on the caribou start to get thicker is called UKIULIRUUT [November] and at this time also the caribous had started to mate. The next is when the ice had formed on the sea, as this was the period when there were no radios available for any type of communications with one another, so when the people were now able to visit another camp. This moon was called TUSAQTUUT [December]. At this time camps started to hear from one another.

Each full moon marked a season. There are 13 full moons during one year. One month always has two full moons. It would appear that the name for one moon has been lost because we had a name for all thirteen moons but now only use the names of the twelve months.

Seasons of the Year: This story is an adaptation of an interview with Joelie Sanguya of Clyde River).

In the calendar we use today there are 12 months. This calendar doesn't take into account the changes that are occurring around us because of the changes in the weather caused by the amount of light or the temperatures. For Inuit there are changes that we see in the environment. You can observe them.

I remember as a child TUSAQTUT (news-month). This is around November when it is getting colder and the ice is beginning to form. Up until then it had been open water and as the ice began to form we could slide and travel carefully on the ice and begin to share the news of what had happened over the summer. I remember my father making skis out of 2x4s so he could travel across the thin ice safely. December is TAUVGJUAQ. This was the start of the dark season. In QAUMMAGIAQ (January), the light returns. In QANGATTAAQSI (February) the seal begin to make spaces under the drifts on the ice to have their pups. This is followed by AVUNNIT (March) which is when the first seal pups would be born. In NATTIQQALIQTANGA (APRIL) is the main time the seal pups are born. As the weather gets warmer we could no longer stay in snow houses and we would need to move into tents. This was around May and we call this time TUPIQTUUT. The snow at this time melts during the day but still at night it might freeze. The snow would get a crust on it at night and this season in June is called QIQSUQQAQTUUT. As the snow begins to melt and there was not often freezing at night we would get the season of flooding which is IKSUUT or July. Around August we notice that the caribou hair is still very thin and the caribou skins were not good for clothing. We called this time SAGGARUUT. As it gets colder it often gets windier and this made for difficulty in traveling. So we called this season in September the season waiting because of winds or AMINAIJAUT. Again as it got colder we would see the velvet on the caribou coming off. This is around October and this time was called AMINAIJAUT.

All of these things we observed were caused by it getting warmer or colder. In the fall it would get colder and then in the spring it would get warmer. Today there is some change in these seasons. It is warmer and we see changes from the earlier days.

Seasons of the Year: This story is an adaptation of an interview with Jayko Peterlossie of Pond Inlet. It is not finished. Finish the story for your community

We have six seasons during the year. In the south they talk about spring, winter, summer and fall or autumn. It is not the same here.

Each season has different things we do mainly because of the changes that occur as it gets lighter and warmer or darker and colder.

The coldest time of the year is **UKIUQ**. This is in February or what we call QANGATAAGSAAQ. It could even be in March called AVUNNIIT.

As the light returns we start to enter early spring or **UPINGAKSAAQ** which is around April or NATTIJAN.

Then comes the month of May or TUPIQTUUN followed by QIQSUQAOTUUN or June. During this time we experience spring or **UPINGAAQ**.

July is IKSUUN. As we approach fall or **AUJAQ** it will be in August or SAGARUUN. Then there is September which we call AMARAIJAUN.

Fall or **UKIAKSAQ**

All of these things we observed were caused by it getting warmer or colder. In the fall it would get colder and then in the spring it would get warmer. Today there is some change in these seasons. It is warmer and we see changes from the earlier days.

There are scientific reasons for the cause of the seasons

What you need

Globes of the Earth (2) and a light bulb, preferably an open bulb like a lamp without a shade
Access to the internet Site explorelearning.com

What you do

- Ask students why we have seasons. That is why does it get cold as we move into winter and warm as we move into summer? Write this question on the board?
- Students typically incorrectly explain this because of the Earth moving further away from the Sun or, conversely, the Sun moving away from the Earth. Record students on the board as these will be explored. Northern students are likely to stay that its gets warmer as the sun returns and colder as the sun disappears? This answer has some merit as the sun's presence does make a difference but the closer answer is associated with both the intensity of the sunlight we receive and the amount of sunlight we receive. In summer the sun is up longer and it also strikes the north with more intensity. In winter the sun is not up as long and strikes the Earth with little intensity.
- To explain these ideas is very difficult and can only be done with the use of a model or a computer simulation.
- Have the students sit in a large circle and place a light bulb in the middle of the circle and turn off the lights. Talk to the students about this representing the sun and the limitations of using the light bulb as a model. That is it does create heat and light but it isn't made of glass and it is much larger.
- Then place a globe on the floor with the northern hemisphere tilted TOWARDS the sun about a metre from the light bulb. Students should see an illuminated side to the earth and that there is much more intensity on the northern hemisphere than the southern hemisphere. This 'time' is summer. As well students should see that at this time, one side of the Earth is in day and one is in night. Get students to look at the arctic and note that during a 'day' or one rotation of the Earth on its axis, the north gets much sunlight meaning the days are long and warm. In fact, above the arctic circle in summer, the arctic gets 24 hours of sunlight.
- Get students to consider what happens to the Earth in a YEAR. Students are likely to realize that during the year the Earth not only rotates on its axis, it also revolves around the sun once. So, in six months when it is winter the Earth is on the other side of the sun BUT now it's axis is causing the northern hemisphere to be tilted AWAY from the sun.

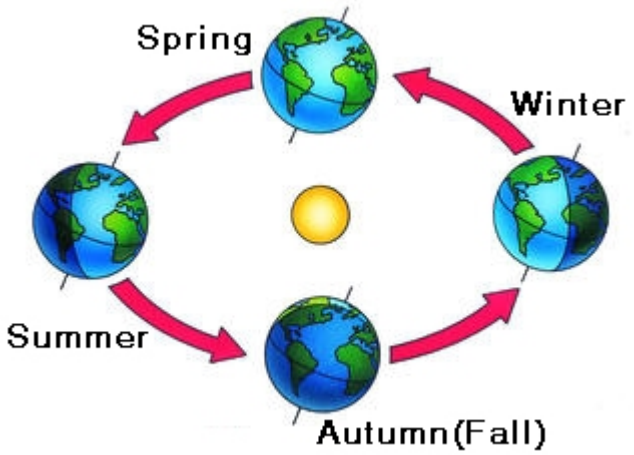
- Get students to look at the Earth at this time and note that now the north in northern hemisphere gets little intense sunlight and that the days are quite short. In fact, above the Arctic Circle, in the middle of winter, the arctic does not get ANY sunlight. Note as well that Earth is NOT further away from the sun. Distance does NOT cause the seasons.
- Thus, the tilt of the earth is responsible for the seasons. The northern hemisphere is tilted towards the sun in summer and away from the sun in winter. The tile causes different intensity and different amounts of sunlight through the day.
- It is not expected that students will learn this from one modeling session and you are encouraged to use this model and other internet options to show the Earth-sun relationship.

What you look for

- Can students explain the relationship between the sun and Earth during one day and one year?
- Can students explain why there is a summer and winter using this model based on the amount and intensity of sunlight received?

Explaining the Seasons

The picture below tries to show the movement of the Earth around the sun in a year.



1. Draw lines from the sun to the Earth to show the light from the sun striking the Earth in both summer and winter in the Northern Hemisphere. Note where the light is directly hitting the Earth in summer and winter
2. What is the difference between the way the sun's light hits the Earth in winter and summer? Why does this cause a difference to Nunavut in the summer and winter?

3. Does Nunavut get more sunlight in summer or winter?

4. Explain why.

There are suggestions that weather patterns are changing. This is what is called 'climate change'

What you need

Story by Jueli Sangya of Clyde River

What you do

- There are many opportunities here for students to develop and appreciation of how Inuit have been able to recognize subtle changes in their environment over time. As well, they attribute these changes to a warming environment.
- You might wish to begin by choosing one obliging and confident student and let the children in the class observe her very closely. Get students to look carefully at all of her features from head to toe. They might wish to draw a picture of their classmate from head to toe. Point out her details: clothing, hair, etc. Once the students have done their observation and drawing ask the students to wait quietly. Take the student outside and make a significant change to the student such as change her hair style or get her to wear something obviously different. Lead her back to the clas and ask the students to look at her again and through observation and without vocally disclosing identify any difference in the student. Make note of their ideas and, if the change is identified, remind students that because they were familiar with the student and had observed her closely they were able to identify the change. Repeat, but this time choose a minor characteristic to change such as how she ties her shoes, or roles a cuff on her trousers. If students gain make the correct observation change state the importance of only noticing changes if you are very, very familiar with the object.
- Continue by reading the story by Jueli Sangya of Clyde River. Focus on the months of the year and the activities he states are associated with each month. If you have not had students draw illustrations of these months it is suggested you do so as the story is read. Students are likely to have had first hand experiences with each of the seasons he mentions. As well, students might draw a picture alongside of what they do or know happens during this time of year. That is, what are their experiences at these times of year? Note that the changes are subtle. Only because of familiarity are we able to observe changes.
- It is suggested that students get the opportunity to explore through interviewing elders in pairs or hearing an elder's story of changes observed. If you are fortunate enough to have students connect with an elder have students use the information collected from the interview to

draw a picture showing the changes in the environment that their interviewee is aware of.

- Conclude this activity by emphasizing that the changes occurring are associated with changing patterns of temperatures and winds, not amount or intensity of sunlight. Also include a more definitive understanding of climate change which is a consistent noticeable change in the weather patterns, in this case for Clyde River warmer and windier.

What you look for

- Can students appreciate that some Inuit are careful observers of and are very, very familiar with their environment their environment and have been able to identify changes?
- Can they see that the changes are associated primarily with warming?
- Can they understand the meaning of climate change?

Changes in the Seasons of the Year: This story is an adaptation of an interview with Joelie Sanguya of Clyde River).

Before I told you about how there are seasons in the year .In the calendar we use today there are 12 months. These changes in the weather caused are by the amount of light or the temperatures. But now we are seeing that there are new changes and things are a bit different than they were.

In TUSAQTUT (newsmonth) which is November, it is getting colder and the ice is beginning to form the ice does not come as early. The thick ice for traveling takes longer to come. December is TAUVGJUAQ. This was the start of the dark season. In QAUMMAGIAQ (January), the light returns. These haven't changed. But, when we fish through the ice, the char are lighter in colour on their skin. Maybe this is because the char are eating different things that are living in the water. As well, the ice seems to be thinner, not as thick. The light from the sun still comes at the same time as winter begins to end. Some say there are changes in the light but most do not. In QANGATTAAQSI (February) the seal begin to make spaces under the drifts on the ice to have their pups. This is followed by AVUNNIT (March) which is when the first seal pups would be born. In NATTIQQALIQTANGA (APRIL) the main time the seal pups are born. This is the same. But we now see that it gets warmer sooner and the ice melts sooner. Before in the late spring the snow would get a crust on it at night and this season in June is called QIQSUQQAQTUUT. This is not as much now. There is crust on the snow not as much. In IKSUUT or July and around August we notice that there are new plnats that we have not seen before. We see some different birds and even in Iqaluit they say they see Robins which are usually only in the south. It gets colder later now. As it gets colder it often gets windier and this made for difficulty in traveling. Before the winds might be for only a day or two but now they last longer. So the season in September, the season waiting because of winds or AMINAIJAUT, this is windier.

All of these things we observe are caused by it getting warmer. The fall comes later and then in the spring it comes earlier. Today there is some change in these seasons. It is warmer and we see changes from the earlier days. There are other changes that people see as well.

There are suggestions that weather patterns are changing. This is what is called 'climate change'

In the space below draw pictures and explain with words the changes mentioned by the story teller.

Climate changes affect living things. Sometimes these changes have been known to cause extinction

What you need

Stories from the elders about climate change
Weblink - http://www.cbc.ca/news/background/climatechange/

What you do

- The NWT Dinosaurs book (green and likely to be in your school's resource room) is still an excellent resource on the best and most familiar example of extinction for younger students.
- Ask students why dinosaurs are no longer exist today. Record their answers?
- Explain the word extinct.
- Write this poem on the board and read this poem:

The dinosaurs are dead and gone;
Completely disappeared.
And no one knows the reason why –
It's very, very weird.
Some say that they lost their eggs,
And some say they froze,
But if you want the truth,
The fact is no one knows!

Tom Stainer MacDonald Educational (1980)

- Most scientists suggest that the Earth's cooling caused changes in the Earth to such an extent that Dinosaurs could no longer survive. Ask why they couldn't survive.
- Relate to the stories from the elders. What have they been saying about the climate in the north? What changes are they seeing evidence of? If it is warming could the same result occur – that is extinction?
- Get students to consider what could happen if the north does warm considerably. Can they consider the influence this might have on organisms knowing that already some changes have been observed?
- List some of these possible changes for selected plants and animals.
- Get students to illustrate what the consequences might be.

What you look for

- Can students understand the meaning of the word extinct/

- Can they understand why climate change may have caused the extinction of dinosaurs?
- Can they identify some of the possible effects of global warming on their environment, especially living things in their environment, including themselves?
- Can they see that at this stage many people are mistakingly already predicting extinction for northern animals when there is little evidence to support such a statement?

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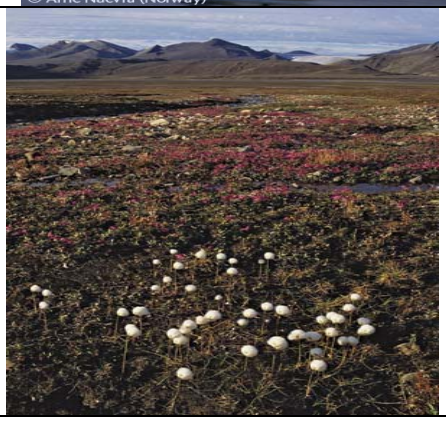
Climate changes affect living things. Sometimes these changes cause extinction

How might these things be affected by global warming?

Living Things	What Might Happen?
	
	
	

What is climate change?
What is extinction?
Why can climate change cause extinction?
Does climate change always lead to extinction?

Human beings are contributing to climate change

What you need

Jars or pop bottles with lids
Thermometers and water to measure temperature
Sun or artificial light source like a light bulb, even an overhead projector

What you do

- Start the lesson by placing a small and the same of water in a pop bottle. Possibly to a depth of 2 cm.
- Take the temperature of the water ensuring it's the same in both.
- Put the lid on ONE bottle.
- Tell students that you are going to place both of these bottles near the strong light source so the light exposure is direct. If the temperature is below zero outside the school, there is no option but to use a light source inside.
- Ask what they think will happen over time to the water.
- Record their suggestions.
- During this time prepare a graph of time versus temperature – the temperature is unlikely to get above 40 degrees.
- Let the bottles sit for a period of 15 minutes and then quickly take the water temperatures ensuring you replace the cap on one bottle when done.
- Record and plot the temperatures again.
- Continue to record the temperature for a long enough period to get a notable difference.
- Get students to come to some conclusion as to why this is happening.
- Show students the picture of the 'greenhouse effect" and explain that our atmosphere behaves like the cap and keeps warmth near our earth causing the water to warm.
- Let them know that many things that we do as humans, especially burning things like fuels and forests puts greenhouse gases in the air that makes the atmosphere more of a blanket or a 'thicker' cap that keeps the warmth in, causing the earth to warm.
- Get students to consider what are the major contributors of greenhouses gases our in our country and our community.
- Get students to consider what changes can be made by our community to contribute less greenhouse gas to the environment as we are all a part of the problem.

- Get students to consider what changes they and their family can make to contribute less greenhouse gases to the environment as we are all a part of the solution.
- Consider how the principles of *Inuit Qaujimajatuqangit* might be acted upon to make some decision within the school, community or classroom to support some solution to Global Warming and the reduction of greenhouse gas emission at the classroom or community level.
- Follow through with these principles on an issue important to your students.
- Act in some way for the environment.

What you look for

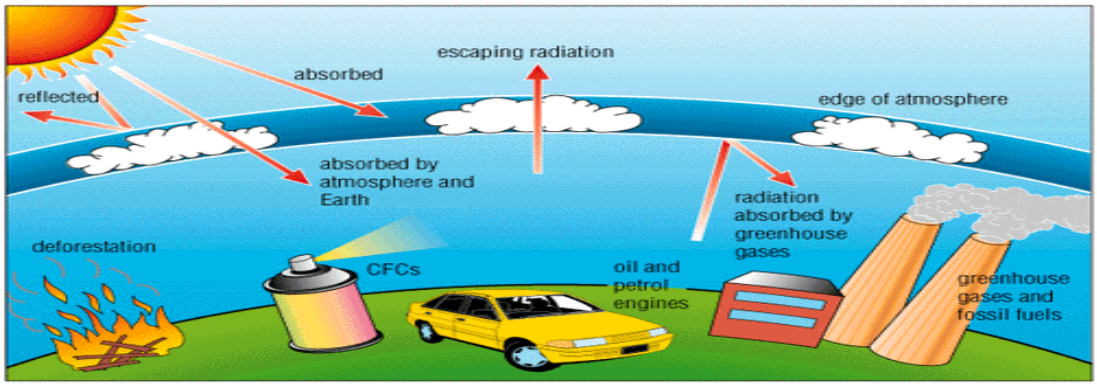
- Can students measure, record and plot their data?
- Can students make conclusions based upon their data?
- Can students make inferences about causes observed?
- Can students relate this investigation to the illustration of greenhouse gas emission?
- Can students make suggested sources of action based on the principles of IQ?

Human beings are contributing to climate change

Record your temperatures in the chart below

Time in Minutes	Bottle with Lid	Bottle with no lid
0		

Graph your results below



1. Explain why the temperature rose in one more than the other?

2. Use the picture below to explain how this investigation relates to the greenhouse effect.

Human beings are contributing to climate change:
Making a Plan and Acting Upon It

What changes can be made by our community to contribute less greenhouse gas to the environment? What changes can we make to contribute less greenhouse gases to the environment.

Below are the Principles of **Inuit Qaujimajatuqangit . How can we follow these in acting for our environment?**

(1) tunnganarniq (respecting others and relationships) (2) pijitsirniq (serving and providing for family and community especially for organizations within the community and who they serve) (3) aajiiqatigijnniq (ensuring all aspects of community development are fostered through decision making through collaboration and concensus) (4) pilimmaksarniq (development through practice and action ensuring members of the communities are full and meaningful partners community and social development activities) (5) piliriqatigiinniq (working together for a common cause) (6) qanuqtuurniq (being innovative in seeking solutions) (7) avatittinnik kamatsiarniq (respect and care for all aspects of the environment) and (8) inuuqatigiitsiarniq (fostering good spirit by being open and inclusive).

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MacDonald, J. (1998). The Arctic Sky: Inuit Astronomy, Star Lore, and Legend. Nunavut Research Institute, Iqaluit, Nunavut.

Nunavut Research Institute Archives, Igloolik, Nunavut.

Appendices

Describing Winds: Based on an interview with Joelie Sanguya of Clyde River

It has always been important to know and understand the wind. The strength of the wind and its directions can help you to know what is ahead.

The wind is ANURI. We know the wind can have different speeds or forces. When it is calm it is IKULLIAQTUQ. A little bit of wind or a breeze is ANURAJAAQTUQ. If the breeze is a little stronger and begins to ripple the water and drift the snow it is ANURAJUKTUQ. More than this and it is windy or ANURAAQTUQ. There will now be drifting snow and waves on the water. If its very windy we would not travel if we had a choice and now the wind is called ANURAAQTUALUK. There would be very limited visibility and you would not be able to see. Only sometimes there has ever been severe or gale-force winds that are very destructive and this is ANURAAQTUVIGJUARAALUK.

We also have names for the directions of the winds. Depending on the direction of the wind the weather conditions will change because the air is coming from a different place. The coldest wind is from the northwest wind or AVANNGARNIQ. Especially in winter it is cold.
If the wind comes from Baffin Bay it is called NIGGIG. This wind usually brings moisture like fog or mist. The wind from the south-east from the Atlantic Ocean does to. If it comes from the south it is a warm wind and this is called UQQUQSUQ. This wind is important to Clyde River because we are the south of an inlet and this wind moves the ice away.

I remember in winter one time we went to Eglington Fjord to pick up fish with komatiq and skidoo. At night we made an igloo for shelter and during the night there was a very warm breeze (UQQUUJUMIK ANARAAQTUQ). This warm breeze was from the south so it was UQQUQSUQ. During the night the side of the igloo facing the south wind melted. I had never seen this wind do this during the dark season when it is so cold.

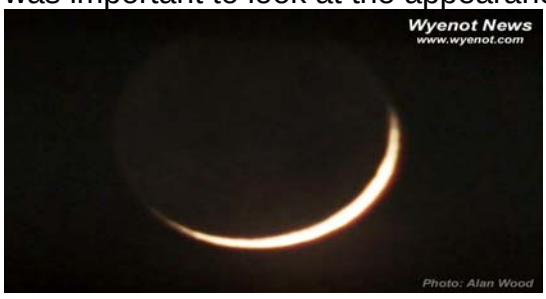
The words we have for wind are for Clyde River. They are likely different in another community.

The Moon and Hunting: This is an adaptation of a story told by Ilkoo Antutiqjuak of Clyde River. It is a story repeated across the north.

From an early age I was shown to look at the moon (Taqqiq) and to know what the appearance of the moon meant. In those days we did not live in Clyde River. We lived in our camp near Sam Ford Fjord. There were many stories to be told that had to do with the moon. Sometimes we were told things that weren't stories. It was just important for us to know these things as they would be important in knowing what was ahead.

We did not have electricity or fuel in those days so the moon was very important in the dark season (Tauvikjuaq). For many weeks we would not see the sun, and the moon was our only light. It was during this time that it was very cold and hunting could be very hard.

The moon would tell us what the next month of weather and hunting would be like. We would look for the first sign of the moon after the new moon (Taqqilla). It was important to look at the appearance of the first moon.



We would look to see if it was leaning or not. When the moon comes out, and just before it starts to grow, if it comes out tilted up, there is a saying that goes: ANURIMIK NAKSARTUQ.[It is bringing wind] What it means is that the winds will prevail as the moon gets bigger. If it comes out in almost a vertical position, it is said that the weather will be fair. When it becomes a full moon, it is than called; NAAQQURUKPUQ [full moon]. When the moon starts to fade again, when it gets half they use to say that it is QULLILLUANNGUQPUQ [half moon]. It is shaped like a QULLIQ. That is the way it is usually referred to as.

We would look at the moon and if it was leaning we would still hope that the days ahead would be good for hunting. It was not always a sure thing. Nothing was ever certain, but it did make you hopeful. Today, things have changed. It is hard to predict the weather.

Describing and Changing Winds: Based on an interview with Joelie Sanguya of Clyde River

It has always been important to know and understand the winds. The strength of the wind and its directions can help you to know what is ahead, especially if you are traveling by water or overland.

The wind is ANURI. We know the wind can have different speeds or forces. When it is calm it is IKULLIAQTUQ. A little bit of wind or a breeze is ANURAAJAAQTUQ. If the breeze is a little stronger and begins to ripple the water and drift the snow it is ANURAJUKTUQ. More than this and it is windy or ANURAAQTUQ. There will now be drifting snow and waves on the water. If it's very windy we would not travel if we had a choice and now the wind is called ANURAAQTUALUK. There would be very limited visibility and you would not be able to see. Only sometimes there has ever been severe or gale-force winds that are very destructive and this is ANURAAQTUVIGJUARAALUK.

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When these winds came you knew what the conditions would be like – weather it would be foggy or cold or warm. But today, it is hard to predict the weather. The winds can change and what we think might come today, might not end up coming. We still know that if there is moisture or snow in the west, like near Igloolik we will get it hear too.

Moons and Months of the Year: Based on an interview with Michel Kupaaq of Igloolik

In the past they use to name the month for the Moons in that month. January was called SIQINNAARUT. The next month February was called QANGATTAARSAN. The third month, March was called AVVUNNIQ. April was called NATTIJAN. May, the fifth month was called TIRIKLUK and at that time tents can now be used. The sixth was called NURRAIT. This is June and at this time the temperatures are getting warmer but at times it still get cold even sometimes the ground does not thaw out. It is also at this time that the caribou calves are born. The next one is MANNIK [July]. This is when birds start to lay eggs.

The next is called SAGGARUUT [August]. This is when the hairs on the caribou had molted and replaced with a thin hair. The next is known as AKKULLIRUUT. This is the time the plants called MALIKKAAN starts to uncoil. This period is the mid season where the warm temperatures had reached its peak and it would now start to get cold so that is why the plants MALIKKAAN start to uncoil. At this time the caribou skins are ripe for clothing. When the small lakes start to freeze over this is called AKKULLIRUUT [September] in some regions but for us in this region it is called AMIRAIJAUT [October]. This not only refers to the caribou antler velvets that might start to fall, it is also when the skins of the antlers of the KANAJUIT [sculpin fish] starts to peel off as well.

The next is when the bays start to form ice and the fur on the caribou start to get thicker is called UKIULIRUUT [November] and at this time also the caribous had started to mate. The next is when the ice had formed on the sea, as this was the period when there were no radios available for any type of communications with one another, so when the people were now able to visit another camp. This moon was called TUSAQTUUT [December]. At this time camps started to hear from one another.

Each full moon marked a season. There are 13 full moons during one year. One month always has two full moons. It would appear that the name for one moon has been lost because we had a name for all thirteen moons but now only use the names of the twelve months.

Seasons of the Year: This story is an adaptation of an interview with Joelie Sanguya of Clyde River).

In the calendar we use today there are 12 months. This calendar doesn't take into account the changes that are occurring around us because of the changes in the weather caused by the amount of light or the temperatures. For Inuit there are changes that we see in the environment. You can observe them.

I remember as a child TUSAQTUT (news-month). This is around November when it is getting colder and the ice is beginning to form. Up until then it had been open water and as the ice began to form we could slide and travel carefully on the ice and begin to share the news of what had happened over the summer. I remember my father making skis out of 2x4s so he could travel across the thin ice safely. December is TAUVGJUAQ. This was the start of the dark season. In QAUMMAGIAQ (January), the light returns. In QANGATTAAQSI (February) the seal begin to make spaces under the drifts on the ice to have their pups. This is followed by AVUNNIT (March) which is when the first seal pups would be born. In NATTIQQALIQTANGA (APRIL) is the main time the seal pups are born. As the weather gets warmer we could no longer stay in snow houses and we would need to move into tents. This was around May and we call this time TUPIQTUUT. The snow at this time melts during the day but still at night it might freeze. The snow would get a crust on it at night and this season in June is called QIQSUQQAQTUUT. As the snow begins to melt and there was not often freezing at night we would get the season of flooding which is IKSUUT or July. Around August we notice that the caribou hair is still very thin and the caribou skins were not good for clothing. We called this time SAGGARUUT. As it gets colder it often gets windier and this made for difficulty in traveling. So we called this season in September the season waiting because of winds or AMINAIJAUT. Again as it got colder we would see the velvet on the caribou coming off. This is around October and this time was called AMINAIJAUT.

All of these things we observed were caused by it getting warmer or colder. In the fall it would get colder and then in the spring it would get warmer. Today there is some change in these seasons. It is warmer and we see changes from the earlier days.

Inuit Qaujimajatuqangit

The information that follows is written by and used with permission from John MacDonald of Igloolik.

SILAGA NAUK? - Where is my Weather?

This chapter presents a selection of narrative, opinion, and observation on the broad topic of weather - "Sila" in Inuktitut – excerpted from interviews given by Inuit elders of Igloolik, a small community in Canada's Eastern Arctic, situated just below 70° north, in the territory of Nunavut. The chapter concludes with a short discussion on the changing significance of weather to a community concerned about its increasing separation from the natural environment in the face of on-going cultural loss.

The interview excerpts derive from the archives of the Igloolik Oral History Project, an on-going, community-based endeavour, begun in 1986 as collaboration between the Inuit elders of Igloolik and the Igloolik Research Centre. Concerned about the increasing loss and uncertain transmission of their language, cultural skills, traditions, and values, the elders resolved to record their histories, experiences, knowledge and teachings, primarily for the benefit of the community's youth, but also for the enlightenment the wider world beyond Igloolik.

Inuit elder's knowledge is characteristically personal, its acquisition and application, in varying degrees, specific to communities, families, and individuals. When imparting information elders usually made it plain that they were speaking for themselves, that their opinions were not necessarily correct in any absolute sense, and that others may, and in all probability did, have different views. Conversely, the attempt to crosscheck information between elders - to reach consensus on certain points – was often found to be counterproductive in that it was seen to question the validity of individual knowledge. [MacDonald, 1998:6]

With few of exceptions, the project's interviews are conducted in Inuktitut using an informal, conversational approach, encouraging elders to be as discursive as they wish. Those conducting the interviews come with a variety of motivations and interests: community members in quest of family histories; government-paid interviewers working under direction; film-makers in need of a script; and, of course, researchers pursuing a thesis or a paper. A number of the interviews are "self-recorded" and, in some cases, elders interviewed elders, prompting shared memories and engendering rich discourse. But regardless of the interviewer's specific aims, the elder usually, and always gently, takes control of the interview; a subtle process not always immediately apparent to the interviewer. This seemingly unstructured approach to information-gathering occasionally leads to frustration among academic researchers, sometimes impatiently, if privately, voiced as: "we ask elders specific questions but get general answers back!". In fact, the details are always there - embedded in a contextual matrix important to the narrator, if not always to the researcher. Clearly, elders prefer to be circumstantial rather than categorical. For an example of this principle in action see the excerpt below from Eli Amaaq's 1989 interview (IE-074) where he offers a wonderfully discursive response to the question: "did you ever experience rain in the wintertime?"

To date, the project has recorded over five hundred interviews on dozens of topics including legends, shamanism, traditional medicine, hunting techniques, skin preparation and sewing, astronomy, navigation, and social control. A number of interviews deal specifically with aspects of weather, but regardless of the particular topics under discussion, weather-related information,

perhaps not surprisingly, finds its way into the narratives of very many interviews, like driven snow through the cracks of a building. A simple word-search of the corpus reveals some 1500 references to weather, a similar number to wind, 3000 to snow, and over 7000 to ice.

A defining characteristic of all traditional Inuit societies was their ability, not only to comprehend the intricacies of Arctic weather and environment from their own spiritual and philosophical perspectives, but also to deal with it in practical terms. Inuit clothing and dwellings, for instance, relying solely on materials at hand stand as unsurpassed adaptations to the Arctic climate. In addition, their cosmology, cooperative social skills, comprehension of the land and its resources, and specialized hunting techniques, all combined to make a people competent and comfortable in a remarkably harsh environment.

The crucial role of weather in traditional Inuit society cannot be over-emphasized. Weather, in all its seasonal variety, was, and remains, the principal arbiter of Inuit subsistence activity, determining on any given day what might be hunted and where or, indeed, if there would be any hunting at all.

As an embodiment of nature, weather's manifestations, bad or good, were usually seen as a direct consequence of broken taboos followed by shamanic intervention and propitiation - the tangible product of an ever-fraught relationship between the human and the spirit worlds. Manifest as spirit, *Sila* was one of the most powerful and constant forces confronting Inuit in their day-to-day existence. Knud Rasmussen, tells us that among the people of Igloolik, - the Iglulingmiut - *Sila* is "regarded more than all else as a personification of weather" […] a "great, dangerous and divine spirit" that "lives somewhere 'up in the air', out in the universe, between sky and sea, hovering over earth; from there it threatens mankind through the mighty powers of nature, wind and sea, fog, rain and snowstorm". (Rasmussen 1929:71)

Sila is to be respected and, above all, carefully watched. Eli Amaaq tells us that the ability to observe and understand *Sila* is a mark of the real Inuk: "For us true Inuit it was like this. We were told always to observe [*Sila*] and be alert. This was important in order that we did not endanger ourselves unnecessarily. Human life was treasured and so that it not be lost due to carelessness we were told to be on the alert at all times..." (Eli Amaaq, 1989:IE-074)

The following texts have been selected with a view to presenting something of the broad perspective Iglulingmiut have on matters to do with weather and climate[i]. The texts cover a range of weather-related topics, from the spiritual and mythological (*Sila*), to the more "practical" aspects of weather such as observation, forecasting, and seasonal change. From the Inuit point of view such categories are artificial; in practice they overlap and interrelate, and we use them here merely to gather the material into some convenient, loosely-designated, topic groups.

The spirit of Sila

The power of Sila was said to mark certain people at birth: those born on fine days were known as silatiariktut *("carriers of good weather") while others, whose births happened to coincide with a period of bad weather, were called* silaluktut *("carriers of bad weather"). People marked in this way had the power to invoke certain weather conditions.*

> In Tunnunirusiq [the region around Arctic Bay, Nunavut] there was once an older hunter who lived in a camp with others. As the winter approached the snow was late in coming [and so igloos could not be built]. The people had no choice but to continue living in tents in spite of the cold. [...] The tents were becoming harder and harder to heat, even with added coverings. [One day] when the hunters were returning from their sealing, the old hunter [...] mentioned that he was a "carrier of bad weather" [...] adding that he very much wanted to have snow in order to build an igloo. He said he had decided to do something about it. So when they reached the camp he took his outer garments off and walked to a spot near-by where there be no one else around. The others, meanwhile, were putting away their hunting gear and sleds. [...]. The old hunter began to remove his footwear, and after that his upper clothing. All this time the temperature was severe [...] He now started to walk around, calling out: *Silaga nauk? Silaga nauk?, ungaa, ungaa…* ("Where is my weather? Where is my weather? Ungaa, Ungaa"). Finally he got down on the ground and rolled around. The others in the camp now came to see him, so he got dressed again, put his boots on and went back home. That very night the snow started to fall, becoming heavy as the clouds increased. At the same time the wind began to pick up, blowing throughout the night with such ferocity that a blizzard ensued. When the people of the camp woke the following morning they found that some of the snowdrifts had already hardened. In this way the old hunter succeeded in getting enough snow to build an igloo. **(Noah Piugaattuk, 1990: IE-148)**

The ability to control weather, particularly the winds, could be used for revenge and protection. A well-established tradition in Igloolik tells how a shaman took revenge on Parry's expedition, and by extension on all European visitors. When Parry left Igloolik in 1823 the shaman was said to have invoked wind and ice conditions of an order that would prevent Europeans from ever returning to the shores of Igloolik Island. Remarkably, over a century passed before another ship (the schooner Morrissey *- Captain R.A. Bartlett – in 1927) appeared in Igloolik's waters. Indeed, until the present era of icebreaker-escorted re-supply vessels, reaching the Island by ship was notoriously difficult and dangerous.*

> […] I have heard about an Inuk [shaman] called Quliiqaujaq. He stole a shovel [from Parry's ship] and was apprehended by the white people. Quliiqaujaq was taken on deck with his hands tied, and made to lie on his back. Because he had stolen the shovel, the white people wanted to cut off his arms. When they struck him with an axe it looked as if his arm was severed, in fact the axe blade would appear to go right through his arm and get wedged fast in the deck. But each time they struck him his arm was untouched. After numerous attempts had been made they gave it up. When the white people were done with Quliiqaujaq he blew them away and told them never to return again. **(Hervé Paniaq, 1990: IE-141)**

In Rosie Iqallijuq's version of the same event, philandering rather than theft is given as the real motive for the shaman's revenge. Interestingly, her account also tells us how the shaman's "spell" was finally broken by the bizarre behaviour of one Alfred Tremblay. Known to the Inuit as "Taamali", Tremblay, a prospector by trade was a member of Captain Joseph Bernier's 1912-13 Minnie Maud *expedition to north Baffin Island. In the winter of1913 he travelled overland to*

Igloolik from Pond Inlet on a dog-team guided by Inuit, thereby becoming the first white man to reach Igloolik from the north.

> I have heard when Paarii (Parry) wintered here there was a shaman who was jealous over his wife's philandering with white men. When the ships departed it is said that this shaman, aided by his helping spirit, blew the ship away so that no other ship could ever make it to Igloolik again.
>
> After this, a white man by the name of Taamali (Alfred Tremblay) was brought over by dog team from Mittimatalik (Pond Inlet). Taamali, they say, had a pistol and discharged shots into the ground as he walked around the shoreline. After he had shot the Island he declared that that Igloolik was dead, and that a ship will now be able to get to the Island.
>
> It was not until very recently when I had started to live in this area that we were able to get a ship into Igloolik. This was a small ship called *Tiriisikuluk*, (The Roman Catholic Mission's vessel *M. F. Thérèse*). This ship brought materials with which to build the mission. And from that that time on we finally started to get ships once in a while. **(Rosie Iqallijuq, 1991: IE-204)**

Strong winds were often associated with tension of one sort or another, sometimes too much sometimes too little, suggesting that balance and harmony promoted calm weather. The spirit of Sila *was said to have sinews or muscles which, when tense, caused high winds. In this passage note that the clouds referred to are clearly of the cirrus type typically associated with windy conditions in European weather lore.*

> The autumn was approaching and the weather was foul for an extended period of time. The men were unable to determine the cause of this bad weather. Then a woman presented herself, and undertook to perform a shamanistic ritual. She started to talk to the air and was able to determine that the cause of strong prevailing wind was a tense muscle, a tense muscle of *Sila*.
>
> Sometimes you notice clouds that are streak shaped [cirrus clouds] - well, she hooked one of them with a *niksik* (a seal gaff). [Having hooked the cloud] she found it to be extremely difficult to hold and was being lifted into the air even though she was trying counter-balance the force with the weight of her body. She called for assistance and immediately two men rushed to her and grabbed her around the hips. She was now steadied, though she still tended to go off the ground from time to time. The woman then asked for a knife. This is the way the shamans work. When she was handed a knife, she reached for the part of the cloud that she had hooked. At first the knife was not able to reach the cloud, but soon it connected and she started cut the part that she had hooked, cutting with so much vigour that one could hear the resonance of the knife. Finally she severed the cloud [*Sila*'s muscle] and folded her arms, her *niksik* now free. The woman then announced that the weather was going to become calm. **(George Kappinaq 1995: IE-329)**

Kappinaq's next excerpt tells of another kind of tension, that between two opposing winds, Nigiq and Unagnaq, personified respectively as male and female.

> If *Uangnaq* [the WNW wind] blows hard, Nigiq [the ESE wind] will always retaliate. This is the reason why after a strong blow from *Uangnaq* the wind will shift to Nigiq most of the time... Nigiq has a man inua [spirit] while *Uangnaq* has a woman inua [spirit]. When the woman with her words intimidates him, he does not get agitated as a woman would under the circumstances. He is able to cope with this intimidation for a length of time. That is why he is able to smooth things over, whereas, as always, a woman will make things rough. [...] It is said that when *Uangnaq's* igloo gets holes in it (as a result of the seams between the snow blocks melting), she will move outdoors and remain there until the holes have been repaired. [...] In the winter when *Uangnaq* is prevailing without any sign of easing, a shaman would try to ascertain the cause. He would find the woman standing outdoors, miserable because her igloo is full of holes. Once the shaman properly plugs the holes, the woman would go back into her igloo and the *Uangnaq* wind would abate. **(George Kappinaq, 1993: IE-265; IE-273)**

There are a number of references in the Igloolik interviews to the symbolic ritual of "depriving Sila of his wife", thereby effecting a change (for the better) in weather. The account related here is from the 1930's, a time when some Inuit were beginning to take Sila less seriously and others not. Hence the reprimand at the conclusion of the story that one "should not make fun of serious things".

> [Once] on our way from Repulse Bay we became fog-bound and could not make headway. We were camped because of the fog, and Qumangat started to ask me to deprive *Sila* of his wife. This was the first time I ever heard of such a thing. He told me I should make a motion as if having sexual intercourse and at the same time turn around and cry out repeatedly "I have deprived the fog of his wife". I did not wish to do it but my late sister Akittirq (possibly she was concerned about my well-being) told me that if you are asked to do something, you should obey). [...] So my nephew led me out and I was asked to step on top of a rock […] I pulled my pants down and started to move my hips as if I was making love ... I turned around in a complete a circle in direction of the sun, as I was told to do, saying repeatedly: "I have deprived the fog of his wife! I have deprived the fog of his wife!".
>
> The same day the fog started to lift. It cleared! Qumangat was amazed. [...] That evening after we had played outdoors I went in and he told me 'you have deprived the fog of his wife'. We were all living in one big tent then. I had my bed next to the entrance. [That night] Qumangat had placed a pillow in my bed to make it look as if someone was sleeping there. When I entered the tent I saw something sticking out my bed, and then Qumangat said to me [pointing to the pillow] that I had deprived the fog of his wife now she was going to be my wife. I started to cry. Qumangat got a proper scolding from Isigaittuq! He was told he should not make fun of these serious things. For my part I did not really come to believe it all, and, besides, I never wanted to deprive anyone of his wife! **(Aipilik Inuksuk, 1989:IE-068;1990: IE-165)**

In former times, epidemic illnesses affecting both humans and dogs were attributed to the "workings" of Sila. Disease, like bad weather, resulted from taboo breaking and it was the shaman's task to discover what particular taboos had been broken and to make appropriate amends.

> […] Before modern medicine was available and before white people settled [here], there used to be epidemics claiming victims. These unfavourable circumstances happened periodically. Sometimes humans will not be affected but the dogs will suffer the consequences. Dogs used to die in large numbers […]. The working of *Sila* would sometimes bring sickness. Sometimes the dogs would be the victims, usually through rabies and distemper. The foxes and other wildlife would get rabies at the same time as dogs. This is the result of the *Sila's* working. When *Sila* caused unfavourable conditions, hunting was bad throughout the region in some summers, resulting in the scarcity that leads to famine. Weather conditions were extremely important to our survival in the time [when Inuit had] inadequate hunting implements [meaning before firearms] If one camp were affected, the rest of the region would suffer the same consequences. **(Noah Piugattuk, nd: IE-070)**

Ikkiq is the so-called Fury and Hecla Strait separating the northern Melville Peninsula from Baffin Island. For generations, through the "workings of Sila*", its treacherous currents and ice conditions have claimed the lives of many Inuit hunters.*

> Indeed, there have been incidents where some hunters never returned [from *Ikkiq*]. I remember when I was but a child, my father said: "*ikkingaasit inugulittualuungmat*" ("*Ikkiq* is once again yearning to claim a human life"). I did not understand what he meant by that then. But now I know that the lives of hunters have been lost from time to time in *Ikkiq*. So I have always remembered his remark. Some shamans in the past use to say that, from the time the world was created *Ikkiq* had claimed so many lives that when the clothing [of the lost ones] are placed side by side, one cannot see the end of it. Well, death is everywhere and will continue so long as we have *Sila*. **(Emile Imaruittuq, 1990: IE-161)**

Weather Observed

Traditionally among the Iglulingmiut one had to go outdoors each morning to observe Sila*, as soon as possible after waking. To the regret of the many elders, this important ritual - known as* "anijaaq"- *once obligatory for adults and children alike, is falling out of practice. For it was through each morning's* "anijaaq" *that Inuit learned to observe weather conditions closely and consistently, and so make the deductions necessary for accurate short-term forecasts. Excerpts on weather observations, descriptions, and the seasonal cycles follow.*

> This is what I think: because we depend only on animals for food you had to see the beauty of *Sila* first thing in morning. You must appreciate the beauty of *Sila*, in order for to enjoy the outdoors and get used to it. **(Pauloosie Akittiq, 1992: IE-243)**

We were told that we should make a point of seeing *Sila* as soon as we could when we woke up. We did this so that we could live longer. [...] A girl would be told: *'aniutturin, anisaaligin ullaakun makituaruvin, irnisuliruvin irnisaalijumaaravit.*' ("you should go out quickly in the mornings after you get dressed, so that when you are in labour you will deliver your baby quickly"). But we no longer tell our young people that they should hurry outdoors. All we tell them is that they should get up -"it is almost time for school"! Yes, we use to be told to go outdoors first thing in the morning. Perhaps our parents wanted to know if it was windy, for they would always asked if it was windy us when we returned indoors. Maybe that was their excuse to get a weather report without them having to find out for themselves! So as soon as we put on our footwear we would rush outdoors!" **(Zachariasie Panippakuttuk, 1991: IE-201)**

We had to *anijaaq* [the ritual of observing *Sila* each morning]. We would observe the sky conditions - what sort of clouds there were - and the position of the stars. Today even I don't do that anymore. I listen to the radio to hear the weather forecasts. It was different when we had to observe the weather by watching the clouds and noting the wind directions all the time. **(Hubert Amarualik, 1994:IE-314)**

We were conditioned by having to get outdoors in the morning. [On coming back in] we would be asked questions: How is the weather? If you were not observant, you would be asked more questions. Then and there, you would realize that you have to bring in more information. This is when you realize the things that you need to know. I personally had one particular tutor - Siniqqaq. He would say to me:

"Tuattuuq *nakinngajaaqpa?"*(Thin one, which way is the wind blowing?) I had not noticed it. So I'd have to go back out and check it again.
"*Nuvujavaa?"* (Is it overcast?) "*Aamai*" (I do not know) "*Atii takujartunngua&arit!*" (Then go out and look!).

This is how I started to learn. He made me aware of the importance of weather. When I finally was able to describe the conditions, he would stop asking me these questions. It was from Siniqqaq that I learned the importance of observing. […]. He would ask me if I thought that there might be winds […] - this was long after the need to get outdoors. If I hadn't noticed I'd go out again and check. Those questions were very useful.

I was able to guess what conditions were coming, but I never really learned about it. Now we don't pay too much attention [to the weather], perhaps because we no longer hunt as much as we used to. **(Nathan Qamaniq, 2001:IE-471)**

[…] To learn about weather conditions you pretty well need to be outside the community if you want to guess what the weather is going to be. […] When you're away from the community you pay a lot more attention to the current weather conditions, observing, for example, that in the evening the daylight is in this direction, in the morning it's in that

direction, at noon the sun is located there, and, at night, certain star is in such and such a position. These are the things that can be learned only outside the community. In town there is too much light [from the street lamps] making it difficult to observe the stars. When you are outside the community, the stars are clear and you can use certain ones for your way finding, so it is easier to navigate. **(Nathan Qamaniq, 2002: IE-496)**

Rain in winter; snow in summer. Many Igloolik elders vividly recall spells of extremely unseasonable weather in the past. These episodes were sometimes a curiosity, sometimes an inconvenience, and, occasionally, a factor in tragedy as in the well-known case of Ataguttaaluk and her family who in the early 1900s were stranded inland, not far from Igloolik, by deep snow. Starvation followed. Ataguttaaluk was the sole survivor

There was a time when I experienced a heavy snowfall in the late springtime [mid-July]. When the birds have lain their eggs the temperatures usually are warm and there is no expectation of snowfall at this time in the year. It happened some years ago, not too far in the past, when hunters started to hunt walrus and cache them for winter, so it was necessary to get as many walrus as possible. We had been staying at Qikirtaarjuk [the northeast peninsula of Igloolik Island] but when the walrus hunting season startes we moved our camp towards Pingiqqalik [a hunting camp on Melville Peninsula southwest of Igloolik] to get to an accessible location before break-up [of the sea ice]. It was about that time when the small birds had laid their eggs including the Arctic terns. We made a trip to Ikpiarjuk [the bay on which the settlement of Igloolik is located] during the day, after we had moved our family to Igloolik Point. While we were here it started to snow, it was not a light snowfall but a really heavy snowfall. It was not cold. Because of the snowfall the ground became deep in snow when we travelled back home. **(Pauli Kunnuk, 1990: IE-087)**

I have seen bad weather in the summer on few occasions. I once experienced a snowstorm in the middle of summer, some years ago. […] There was a snowstorm immediately after the ice broke up. I have never seen one like that before. During spring the birds usually have their eggs. Around the time the ice breaks up the eggs hatch and become chicks. It was when the chicks started to roam around. There was a heavy snowfall, the snowfall then turned to a full-blown snowstorm. The lee of boulders and rocks were piled with snow. I have never seen another storm of that magnitude since. I do not recall what was said of that storm even with elders amongst us. My father was alive then. They never made it known to us what might have caused the snowstorm nor did they mention any similar experience before then. The weather must have been cold at that time for it did not rain. It might have been cold, but I recall the sun was giving off heat in those days. **(Eli Amaaq, 1989: IE-074)**

I experience rain in the wintertime, this phenomenon does not happen every year. As a matter of fact this occurrence is more frequent than that of a snowstorm immediately after the ice break-up. It would rain sometimes in the middle of winter. As far as I am concerned it is an unpleasant experience. I was not able to hear the explanation about it from the elders so I cannot elaborate on it. It was around early spring when we lived at Iglurjuat [Cape Thalbitzer, Baffin Island], not too long ago [the 1950's]. When we were running short on food, in fact we were almost out of it. Because of the poor floe-edge we were not able to keep ourselves supplied with food. I decided that I should make a journey in search

of caribou. Qulittalik was there to drive his own dog team. There were now two dog teams at our disposal. Qattalik and his younger brother drove one team while we had the other. We started our journey to Kangirlimajuq [Steensby Inlet, Baffin Island] in search of caribou. As we passed Ikpigaarjuit we came across a seal breathing hole so I decided that I would wait for the seal - all afternoon if need be.

I told the others to drive on so they could set up camp not too far off. So they left and while they were still within sight they stopped and made camp. I was waiting in the aglu [seal breathing hole] in a sitting position. The afternoon passed into night, then night into morning and I started to get so sleepy that I could not keep awake. My harpoon was crossways on my lap as I did not have my harpoon rest with me. I stooped forward and went to sleep unintentionally and started to dream. I knew that I was waiting for a seal. I began to hear a noise coming from below, making its way up getting closer, getting louder. The noise suddenly came into contact and made a ringing sound that went through my harpoon from end to end. I could hear the sound travelling but I could not wake up. This was repeated a number of times; the sound would come from beneath me getting closer and closer until it reverberated through the harpoon and dissipated. This went on for a while; perhaps the seal had finally left the hole. I was now wide-awake, really expecting the seal but it never came back. All this time we were without food. The weather was now very mild. It was getting milder and milder and in the morning it started to drizzle. When the full daylight came, I left the hole and went to my companions that were camped near-by. One sled had mud runners with walrus hide covering the fore arch of the runners. The mud coating had melted, exposing the steel runners beneath. As we left to move on the rain started to fall heavily; we were now really out in the rain. Because it was winter we were wearing our *qulittaq* [caribou skin "parkas]. When we neared the other side of the bay we started […] to search for *aglus* [seal breathing holes]. We came across one and I stood on top of it and waited. My footwear were made from caribou skin and, because of the rain, my feet were making a tapping noise. I waited for a while but decided that a seal would not come […] due to the noise from my feet. I left the *aglu* because of all the rain.
[After successfully hunting caribou] we started for home when it became light. We had a heavy load as we had caught many caribou. As we were going on to the sea ice we made camp before the snow hardened […]. The snow was freezing now so it was very difficult to make an igloo. In later years I noticed some rain in the winter, but I do not remember it as distinctly as this incident. **(Eli Amaaq, 1989: IE-074)**

I remember there was rain in the wintertime when we had taken a trip over to the Agu Bay [Baffin Island] area. I forget exactly how long it rained, not many hours. During that time there was no sun because it was in the month of December. But after the rain, the rabbits disappeared and there were none for years following this incident. It took years before the population was back. […] I was old enough to hunt at that time. It rained so hard that all our dog meat melted. There was a thick ice layer afterwards. I did not understand how it could rain when there is no sun. **(Alain Iyerak, 1997: IE-401)**

The Winds

Iglulingmiut designate four "primary" winds - Uangnaq, Kanangnaq, Nigiq and Akinnaq - from which all other local wind directions can be specified. When related to the divisions of a European

compass "rose" these four primary winds have the following approximate values.[ii] *Uangnaq, WNW (296°); Kanangnaq, NNE (019°); Nigiq, ESE (119°); and Akinnaq, SSW (202°).*[iii] *It will be noted that there are two sets of roughly opposing, or counterbalancing winds, one on the Uangnaq-Nigiq axis, the other on the Kanangnaq-Akinnaq axis. To the Iglulingmiut this arrangement of "opposites" is symbolically important, especially in the pairing of Uangnaq and Nigiq which, as we have seen, are personified respectively as female and male and are said "retaliate" against each other. It is, in fact, not uncommon to have a west-northwest gale followed by a contrary blow from the east-southeast. In Igloolik wind is the most closely observed and frequently discussed of all environmental phenomena* (MacDonald, 1998).

A cogent illustration of the crucial link between wind direction and Iglulingmiut hunting activity comes from Pingiqqalik, an ancient, now abandoned, settlement near Igloolik. Here, a northeast wind - the wind most favoured for walrus hunting on the moving ice - was given its own local name and referred to with unusual metaphorical flourish as Qukturaaqtuq - "the broken thigh".

> Near the sod houses at Pingiqqalik there is a small pond lying in a north-westerly direction. They call this pond *Qukturak* (because it is shaped like a human thigh). As was our custom, the first person who went outdoors in the morning would check the weather and inform the rest. If the wind was seen to be coming from the direction of the moving ice, in other words blowing across the pond, it was said that the thigh was broken. The person who observed this, especially if an elder, would then go back indoors and announce that "the thigh is broken!" (*Qukturaaqtuq*!). At this, the men immediately became lively with anticipation, knowing that the conditions were just right for walrus hunting on the moving ice. That's the way they did things at Pingiqqalik! **(Noah Piugaattuk 1986:IE-054)**.

The term qakiijauniq *refers to a violent winter wind, which, acting with airborne snow particles, is capable of eroding snow-houses to the point of destruction. There are also dangers associated with building a snow-houses in the lee of hills, including the possibility of avalanches*

> An igloo can be eaten away by this wind [...]. When it appears that this is going to happen, the best way to treat the igloo is to coat it with water [...]. *Qakiijauniq* can be very dangerous and, for this reason, during a blizzard we always try to build a storage extension on windward side of the igloo. This offers some protection. **(Emil Imaruittuq, 1990: IE-101)**

> There are always dangers when one is travelling. Sometimes in a blizzard one is forced to make a shelter, and one might think that the best place to build one would be on a lee side of a hill, or rise, [to escape from the wind] as it is extremely uncomfortable on the face when building an igloo in a blizzard. Always be careful where you build a shelter. One must never build under a cliff or in the lee of high hills as these usually have an aluiqqaniq (a cornice). In blizzards cornices continue to build up making them heavier, increasing the danger of an imminent avalanche. It is well known that people have been killed in avalanches, so care must always be taken. One must not build a shelter, even for the night, under such conditions. **(Emile Imaruittuq, 1990: EI-101)**

The Moon-Months

The Iglulingmiut lunar calendar counts thirteen "moon-months" – one for each lunation in the annual cycle - each named for some recurrent event in the natural world: nesting of birds, birth of seal pups, caribou moulting, winter's darkness, and the return of the Sun, to name a few. Iglulingmiut, aware of the subtle changes around them, recognize eight seasons when often the less observant, poorly acclimatized visitors to their land count only two: winter and summer.

> The January moon was referred to as *Qaummagiaq*. At this time it was said that the Moon and the Sun would compete to determine which would come out first. I have heard that if the Sun won the competition then the Moon would not be as bright even when it is full. Should the Moon win it would shine much brighter when full. […] In addition when a new Moon first appears it is usually very thin. When we were children we would play outdoors at night so we would see the moon as it was just coming out. When we entered a dwelling we would tell the elders about the moon that we just saw, and at once they would ask us: "*usivaa*?" ("Is it carrying a load?")… I was told that when the Moon first comes out it is sometimes tilted so that it appears to be almost facing up [horizontal to the horizon], as if it were carrying a load. When that happens it means that it is carrying "*usijuq*" – "carrying" the wind. If the moon seems vertical to the horizon it means that it is not carrying a load. This is interpreted to mean that throughout this particular month the weather would be favourable without too much wind. […]
>
> February was known as *Qangattaasan*. At this time the Sun has returned to the horizon and it was starting to get higher and higher. The month of March was referred to as *Avunniit*, followed by *Nattian* - April - when the seal pups are being born. I am not certain about May, I believe it was *Nurrait*, when the sun starts to melt the snow, but soon after that there is a period of freezing, known as *Qissuqaq*, or the "freeze over", when the temperatures will plummet freezing the ground that had previously melted. It is at this time the caribou give birth to their young. In the past there was a saying that: " *Sila* does not have any sympathy for the caribou", the reason being that when the caribou are giving birth the weather usually gets really cold and stormy. On the other hand, it is said: "*Sila* sympathizes with the seal pups", because mild weather with new snow blanketing the ground usually accompanies the birth of ringed seal pups. Often I used to hear that *Sila* adored the seals, while not caring for the caribou.[…] June is called *Tirigluit*, referring to the bearded seals pups that are born at this time. July is the "egg month" - *Manniin* – followed by *Sagaruut*, the month when the caribou moults and their hair becomes very thin). Next is *Akulliruut*, meaning that the hair on caribou is now prime - not too thin nor too thick; the word literally means "the middle". September is *Amiraijaut*, when velvet on the antlers of the bull caribou starts to peel. This is an indication that the season is now well on its way to autumn. [We call] October *Ukiuliruut* when the caribou skin is getting thick with winter hair […] The next is moon *Tusaqtuut*. This is the time when the sea freezes over making it possible to visit other camps that had been unreachable since the spring. The camps are now in communication again, hence the name *Tusaqtuut*. [And finally] there is the [mid-winter] moon *Tauvikjuaq* - the "time of great darkness". **(Mark Ijjangiaq, 1991: IE-184)**

Anticipating Weather

Inuit short-term weather prediction involves the observation of clouds, wind-shifts, twinkling stars, halo phenomena, the movement of sea mammals, the look of distant land, bodily aches and pains, and even a ringing in the ears. Long-range forecasting, however, can engage more arcane associations usually played out in the celestial sphere, including the race between the Sun and the Moon following winter's darkness, and the apparently shifting position of the Galaxy. Much Inuit forecasting seems to be based on assumptions of balance and reciprocity, and sometimes of retaliation (as described in the passages from Kappinaq above [**IE-265; IE-273**]. *Persistent winds from one direction are eventually answered by winds from the opposite direction; cold, calm periods alternate with windy warmer periods; severe winters are compensated by good summers and vice versa.*

In the following passages mention is made a number of times of a long, smooth, darkish cloud as being a predictor of windy weather. This is probably "altocumulus lenticularis", typically having the long, lens-like profile of a basking "bearded seal" [Erignathus barbatus] - *hence the Inuktitut name,* Ugjunguaq or Ugjuujait [pl.].

> When the sun was going to return, they used to say that the Moon and the Sun would compete with each other so that one would come out before the other. When the sun returns before the first new Moon of the year it was said that the Moon had been defeated and that the spring and summer would be warm. But should the Sun come out after the first new moon [following the dark period] it was said that the spring and summer would not be as warm. This past winter [1990] the Sun came back first and for this reason the spring was very dry, when it would normally have been rainy. So the spring was good because the Sun had come out before the Moon. **(Noah Piugaattuk, 1990: IE-153)**

> I have heard that it is called *Avigutaa* [the "Milky Way"] - a "separator" for the winds. It is here that the winds collide [...] and where the stronger wind prevails. This cloud-like mass is not stable, so that when you see it has moved slightly in one direction it means that, for a while, the wind will blow from that direction **(Hubert Amarualik, 1992: IE-212).**

> During the winter months when the temperatures are their lowest, clear skies continued for a long period of time with *uangnaq* [WNW] winds prevailing. This was the case this past winter [1992/93]. There was hardly a time when the wind blew from the *nigiq* [ESE] direction this past summer. I thought to myself when I saw the weather's behaviour this winter that the prevailing winds would be coming in from a southerly direction when the temperatures got warm enough to the point where water no longer froze. The reason for this is that the wind hardly blew from the *nigiq* direction this winter. This has happened before only once during my lifetime, at Kapuiviit (on Jens Munk Island). At that time, late in the season when the days were getting shorter again, we had not been able to hunt walrus because of ice floes [brought in by the northwest wind]. I had a feeling that this was going to be again the case this year, and indeed this is the way it's turning out.
>
> When these conditions happened in the past at Kapuiviit we found ourselves running very low on dog food that winter, not being able to hunt for walrus during the preceding summer. I would think that this is going to happen to the people who are hoping to make caches for *igunaq* [fermented walrus meat] this summer.

This happens once in a long while, indeed, once in a long while. The weather conditions change from year to year, there are some summers with much warmer temperatures than other summers and there are those that are not as warm. When these conditions (called *aujjarluktuq* – a "weak, deficient, summer") occur, the areas where it takes longer for the ice to break up under normal conditions will experience hardly any break-up in summer, right through to autumn. It will also start to freeze earlier than normal, and where there are narwhales, especially around Tununirusiq [the Arctic Bay area] and in the waters of Mittimatalik [Pond Inlet], an early freeze-up will periodically trap the narwhales in the ice. When narwhales were caught in this way it will mean that the people will have plenty in that year. That was the way it was in the past. I have not heard of it happening like this in recent times.

When there are too many open crevices on the surface of the sea ice, water from melted snow, which would have contributed to the melting of the ice, drains off into the open crevices thereby delaying the weakening and melting of the ice. Conversely when there are few crevices on the ice, [the surface water accumulates] forming deep puddles that cause the ice to rot faster.

Then there is a condition where the wind blows from *kanangnaq* [NNE] and a strip of dark cloud appears just above the horizon: When this happens they say: "*taikaguuq anuri*" (there is the wind). The following day you do not get any wind, but on the day after that it would start to get windy from the direction where you had seen the strip of the dark cloud. As the wind starts to blow it gets stronger and stronger. For the next three days you will experience very windy conditions from the direction where you had seen the strip of the dark cloud. When these strips of clouds are sighted the hunters are advised against hunting on the moving ice, especially the younger people. They knew that the moving ice would be separated from the landfast ice for a prolonged period of time. This prediction was always accurate.

Then there is another condition from the [southerly] direction of *Kivati*. When you see white clouds [fair weather cumulus] spread out low on the horizon, it is said: "*anuriguuq palaqsimaniattualuuvuq*" ("the winds have been lulled for sometime") or "*ikulliaaraaluitguuq tauva*" ("those are the calm winds"). When you see such cloud formations there is absolutely no danger in going out to the open sea to hunt for walrus.

The only thing that one should be weary about is the thin strip of clouds that I mentioned. They will not get to your location immediately but once they reach you the wind will blow […] for many days. This was the condition that I was warned about. When it prevailed I should take extreme care and be anxious.

There is one thing that I have not been able to find out for myself and that is when, after a long period of calm weather, the wind is finally going blow from the *Uangnaq* [WNW] during the period when the temperatures were coldest. It is said that you could smell *Sila* just before the wind started to blow. I personally have not smelled it, but these are the signs that were closely observed when Inuit had to depend entirely on animals for subsistence.

[When you] notice that marine mammals appear to be heading in one general direction, it is said that they are heading in direction from where the wind will start blowing. In the winter when the temperatures are still cold enough so that the water freezes very easily, the game animals will head towards the direction where there will be open water. This assumption was accurate.

When we were hunting walrus on the moving with a strong *Nigiq* [ESE wind] the wind would abate but still come from that direction. The walrus would start to swim towards the landfast ice. That meant that the wind would soon blow from *Uangnaq* [WNW wind]. When walrus starting to move one direction during extreme temperatures when the sea freezes easily, that means that the moving ice is going to separate from the landfast ice making an area of open water. **(Noah Piugaattuk, 1993: IE-276)**

In the springtime there are great mirages appearing near-by. [...] Sometimes the land [across the strait] appears farther away and sometimes closer. The mirages seem to move the land. They say it is the winds that make the land seem closer or farther. When there are going to be winds blowing the land appears far away, and when the winds are going to calm down the land seems closer. A great mirage means that there are winds ahead of us. Sometimes these forecasts are correct, sometimes not. When you live outside the community you still have to observe the weather. If you don't observe the land it is very hard to know what is happening with the weather **(Hubert Amarualik, 1994: IE-314)**

[Halos] are used to tell what lies ahead. When the Moon gets an *avaluarutaq*, [literally, "framed"- a full halo] it means that bad weather lies ahead. You can use it to guess what the weather will be like. When the Moon is completely surrounded by the *avaluarutaq* there is a strong possibility that bad weather will prevail, and that overcast conditions are eminent. I know that this is used to guess what the future holds […] **(Nathan Qamaniq, 2002: IE-496)**

The stars and the clouds were also used to tell a change in the weather. The clouds sometimes were known to bring winds. But only certain kinds of clouds were classified as wind clouds. They are the thick, dark, rounded ones known as *Ugjuujait* "those that resemble bearded seals" [*altocumulus lenticularis?*] (**Pauli Kunuk, 1997:IE-402)**

After a good number of clear calm days, you see long thin black clouds forming in the north over the land just above the horizon. They would say the *Ugjunguaq* - " those that resemble the bearded seal" [*altocumulus lenticularis*?] have appeared. Once those clouds have appeared then you shouldn't make plans to hunt on the moving ice. The wind does not begin right away [perhaps] a couple of days later, but once it does there'll be continuous wind for the few days. That is what happens. If the black clouds I mentioned appear from *Kanangnaq* (NNE) then you know that there's going to be bad weather for some time. If you are out in a canoe during these conditions, you should make every effort to get to your destination while the weather is still good. […]. These clouds indicate bad weather that will last for some time. Hunters of the past knew these things ahead of time. **(Noah Piugaattuk, 1988: IE-040)**

We were always guided by the weather for hunting. Our hunting of different animals depended on the kind of weather we had for that day or that time. In fact the prediction of southerly winds meant a time for walrus hunting. It was a time of joy for us all. (**Pauli Kunuk,1997: IE-402)**

Nothing is certain, but there are times when you recognize certain conditions. It is said that when there is so much accumulation of soft snow (*piqsuksalialuulirami*) there is a good possibility of a blizzard.[…] Or it might be that the temperatures are severe – a condition called *singumajuq,* meaning that there is a strong possibility of high winds. We have the saying: *singumajualuuliramiqai anuraatuinarialialuulirami* ("because it is *singumajuq* strong winds are imminent"). These are the conditions that allowed us to guess in advance what the weather conditions would be like.[…] I would not know how long a blizzard would last. If the wind starts to blow from *Nigiq* (ESE) in the morning, it will be moderate, but towards the evening will get stronger. […] That is the way it seems. There is a saying: *"nigirluguuq unnugiksiannuniarani"* - "the *Nigiq* (ESE) wind will not allow a favourable night" – meaning that with nightfall the wind seems to blow even stronger. This is something that I have heard and learned from. **(Nathan Qamaniq, 2002: IE496)**

I am not much of a weather predictor, but I know that in winter, spring, summer and fall, the clouds are all different when you are trying to predict the weather. I have not yet seen any changes globally in the weather; it is still the same as when I was growing up. Sometimes we ask ourselves what the weather will be like tomorrow, and most of the time our predictions are true, mine usually are, but sometimes it is different. Sometimes during the winter, when the weather is mild and there are some clouds, it could look like a good day to go hunting. But if we go hunting under these conditions, you have to worry about something, because you know it's not going to be like that for long. There might be a bad storm right away or a day after. That's something our young people should know about. Also if it gets really cold, colder than usual, then not too long after that the weather usually becomes very mild and so that is something to look forward to, because it will be good to go out hunting. In winter, I think hunters know what the weather will be like for the next day. I know that if it is very clear and calm, you can predict the weather by looking at the clouds to south. You know that there will be north winds. You can tell by the narrow clouds that appear from the south. It is the other way round if there is going to be south wind; you will see narrow clouds coming in from the north. All this is true. I have experienced this, and I only talk about what I have learned.

I learned from my ancestors and other elders. I don't know why the elders never really tell other people what the weather is going to be like even though they know. I can't understand why they don't tell others. Perhaps it's because they don't want others to know, or maybe because they think they are going to be wrong. […]

If you see clouds that look like the liver of a seal, smooth, long and dark, and you can't really see the outline of them, those kinds of clouds make elders and hunters worry, because they know there's going to be bad weather later on that day, or at night, or the next day. Also if you see cumulus clouds on the horizon then that means there will be good weather

soon. And if you see smooth long dark clouds in front of the cumulus clouds, it's an indication that it might become windy later on. Cumulus clouds forming in front of the smooth long dark clouds cause hunters to smile, because they know the weather is going to be good for hunting. **(Maurice Kigutikkaarjuk Arnattiaq, 2001: IE-467)**

The phenomenon of bodily pains and sensations as an indication of imminent change in weather conditions was common among Iglulingmiut. Ringing of the ears, for some a sign of impending strong winds, was for others a prediction of hunting success.

[…] When bad weather is coming, people who have illnesses feel worse […]. Those who have had surgery are especially affected by the storms. Also in the past, when there was no modern medicine, people that were sick felt worse and had no appetite. It happened that when a storm approaching, a sick person would first feel it and then the bad weather would follow. And during the storm, before its abatement was evident, a sick person would feel better ahead of the weather improving. With a sick person you could tell when the weather was changing because they would feel better even before the weather improved. That was my experience when I spent time with sick people. I never felt it myself because I do not really have an illness. **(Rose Iqallijuq, 1997: IE-398)**

When persons that are no longer normal, especially those that have gone through surgery, their behaviour is more connected to weather. With those that are healthy and normal you cannot tell the difference […]. But people that are not normal do change with weather conditions. When my wife had an operation on her lung, I used to use her to predict changes in the weather. It was always accurate. […] It is true - tidal currents and bad weather does affect people just before they occur. **(Noah Piugaattuk, 1992: IE-226)**

Each ringing [of the ears] has its own meaning. An extended ringing will bring prolonged windy conditions. Heavy winds can be predicted with low ringing, and a high-pitched ring, means fair winds. This only happens when the wind is going to blow strongly. **(Antonen Qunnut, 2001:IE486)**

Weather Change

For Inuit, climate change is hardly a new experience. Over generations they have been challenged by the sudden vagaries of extreme, "unseasonable" weather, and usually have come through whether surprised by winter or summer. The following excerpt relates a song commemorating an autumn-less year of 1911. The term "qitissuqtuq" *refers to the "middle" or dividing period between summer and autumn when the first snow of the season falls only to melt quickly and vanish.*

Sila the weather differs from year to year. Sometimes the summer is weak; indeed I have seen it more than once when ice does not break up in some summer. As a matter of fact my father composed a song about one such incident at Aggu (Agu Bay on Baffin Island) around the time I started to take notice of the things that happened around me. The year was 1911 and I was to see a whiteman [the explorer Alfred Tremblay] for the first time […]. That summer it seemed as if *qitissuqtuq* was going to revert to warmer temperatures, but it didn't. The weather remained cold so that the season just moved right on into winter. The

caribou that year had a late migration waiting for the snow to accumulate before they finally started to migrate. I remembered that year my father tried really hard to keep us supplied.[…] [Weather like] this has been known to happen from time to time. Sometimes people think that it is going to happen again but if it does it is not going to be the same. My father composed a song at that time which goes:

Aja... mangata&alirnirmatiguun aja,
Aja... We had been fooled
Silarujuk nigirujuk ija...
By appalling weather, the southeast winds
Aja... ukiaksa&alirnirmalli aja,
Aja... The autumn has sneaked up upon us
Anurajuk nigirujuk ija.
With constant winds, the southeast winds
Aja... kajusi&alirnirmingman manna aja,
Aja... Why does it have to be this way?
Anurajuk silarujuk ija...
The constant winds, the appalling weather.... **(Noah Piugaattuk, 1992: I E-245)**

However, they use to say that long ago *Sila* was much warmer in the spring and the summer. The wind used to blow moderately. That was the way it appeared in the years past, at least from my own personal experience. It seemed as if the temperatures were warmer and the sun's rays use to be much warmer (*kijjiq*). But now we have started to see that the Sun is much warmer when not covered by clouds. **(Hubert Amarualik, 1993: IE-290)**

In my youth it seems that the weather was really warm and there was hardly any wind in the summer and spring. That was the way it seemed to me then. Someone mentioned to me this morning that the new ice on the shore's edge never appears to have a slippery surface; I then recalled the time when newly formed shore ice used to be really slippery. In the early spring, it did not freeze as quickly as in winter, it used to get very smooth and slippery, but now, with constant snowfall, it never appears to be slippery.

In those days when we wore sealskin pants in the spring, the sun's rays would be so strong that the sealskin pants got really warm. The sky looked much bluer then, but now it is hazy, and easily tends towards snowfall. Even in the summer, it is now constantly blowing.

At the time when we depended totally on sail to propel our boats, the sea would get calm and remain like that for days, preventing us from traveling. But now, because we no longer depend on sail […] it seems as if it's always blowing! **(Nathan Qamaniq, 2001:IE-471)**

Some TV weather forecasts are accurate, but only for the immediate future, like the following day - beyond that they're not too accurate. This past summer and autumn, I took to writing down the forecast shown on TV. I did not record the current conditions for the evening, but only the following day's forecast. I wanted to find out how accurate they were. I found that in a lot of cases they were not right, especially the longer range forecasts. As

> for the day's current conditions and evening forecast, they were basically right, but at times not exactly so. There were times when the forecasts were completely opposite from the weather that actually occurred. This was mainly the case for longer forecasts. **(Nathan Qamaniq, 2002: IE-496)**

Silaga nauk? **- Where is my weather?**

The variety of perspectives, attitudes, and understandings of weather offered in the foregoing excerpts are rapidly loosing currency, even relevance. *Sila*, as the spirit of weather, is now consigned to the past, its significance held in minds of a very few elders. Shamans no longer work their propitiatory powers, and there are fewer and fewer weather-wise hunters to make forecasts. Today, exhortations like Eli Amaaq's, to "observe *Sila* and be alert" go almost unheeded; and the once obvious signs of imminent storms go largely unnoticed, or are retailed remotely through radio and television.

Igloolik elders are troubled by the loss of traditional ways brought on, they say, by government policies in the 1960's that resulted in the move of the area's Inuit from the land to the shelter of the government-administered town. Here, their traditional forms of leadership and organization fell apart. Inuit became "wards of the state", their lives dominated by agencies and laws, well-meaning, perhaps, but not their own. Their children were sent to schools for an education having little to do with a life on the land, and, in town, existence for many could, and does, go on with scant reference to the environment and its resources. Store-bought foods compete successfully with the traditional "country foods"; garments of manufactured fabrics, no match for extreme Arctic weather, are replacing caribou and sealskin clothing. The language – Inuktitut – with its extensive, specialized vocabulary, once the conceptual basis of profound environmental comprehension, is being eroded at an alarming pace, terminologies to do with land forms, snow and ice conditions, the celestial sphere, and, yes, weather, being especially vulnerable. The most troubling (and most elusive) aspect of this cultural loss and alienation is, of course, the extent to which it contributes to the community's endemic level of social malaise, expressed through increasing rates of anomie, addiction, malnutrition, and suicide.

An evident result of Igloolik's shifting social and material setting is that the younger generations, to a greater or lesser degree, are not well prepared intellectually, attitudinally, practically, or even physically, to deal with the environment much beyond the limits of the town. To the dismay of many elders, the land and its resources are being increasingly relegated to the realm of weekend recreation. Nathan Qamaniq is not alone among Igloolik elders attributing the demise of life-affirming environmental attachment to the apparent ease of town life:

> […] We get everything so easy now, and do not need to work hard. These are the reasons why the weather conditions are not as well known as they were in the past. We are not hunting as much as we use to, because food is secured from the stores, and it appears that store-bought food is now the main diet of the people. The weather conditions that would have seen hunters going out to hunt are no longer being paid attention to. […] When you depend mainly on animals for your needs, you would want the weather to be favourable for hunting, these are the things that contribute to paying closer attention to the weather. But

> now we are no longer as active in hunting and, as a result, we no longer pay attention to the weather, because we are now housed in warm houses. (Nathan Qamaniq, 2002: IE-496)

Elders tend to see the opposing spheres of "town life" and "land life" as virtually incompatible. socially, culturally, and linguistically. As Qamaniq points out, living in town is hardly conducive to learning about the environment or, for that matter, about life in general:

> […] You need to be outside the community in order to learn these things. You need to away from this place. You have to endure hardship every now and then, for instance when you need to travel over thin ice or face other dangers, or if you need to get to your destination but get lost. You learn from these things. When you have everything so easy, [such as] driving a snow machine, all you have to is follow a trail; you don't need to worry or work hard to reach your destination at night. Now they navigate only by following trails. This slows down learning and makes it more difficult to acquire knowledge about things that need to be known. […] When you are driving yourself, and not following any trails, this really helps you to learn things. In fact you may find yourself in a situation where you think you are going to get lost. This is a good way to learn. When you endure difficulty or experience hardship, in any way, or get into a desperate situation, this is a good way to learn. (Nathan Qamaniq, 2002: IE-496)

For some years now, Igloolik elders, through their association – the Inullariit Society - have been trying to stem this disturbing retreat from tradition by organizing "on-the-land" courses for the community's youth. The courses take place at remote hunting areas and expose the participants to a wide variety of weather and seasonal conditions. There is an emphasis on safety, and practical skills are taught such as hunting and fishing techniques, skin preparation, sewing, shelter construction, navigation, and short-term weather forecasting. Care is also taken to introduce participants to the correct contexts, attitudes, and philosophies needed to live safely and in harmony with the environment. Accordingly, instruction on local geography and ecology, Inuktitut place-names, and associated family histories are intermingled with traditional maxims setting out the rules of life and the proper treatment of animals.

The Inullariit Society's courses are popular and the young participants usually enjoy the experience, having learned some of the basics of survival on the land, and perhaps killed their first caribou, seal, or walrus. Bouts of bad weather confining them to camp and boredom, along with running out of cigarettes and store-bought food, are the most common complaints. Most are not unhappy to get back to the settlement. For some, however, the experience of a life away from the confines of town proves attractive and they return with an enthusiasm for more. Other potential recruits to a hunting vocation come from a few families committed to teaching their children the essential practical knowledge needed for a life on the land.

Continuity of hunting know-how and practice, are crucially important to elders troubled by what they believe is the community's diminishing capacity and desire to access and use the land's natural resources. Some, for example, predict the demise of most walrus hunting, pointing out that there will be few, if any, from the younger generations capable of replacing the dwindling pool of skilled, elderly hunters. It is difficult to know to what extent these fears will be realized, and even

harder to imagine Igloolik - a community virtually synonymous with walrus hunting – ever ceas this activity.

Against such forecasts and concerns, however, the place of weather, good or bad - or for that m the issue of climate change - in daily life becomes less and less significant: and with it the deepening separation from a uniquely comprehended environment that, not so very long ago, wa the body and soul of Inuit existence.

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[i] Excerpts have been taken from interviews variously conducted by Louis Tapardjuk, Leah Otak, George Qulauk, Maurice Arnatsiaq, Susan Avingnaq, Paul Irngaut, Wim. Rasing, Shari Fox, Claudio Aporta, and John MacDonald. Translations from the original Inuktitut were provided by Louis Tapardjuk, Leah Otak, and Paul Irngaut. Some of the material presented here was previously published in *The Arctic Sky, Inuit Astronomy, Star Lore, and Legend* (John MacDonald, Nunavut Research Institute, Iqaluit / Royal Ontario Museum, Toronto, 1998).

[ii] Inuit names for wind directions vary from region to region. They are "absolute" in the sense that they usually relate to local coastal orientation rather than to some universal marker such as "true" north. This system, Michael Fortescue argues, "may be a more reliable guide to Eskimos discussing journeys over complex Arctic terrain than compass orientation can provide" (Fortescue 1988:3)

[iii] Emile Imaruittuq, September 24, 1993. The bearings of the winds (in degrees) were determined by a theodolite set up outside the Igloolik Research Centre, Igloolik, and aligned (astronomically) to "true" North. Note that when using English, knowledgeable Iglulingmiut usually translate *Uangnaq* and *Nigiq* as northwest and southeast respectively. Among many of the younger generation the "nominalization" process is taken even further; *Uangnaq* becoming "North" and *Nigiq*, "South", a liberty that earns the disapproval of some of the older hunters.