

2010

# Decolonizing actions that speak louder than words : science education through multiple lenses in Nunavut / by Marc Higgins.

Higgins, Marc.

---

<http://knowledgecommons.lakeheadu.ca/handle/2453/3953>

*Downloaded from Lakehead University, Knowledge Commons*

**Decolonizing actions that speak louder than words:  
Science education through multiple lenses in Nunavut**

by

Marc Higgins

A Thesis

submitted in partial fulfillment of the requirements

for the degree of

Master of Education

**FACULTY OF EDUCATION**

**LAKEHEAD UNIVERSITY**

**THUNDER BAY, ONTARIO**

© Marc Higgins

April 2010



Library and Archives  
Canada

Published Heritage  
Branch

395 Wellington Street  
Ottawa ON K1A 0N4  
Canada

Bibliothèque et  
Archives Canada

Direction du  
Patrimoine de l'édition

395, rue Wellington  
Ottawa ON K1A 0N4  
Canada

*Your file* *Votre référence*  
ISBN: 978-0-494-71773-8  
*Our file* *Notre référence*  
ISBN: 978-0-494-71773-8

#### NOTICE:

The author has granted a non-exclusive license allowing Library and Archives Canada to reproduce, publish, archive, preserve, conserve, communicate to the public by telecommunication or on the Internet, loan, distribute and sell theses worldwide, for commercial or non-commercial purposes, in microform, paper, electronic and/or any other formats.

The author retains copyright ownership and moral rights in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

---

In compliance with the Canadian Privacy Act some supporting forms may have been removed from this thesis.

While these forms may be included in the document page count, their removal does not represent any loss of content from the thesis.

#### AVIS:

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque et Archives Canada de reproduire, publier, archiver, sauvegarder, conserver, transmettre au public par télécommunication ou par l'Internet, prêter, distribuer et vendre des thèses partout dans le monde, à des fins commerciales ou autres, sur support microforme, papier, électronique et/ou autres formats.

L'auteur conserve la propriété du droit d'auteur et des droits moraux qui protègent cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

---

Conformément à la loi canadienne sur la protection de la vie privée, quelques formulaires secondaires ont été enlevés de cette thèse.

Bien que ces formulaires aient inclus dans la pagination, il n'y aura aucun contenu manquant.

  
**Canada**

## Table of Contents

<b>Acknowledgements</b> .....	iv
<b>Note to the Reader on Verb Tenses</b> .....	v
<b>Abstract</b> .....	1
<b>Introduction</b> .....	2
<b>Chapter 1 – Positional Piece – RE:Visiting past identity, revealing decolonizing touchstones</b> .	5
Preface .....	5
Growing up in New Brunswick.....	7
Science Education 101.....	19
Elsipogtog, New Brunswick.....	11
Dream Team .....	15
In the present, looking to the future .....	18
<b>Chapter 2 – Literature Review – RE:Considering the nature of (multicultural) science (education) (for all)</b> .....	20
Introduction.....	20
Multicultural science education .....	21
Worldviews.....	25
Border crossing and the culture broker.....	32
Nature of science as a component of a postcolonial curriculum .....	34
Setting the stage for intercultural dialogue.....	36
<b>Chapter 3 – Methodology – RE:Conceptualizing the reel/real</b> .....	38
Prelude to methodologically messy moments .....	38
Research which places respect first.....	39
Twin lens methodology - participant-driven videography .....	44
Twin lens methodology - video-auto-ethnography .....	48
Ethical preparations for the field.....	52
Data analysis methods and coding tools .....	54
<b>Chapter 4 – Data Story – Re:Telling tales from the field</b> .....	58
<b>Chapter 5 – Data-analysis – Re:Viewing videos</b> .....	65
Data themes .....	65
Participant perceptions on science .....	66
Personal perceptions on research/education process.....	73
<b>Chapter 6 – Research Findings – RE:Defining decolonized science education? (through multiple lenses)</b> .....	81
Science education as a decolonized practice?.....	82
Twin lens methodology – video as a tool for multi-perspectivity .....	86
Decoloniz(ed/ing) science education through the video (twin) lens .....	97
<b>Afterword</b> .....	100
<b>References</b> .....	101

## Acknowledgements

First and foremost, I would like to thank the research participants and their community of Iqaluit, Nunavut as they were warm and welcoming. Every time I go back to Nunavut, I am often the one who is taught although I am the one going to teach, this year was no exception.

I would like to thank Dr. Ghislain Deslongchamps and my high school prom date for pushing me towards this grand and fulfilling (mis)adventure.

I would like to thank both Actua and NRI for allowing me to modify existing camp structures to make this research possible.

I would like to thank Dr. Andrea Belczewski, my first mentor in Aboriginal science education, for setting me off on this path, and continuing to support me along it.

I would like to thank Dr. Connie Russel, who's office visits were filled with laughter. With her positive "make it happen" attitude, I could allow myself to dream big.

I would like to thank Dr. Paul Berger, my committee member, for being a *caring Qallunaat*, for sharing insights regarding education in Nunavut and for modeling in practice what it means to be a critical pedagogue.

I would like to thank Dr. Lisa Korteweg, my supervisor, for standing behind me every step of the way, from the very inception of the project to its very end – be it words of wisdom, a deluge of digital resources, or the ever appreciated office time made when time was not always available.

A kind word also goes out to all my peers who helped throughout the process in various forms, be it editing for grammar and flow or providing further avenues of thought. Thank you Ismel Gonzalez, Emily Root, Blair Niblett, Jocelyn Burkhart, Natalie Rowlandson, Melissa Hill, Meghan Jewell, Brooke Costello.

Lastly, I would like to thank my family for believing in me.

## Note to the Reader on Verb Tenses

Oftentimes within this thesis, there are instances where the verbs are used in the present tense when discussing events in the past. In these situations, I have intentionally chosen to use the present tense to indicate that these events (or feelings) continue to apply to this day, even if the way in which they apply are not the way they might have applied in the past.

Drawing from Richardson's (1994) writing-as-a-method-of-inquiry, this intentional choice serves the purpose of allowing multiple interpretations of the words before us (Richardson, 1994, 1997, 2001) in the postmodern sense. Part of the focus is on the meaning of the relationship between, and the interpretation of, the past and the present (Somerville, 2007) as "the inherent capacity of time to link, in extraordinarily complex ways, the past and present to a future that is uncontained by them has the capacity to rewrite and transform them" (Grosz, 1999, p. 7).

These instances speak directly to the nature of decolonizing journeys – they are processes. As I progress along my own journey, I continue to address my own Eurocentrism and better learn to see Aboriginal culture. While I grow from the process, there is always more to be done.

## Abstract

Education in Nunavut, still largely based on EuroCanadian knowledge and Western teachings, is a negative experience for many Nunavut youth – the result of cultural inappropriateness and worldview mismatch. The mismatch is one between an appropriate learning experience and the character, values, and traditions of Nunavut – and it remains especially pronounced in science education. In addressing this mismatch, I strive to decolonize both practice and practitioner by using movie camera lenses: in the first instance, to lend voice to Inuit youth’s perspectives on *science* and, in the second instance, to turn the lens inward to address my own Eurocentric worldview and how it impacts the science education I deliver. Through this decolonizing synergy, I search to understand and deliver science education that strives to reach tenets of respectful research – to enact decolonizing actions that speak louder than words.

## Introduction

Schooling in Nunavut is still largely based on EuroCanadian knowledge and Western teaching, and is still largely a negative experience for Nunavut youth communities. The locus of the problem is not one of achievement but rather one of cultural inappropriateness (Aylward, 2007; Barnhardt & Kawagley, 2008; Battiste, 2005; Mason, 2006) – there is need for appropriate learning experiences that match the character, values, and traditions of Nunavut (Cajete, 1999; Mason, 2006; Peat, 2002). Currently, one of the most obvious mismatches is between Inuit Qaujimagatuqangit (IQ), “all aspects of traditional Inuit culture including values, world-view, language, social organization, knowledge, life skills, perceptions and expectations” (Nunavut Social Development Council, 1998) and science education. I will argue, however, that Western science and IQ do not have to be mutually exclusive: there are many scientific concepts from both worldviews that resonate with one another (Peat, 2002).

This thesis explores the central research question, how can a meaningful relationship with science be facilitated through culturally responsive informal science programs for Inuit youth? The thesis proceeds to address this question through the following chapters:

(Chapter 1) A positional piece: RE:Visiting past identity, revealing decolonization touchstones (see p. 5). In this chapter, I retrace key steps in my ongoing decolonizing journey to better situate myself in the research and the lens through which I view the world and the world of research.

(Chapter 2) The literature review: RE:Considering the nature of (multicultural) science (or a science education-for-all) (see p. 20). In this chapter, I first address the inappropriateness of the science-for-all approach in Nunavut which, in leaving the all to the end or last position, then prioritizes a particular view of science that becomes Western-size-fits-all. Secondly, I explore and propose an alternative approach to science education for educators concerned with a culturally responsive approach (Gay, 2000). This alternative draws upon the strengths of oft conflicting worldviews present within Nunavut schooling and communities.

(Chapter 3) Methodology: RE:Conceptualizing the reel/real (see p. 38). In this chapter, I describe in greater detail the twin lens methodology (composed of video-voice and video-auto-



ethnography) that frames this study and aims to enact the proposed approach of science education (as described in #2) to create a decolonizing synergy with the Actua camp participants.

(Chapter 4) Data stories: RE:Telling tales from the field (see p. 58). In this chapter, I revisit the key empirical events leading up to, and during, the data collection phase of the study. I also describe and profile the youth participants and their community of Iqaluit, Nunavut, as the co-participants in the research.

(Chapter 5) Data analysis: RE:Viewing video (see p. 65). In this chapter, I explore the youth participants' perceptions of science, as well as my own perceptions on the research/education process of science camps in Nunavut to reveal claims.

(Chapter 6) Research Findings: RE:Defining Decolonized Science Education? (through multiple lenses) (see p. 81). In this chapter, I lay out findings that describe what respectful science education might look like in a science camp with Inuit youth, how non-Indigenous science educators might decolonize themselves in an Inuit education context as well as probing into the twin lens methodological process and what framings this methodological pairing provided.

Overall, in attempting to explore a science education approach that is meaningful, respectful and culturally responsive, the thesis aims to:

- (1) Explore new means of delivering culturally responsive science curriculum that acknowledges, respects and honours multiple worldviews and perspectives,
- (2) Examine how Inuit youth define, document, and determine what science means to them, as well as discover through the youth's video-voice how "science" is enacted within their communities, and
- (3) Critically analyze the roles that I and other non-Indigenous educators can embody in delivering culturally responsive science curriculum in Indigenous communities.

In order to achieve these goals, I set off to Iqaluit, Nunavut during the month of July in 2009. During this period, I was working within the dual role of movie-making camp instructor

and educational researcher. As an instructor, I delivered a movie-making program intending to teach youth (both Inuit and non-Inuit) the basic techniques and skills required to create their own video-media. As a researcher, I collected video data of the youth's media work, as well as my own video-logged self-reflexive decolonizing work. Over the course of two weeks and within this dual role, I worked towards delivering an educational experience that would be culturally relevant, fun and would allow the youth to explore science in a way that they would not normally in formal school contexts.

In the thesis, I argue that when using video as an ethnographic partner (Goldmann-Segall, 1998) and aiming for a language of cultural rejuvenation (Riecken et al., 2006) with the Indigenous participants, then a culturally responsive science education can begin to help youth to learn to see what they already know (Aylward, 2007), through video points of viewing of their world, community and knowledge. Inuit Qaujimagatuqangit, the deep Inuit worldview, and Western science, a worldview that closely and minutely investigates the physical world, are both valuable, yet different culturally responsive paths to knowledge of the world that can be walked upon and viewed simultaneously.

## Chapter 1 – Positional Piece

### *RE: Visiting past identity, Revealing Decolonizing Touchstones*

#### *Preface*

This chapter is a series of narratives that guide the reader through the critical moments when I experienced growth as a science educator working with Aboriginal youth, whether in First Nations, Métis or Inuit communities. These narratives are all steps along my own decolonizing journey; they are moments that began to dislodge my touchstones (Strong-Wilson, 2007), those uncomfortable experiences that challenged the hegemonic colonial narrative in which I was marinated (Battiste, 2005). These confrontations caused a series of un-focusing and refocusing events to the lens with which I view the world. Through a process analogous to ocular accommodation, or the process in which the lens of the eye changes the eye's focal point, my horizon or "everything that can be seen from a particular vantage point" (Gadamer, 1975/1998, p. 302), diverged, converged, and shifted.

In order to critically analyze the roles that I and other non-Indigenous educators can attempt when delivering culturally responsive science curriculum in Indigenous communities, we need to first engage in a deconstruction of our cultural identity, that of the science educator as cultural broker (Stairs, 1995). How can I, as an educator, teach and communicate with a culture that is not my own without first looking at my own culture and cultural standpoint and revisit those events that developed my cultural identity?

My sense of teacher-self and science educator are intrinsically linked to the work I have done in the field of informal science education with Actua (actua.ca), a non-profit organisation. Since the year 2000, I have been actively involved in the delivery of workshops, camps and clubs which focus on making science accessible and fun for all youth – enacting Actua's mission statement:

Actua's mission is to provide young Canadians with positive hands-on learning experiences in science and technology. By stimulating young people's natural curiosity, we help them develop self-confidence, creativity, and critical thinking skills – and inspire them to become learners for life. (Actua, n. d.)

Through this hands-on educational work with Actua, my love for science and science education was rekindled, after almost being extinguished as a result of my formal education in the field. This is a passion I want to share with all, especially with those who have received any disservice from science education.

I remain committed to the power and importance of science literacy as a means to empower the marginalised (Millar 2006), as well as science-for-all, the idea that science should be accessible and of service to all youth, regardless of their race, gender or beliefs. Science has often been my own personal means of empowerment when I have felt like a social other, or social outcast. Science provided personal strength derived from a better understanding of the natural world when the social world made no sense to me. Through my own scientific literacy, I have been able to make sense and choices of the proliferating science information presented in the media. These scientific interpretations and decisions were of my own volition, and gave me a sense of self-determination and control. As my own constant companion and source of understanding the world, I became committed to the idea that scientific literacy could do even more and be of more service to all. When delivered through a culturally responsive curriculum, perhaps science could transcend and even unify different worldviews?

Culturally responsive teaching is defined as using the cultural characteristics, experiences, and perspectives of ethnically diverse students as conduits for teaching them more effectively. It is based on the assumption that when academic knowledge and skills are situated within the lived experiences and frames of reference of students, they are more personally meaningful, have higher interest appeal, and are learned more easily and thoroughly. (Gay, 2002, p. 106)

As a white Canadian male of European descent, it is certainly not my place to impose either science or educational research upon Inuit communities but culturally responsive approaches seemed to offer a promising direction. I am aware of the colonial nature of past and present relationships between Indigenous peoples and Western researchers, as well as continuing colonial struggles with education and educators. Where I may have been more naïve in the past regarding this issue, I now struggle with the reality that “research is probably one of the dirtiest words in the Indigenous world’s vocabulary” (Smith, 1999, p. 1). I have

committed to try not to perpetuate this reality. Some scholars argue that only Indigenous people ought to do Indigenous research (Smith, 1999; Wilson, 2001) while other scholars are open to allies working in collaboration with and under the direction of Indigenous communities. Still other scholars focus on the dominant group and argue that white educators will have to change and do their own work to decolonize, to move away from relying on the dominance of ideological authority, towards a willingness to imagine that cultural encounters and clashes can promote cross-cultural learning (Dasenbrock, 1992, Kanu, 2006; Sleeter, 2000/2001, 2001). As both an ally and as someone on my own decolonizing journey, I still fear that I may never be sufficiently aware of the cultural protocols, values and beliefs of the Indigenous groups with whom I have worked. I know I will continue to grapple with the three R's of Indigenous research: Respect, Reciprocity and Relationality (Weber-Pillwax, 1999). But, my worst fear is that I may never be able to follow through any "R" in a meaningful way (Menzies, 2004).

I came to my master's program with the notion that both the content and the container of science education currently delivered, formally in schools, were lacking in their ability to increase science literacy or "what the general public ought to know about science" (Durant, 1993, p. 129). This has also been my impression from multiple experiences in the Actua informal science programs with Aboriginal youth across Canada's North. While I want and strongly advocate for science education that is more accessible and relevant for Indigenous youth, there lingers within me a fear that western science education may cause more damage by marginalizing Indigenous knowledge through Eurocentric diffusionism<sup>1</sup> (Battiste, 2005; Blaut, 1993). I often ask myself if there is any positive role possible that I can portray and embody in science education in Nunavut and what that role would entail and require.

### *Growing up in New Brunswick*

I was born and bred in New Brunswick. I am the son of a *Québécois* and an Ontarian, both of whom are third generation descendants whose heritage can be traced back to Ireland and Scotland. It was not long before my hybrid sense of cultural identity was jumbled: my first

---

<sup>1</sup> Eurocentric diffusionism is the colonizers' lens onto the world that actively measures everything to an internalized Western meter stick or measurement system. Eurocentric diffusionism erases and silences everything that is not Western or understood as European sensible (Blaut, 1993).

spoken word was “ho,” a hybridization of hot and *chaud*, the result of placing my hand upon the stove’s element. In the past and still to this day, I check both official languages on questionnaires and polls when asked for my mother tongue or first language.

Through school, I associated with the history of Upper Canada, of *Bas Canada*, and *l’Acadie* (the early French settlements located in the Atlantic region). While my home life, as well as my early schooling, spoke of a linguistically reconciled Canada, what awaited me beyond was very different. In later schooling, I became acutely aware of the francophone, a Eurocentric version of persecution and injustices occurring during the founding of Canada through the explicit, and implicit, history lessons learned (e.g., the Acadian Deportation).

It would only be a matter of time before I would suffer linguistic prejudice myself. I had grown up in the aftermath of the 1969 Official Languages Act and the Constitution Act of 1982, which included the Canadian Charter of Rights and Freedoms, and the 1988 New Official Languages Act, which all ensure an incrementally increasing equality of status between French and English as official languages across Canada. In New Brunswick, the only bilingual province, tensions were running high between anglophones and francophones. As part of the 10% minority of Fredericton locals who could speak French, I was lumped into the anglophone-determined category of “frogs.” I would often overhear comments of “how the French are taking all the jobs,” a real concern in a have-not province where the primary sector<sup>2</sup> was dwindling, a province where skills like the ability to speak both official languages would dictate employment opportunities. While I tried to empathize with the anglophones, being bilingual and having a hybrid culture, I was also made to feel othered and other.

In this milieu, my teachers had the daunting task of teaching content in French while their students were pushed into a negative or deficit perception of their own language by the dominant English sea. *Les cours de Français* would not be taught without a cultural assertion component by the teachers – the instructional means of culturally empowering us to use our language and to demand our rights politely, in a typically (schooled) Canadian fashion.

In retrospect, the curriculum I received, in terms of content and delivery, was a cultural practice (Kanu, 2003). My learning experience was one that was assertive, affirmative and

---

<sup>2</sup> In the Fredericton area, and across the majority of the province of New Brunswick, lumber is natural commodity number one.

empowering because the learning started from many of the students' culture and the teaching positively reflected it throughout.

Given my own cultural-linguistic marginalization, the idea of a need for a curricular landscape of our own (Chambers, 1999), a hybrid language that represents Canadian cultural multiplicity in schooling became apparent to me. We need a language, a curricular means through which meaningful dialogue can be engaged. Perhaps through such dialogue, we can find what Bhabha (1994) refers to as a "third space," a teaching-learning space in which all discourses are represented and equally integrated: a world in which endless dualisms of Eurocentric thought – black and white, French and English, powerful and marginalized – are not dominant or the dictator.

Science's ability to move away from duality was certainly one of its appeals for me during my schooling and beyond. While the multiplicity that I strive for today was not, and continues not to be, promoted by science, I was star-struck by the universal truths science seeks. In moving from duality to singularity, my scientist-self had not paid heed to the cultural-self who had learned the meaning of feeling othered and other, and the importance of multiplicity in dialogue. Reconciling my fractured horizon, my selves and inherited positions, would be a lesson for another day.

### *Science Education 101*

My starlust and desire to be an astronaut, when partnered with an overactive imagination and intense curiosity, quickly developed with my young mind a deep ongoing interest in science. I thank my parents for enrolling me in informal, innovative science programming, such as Worlds UNBound,<sup>3</sup> Fredericton's local Actua chapter. This fed my insatiable desire to understand the nature of the world around me and allowed my interest in science to bloom. This would later see me returning to Worlds UNBound (WU) as an instructor.

While my scientist-self sought out singularity, my teacher-self began to see multiplicity. From personal experiences in the informal and formal science education programs, I soon realized that, "there is not one kind of learning" (Bruner, 1985, p. 8). While I had taught

---

<sup>3</sup> See [www.unb.ca/eng/worlds](http://www.unb.ca/eng/worlds) for more information.

swimming lessons throughout high school, it was not until I became a science camp instructor at WU that I learned that all children could learn if you taught with them instead of at them, as well as the importance of multiple perspectives and representations, as children need to make sense of the abstract (Miller, 2000), particularly with scientific phenomenon.

When I began working with youth, I naively and superficially had the notion that “all people are worthy of respect” (Dillon, 2007, ¶1). While I still hold this belief, how I enacted it at the time was distinctly different – it was respect that stemmed from a naïve sense of equality and neutrality. In sameness, I thought I attained fairness for all. This respect was not a deep or mature care respect (Dillon, 1992a), derived from a feminist ethic of care (Noddings, 1999, 2002), which understands persons as unique, particular individuals. While my actions were well intentioned, I regularly enacted the lesser of two forms of caring, which Noddings calls “caring about” (1999) (rooted in rationality and responsibility, which often does more harm than good), rather than “caring for” (2002) (rooted in a genuine desire to care rather than acting out of a sense of responsibility or professional duty).

In 2002, I was a returning camp counsellor at Worlds UNBound and I had my first experience of working with a predominantly Aboriginal group. While my position entailed additional responsibilities above and beyond that of the previous year’s, I was not involved in the decision-making process surrounding working with this group of students. As such, I am, to this day, unsure of the process through which the decisions were made in response to WU being approached by the Mi’kmaq and Maliseet Institute to partner to offer a science and engineering camp to Aboriginal youth. In its first year of partnership, it was decided that the participating youth would be bussed from their community to the university campus to receive a business-as-usual science and engineering camp.

As a team, we were not as effective in teaching and reaching our Aboriginal camp participants as we were with the non-Aboriginal youth. This became clear during the debriefing session that took place at the end of the camp – the staff, as individuals and as a team, myself included, felt that we did not provide an experience that was fun or educational because we were not prepared to “deal with difference.” This is when it first dawned on me that maybe “the transition from the [I]ndigenous world-view to the scientific [Western] world-view is too



great, without a bridging programme” (Sutherland & Dennick, 2002, p. 2) and that the opposite transition, from the worldview of Western instructors to the worldviews of Indigenous students, was also one that should be bridged and guided. Some administrators in Actua now argue that they deliver such programming (in both directions, that is cross-culturally) in the majority of their locations – but in Fredericton, in the year 2002, this bridging did not occur for either the staff or the youth.

The decolonizing journey of my identity as science educator began with both this camp and the debriefing that followed. For the first time, it became clear to me there was a problem with the Actua science camps, and secondly, that the problem did not lie with the participants but with the organization, with the staff, and with me.

### *Elsipogtog, New Brunswick*

In 2003, as the assistant director of Worlds UNBound, the Aboriginal Outreach branch of the program became one of my responsibilities. The WU had established a stronger, reciprocal working partnership with the Mi’kmaq and Maliseet Institute (MMI), an institute which “promotes the professional growth and self-determination of the First Nations [in the Maritime region and beyond] through its programs, services and research” (MMI, n. d., ¶12).<sup>4</sup> Both WU and MMI strongly wanted to collaborate to improve the science outreach to Aboriginal communities, so a few members from WU and MMI partook in what Apple (2007) would call a “critical questioning [as] a collective project” (p. 170) of the prior year’s Aboriginal Outreach. We quickly agreed that the camps did not work. It did not work for WU, it did not work for MMI, and more importantly, it did not work for the youth.

Under Dr. Andrea Belczewski’s lead, we re-assessed the delivery. Dr. Belczewski was MMI’s Bridging Year Coordinator and WU’s liaison to the MMI, and she was far more versed in respectful education than any of WU’s team of budding, and educationally-inclined engineers and scientists. Because the previous year’s experience made me realize that there was a serious problem with the business-as-usual camp model when using it as one-size-fits-all approach, I paid close attention to Andrea’s lead and questions in the re-assessment of delivery.

---

<sup>4</sup> See [www.unbf.ca/education/mmi/](http://www.unbf.ca/education/mmi/) for more information.

Resolution number one was to “go to where the kids were” – or to connect with Indigenous knowledge that is deeply rooted in the place of learning (Aikenhead, 2006; Peat, 2002). Rather than bussing the Aboriginal youth to the university, the temple of Western knowledge, the camps were relocated to three different Aboriginal communities that summer.

Resolution number two was to increase the amount of culturally relevant curriculum by inviting Elders and other members of the community to lead activities such as nature walks, basket-weaving, drum circles and other activities that were natural points of departure for further learning about traditional knowledge, for both the youth, specifically those who showed signs of not being well versed in their own traditional culture, as well as to educate the non-Indigenous WU personnel. The Elders graciously gave of their time and contributed to the camps because they were gravely concerned about the youth’s lack of awareness of Mi’kmaw and Maliseet<sup>5</sup> traditional knowledges and cultural practices. Because the communities, MMI, and WU had together reached a common goal of this science camp becoming a culturally responsive experience, cultural activities were delivered in tandem with the hands-on science curriculum that would normally be delivered alone by WU. As such, the programming delivered became bi-cultural (Cajete, 1999), but this biculturalism was not necessarily one in which both cultural contexts responded to one another or integrated seamlessly. It was, at best, a well intentioned cross-graft which ran the risk of the Western model overwhelming or rejecting the other.

Resolution number three was in my opinion, by far, the most adventurous one. Most of the new curricular programming delivered explored Western science and Indigenous knowledge as different but unfortunately, exclusive paths to knowledge rooted in the same reality, in the same physical world in which we all live in (Mazzocchi, 2006). With an Elder’s permission, we resolved to deliver a project that integrated both Western and Indigenous knowledge.<sup>6</sup> We were to build a geodesic sweat lodge and then conduct a ceremony within it, conjoining both forms of knowledge in a way that was beyond a mere graft. While this project aimed to be respectful, the risk it ran of being the opposite was clear and present.

---

<sup>5</sup> The focus on either Mi’kmaw or Maliseet traditions depended on the region of the province in which the camp was located.

<sup>6</sup> See Belczewski (2009) for this event unpacked in greater detail.

The first of these three WU camps was located in Elsipogtog, New Brunswick (formerly Big Cove). Upon arriving, it dawned upon me how little I knew of this or any First Nations. To me, at the time, they were the others. The city of Moncton, where another satellite camp was being run in parallel, was far away – gone was the concrete, gone were the tall buildings, gone was the sea of whiteness that was Moncton. Instead, in front of me stood a village with dirt roads, buildings that were in no way physically imposing, and radio broadcasts I could not understand. Despite my initial culture shock, as we drove in and as people started peeking out and waving, I realized that I was not just in a village but entering a community – it became clear to me that it was not only important for us to “go where the youth were” but for us to understand where the youth were from and where they were embedded.

As “you need to live with [students] that which you wish them to learn” (Maturana & Bunnell, 1997, p. 10), the construction of the geodesic sweat lodge was to be a communal effort in which youth, members of the community, as well as WU instructors (myself included), would create collaboratively and build understanding at the same time as the sweat lodge. During the initial phases of the construction, the community members and WU staff did not always see eye-to-eye – there was a mild breakdown in communication when culturally laden notions such as time, and how it was employed, clashed. This was only natural, as distinct individuals with different cultural horizons (Gadamer, 1975/1998) made for distinct points-of-view. For me, the sweat lodge construction became a lesson in new listening. I became aware that the geodesic dome was not the important purpose of the activity, rather the integration of community members through the sweat lodge into the science camp was. The construction became a lesson in respect for the WU instructors, of us letting go of what we thought was scientifically important with a geodesic dome in order to respect the stories of the sweat lodge, in order to listen to the other and “begin to learn to hear each other” (Chambers, 1999, p.146).

Upon completion of the sweat lodge, the Elder who was to lead the sweat gave a hearty laugh at the sight of this unusually shaped sweat lodge adorned by blankets that the community had lent. The geodesic dome certainly did not look like a sweat lodge should, something which the kids giggled about during the better part of the construction. Nonetheless, the Elder, smiling, began the preparation for the ceremony. In retrospect, I am

left perplexed as to why this Elder agreed to lead the ceremony, much less allow us to build the geodesic sweat lodge in the first place when one of three communities we worked with that summer outright refused as they saw it as a sign of disrespecting ceremony and cultural traditions.

As we began the construction of the geodesic dome, the same Elder asked about the youth's cultural experiences – for many of the youth present, it would be their first time constructing a sweat lodge; for some, it would be their first time partaking in the ceremony. When the Elder asked these questions, I was shocked, and furthermore, torn. Though I knew the project aimed to be cross-cultural, I came to realize that it was interrupting the community's cycle of knowledge transfer and diluting the traditional culture through non-traditional Western (invasive) means of mixing science purposes with cultural ceremony. When I reflect on how this would have been the first sweat lodge ceremony for some of the youth present, I realize how destabilizing or disconcerting this mix or mash-up of cultures could be for the youth. Nonetheless, the Elder was steady and full of integrity in his ceremonial preparation so he might have seen potential in this mixing and that more good than bad would come of it.

While I knew at this point that learning had to be culturally relevant, it was not until I participated in this sweat that the notion of culture as the start and location of learning could become the means of bridging traditional knowledge (ceremony, cosmology and spirituality) with science (e.g., plant knowledge, geographical science, etc.). The sweat lodge we had built used knowledge of the land to gather materials (the nature of the wood) and the knowledge of mathematics (the geodesic shape). Indigenous traditional knowledge and Western science did not have to be mutually exclusive and were not in this activity – there are opportunities when both worldviews can resonate with one another (Peat, 2002) and learn from one another (Mazzochi, 2006).

Yet, while such bridging can be powerful, this experience also brought to light the fact that such bridging could be interpreted as culturally damaging by the First Nation. During that summer, one Mi'kmaq community and set of Elders disagreed with the cross-cultural integration stating that it would be disrespectful to the traditional culture and spiritually wrong. In future community collaboration, I would exercise more caution on how I would “care for”

rather than “care about” (Noddings, 1999) the youth, the Indigenous community and their traditional cultural practices. In my desire to facilitate bridging work but also be respectful with Indigenous communities, I realize that I need to be better attuned to the discomfort of possible cross-cultural errors, learning to hear “no” to science, and learning to hear and respect cultural protocols.

### *Dream Team*

In the summer of 2008, ideas of cultural interdependence was if not explicitly, implicitly being sought when Actua’s Science, Engineering, Technology, and Education (SETE) instructors, both Aboriginal and non-Aboriginal, were gathered from across the country to create an Arctic outreach team that Actua called, the Dream Team. Saul (2008), with respect to cultural interdependence, argues that:

The original party, the Aboriginal, is built upon a philosophy that has interdependence at its core. This is the opposite of such European ideas as the *melting pot*, which was picked up by our neighbour as a way of explaining how you could get a new kind of European-style purity out of a mix of peoples. The idea of difference is central to Indigenous civilization. These differences are not meant to be watertight compartments, not vessels of purity. It is all about working out how to create relationships that are mixed in various ways and designed to create balances. It is the idea of a complex society functioning like an equally complex family within an ever-enlarging circle. That is the Canadian model. (p. 107, emphasis in original)

With our respective SETE experiences, we would lean upon one another to deliver the dream camp that we each might have individually striven for, but could not try to actualize until instructors worked as equal team members. It is this idea of equality, as well as fairness, that construe the collective consciousness of what “the Canadian model” of Aboriginal-non-Aboriginal Canada is according to Saul (2008).

During my summers in Nunavut (2006-2008), I took to heart and action the pedagogical approach that culture and student learning are intrinsically linked (Davis & Sumara, 2000; Ramirez & Castenada, 1974; Vygotsky, 1981; Wertsch, 1991; Winzer & Mazurek, 1998) and that “no content is fundamental, but rather the content needed for enhancing scientific literacy is dependent on the culture and society in which the science education is implemented”

(Holbrook & Rannikmae, 2007, p. 1352). I was now in a position, both instructionally and conceptually, to explore science within a cultural context, within an Inuit context. One of my early curricular attempts was to explore the concept of sound through a variety of cultural perspectives. The Dream Team, on location in Iqaluit, Nunavut, invited throat singers to sing for and with the youth. We, the non-Inuit instructors (as well as Inuit instructors during the summer of 2008), then worked to partner this traditional knowledge with hands-on projects involving hearing sounds the way a beluga would by feeling the vibrations, as well as constructing an edible (jujube) interactive physical wave to show how sound travels.

Upon reflection, I now realize that this was a step towards learning in a “coming-to-knowing” way (Ermine, 1998; Peat, 2002), a term which reflects how many Indigenous people learn – learning by entering into a holistic relationship with knowledge. We can find a Western pedagogical model in Dewey (1916) that is analogous: “if the living, experiencing being is an intimate participant in the activities of the world to which it belongs, then knowledge is a mode of participation” (p. 393). Polanyi’s (1966) notion of tacit knowledge, where knowledge is to be acquired through experience and relationship with the thing to be known, also has some tenets similar to the ongoing Inuit learning of traditional ancient knowledge (Ingold, 2004). Coming-to-knowing differs from this last form of knowing in that it speaks of entering a relationship with knowledge, where knowledge, like a spirit, exists independently of the human consciousness. Coming-to-knowing respects the notion that, like all other relationships, there are agreements and obligations to be met, there is responsibility attached to the knowledge (Peat, 2002). It is experiential learning with a built-in consciousness.

In the summer of 2008 I had the opportunity to deliver camps to Inuit youth for the third summer in a row. That summer, more than previous summers, I learned of Inuit culture, specifically the culture of Nunavut. I had learned with, and from, the youth about throat singing. I ate *muktuk* (whale skin and blubber) and learnt how it was prepared. I lived on the land for a week, learning the Inuktitut names for the plants and animals we saw. I, with one of the Inuit campers, made my first *Inuksuk*. The people had much to share – and I was ready to listen, maybe more so than in previous summers. I hope that in my brief time in Nunavut that the campers learned as much from me as I learned from them.

There is one event that strongly stands out in the weeks I spent in the community of Igloolik delivering camps: I witnessed firsthand what holistically drawing from both Inuit Qaujimaqatugangit and Western science can result in. Moshi Kotierk, a modest man, refers to himself as *ajungi* (Inuktitut for capable); an understatement to say the least. Moshi, when faced with the rising price of oil in Nunavut, where almost all energy is derived from petroleum, decided to attack the problem in an unconventional fashion. Boiling down blubber from hunted seal and mixing the resulting oil with petroleum, he made use of what was available to him on the land to create an alternative energy source, a seal diesel. At the time of my visit, this fuel was undergoing a full-on experimental process in which he tested various ratios of animal oil to petroleum, their freezing points, and their functionality in a generator. I was in awe of what he was doing. With ease, he, in my eyes, gracefully consolidated, and conjoined notions from distinct and different worldviews that often clash with each other. Where Moshi is both an Inuit weekend hunter and a Western weekday scientist, it may well have been that these two distinct bodies of knowledge engaged in an internal dialogue<sup>7</sup> (Bohm, 1996; Teurfs, 1994).

This last event spoke directly to my scientist-self. Where my teacher-self and my cultural-self saw strength in multiplicity, my scientist-self, indoctrinated by the church of science, imbued with shades of scientism, had been wavering with respect to multiplicity, to seeing the world through multiple lenses. What my teacher-self and cultural-self saw as the right, respectful thing was also what my scientist-self saw, in this event, as a meaningful, productive and powerful thing. I, the whole self, was finally on board with the notion of science education as a cultural undertaking which draws strength from multiplicity.

Teaching in this manner was something I could never do. This was, as I saw it, an application of (Indigenous) wisdom: the “teaching of wisdom is not something that can be done as a manipulation of students in any form” (Maturanna & Bunnell, 1997, p. 10). Nonetheless, even if “creating a *balance* between two worldviews is the great challenge facing modern educators” (Battiste, 2000a, p. 202, emphasis in original), I wish, with my limited and recently learned Indigenous knowledge, partnered with a desire to learn more, to aid Inuit youth in creating their own intercultural scientific “third space” (Bhabha, 1994), a space beyond

---

<sup>7</sup> “In dialogue, we no longer come from a place of wanting to convince or inform. We come with the intention of understanding” (Teurfs, 1994, ¶32).

cultural differences which does not leave behind culture itself. As the people of Nunavut have given me so much, I was excited to work on this project with Inuit youth.

*In the present, looking to the future*

I am immensely grateful to have had experiences that confronted the touchstones (Strong-Wilson, 2007) in which my perceptions were grounded. These experiences allowed me to become increasingly conscious of my own vantage point, experiences that shifted and reconciled my fractured horizons. While I have learnt to better see Aboriginal student's culture, as well as my own, there are still many things about which I worry.

My decolonizing journey is far from over - I now wonder as to how to go about finding for myself a meaningful educational role that I can play that will facilitate empowering Inuit youth without causing further damage, without perpetuating further hurtful cultural legacies. I worry about many things. I worry that "the trend towards a global culture might even worsen this situation and enhance a process of cultural homogenization" (Mazzocchi, 2006, p.465). I worry that science-for-all is a term that draws negative attention to specific groups that may not have benefited as much from science education as others, groups that are often labeled as disadvantaged (McKinley, 1998). I worry that my culture, embodied in any way, is destructive and oppressive. Miller's (1989) words are cautionary to me:

Our culture does not nourish that which is best or noblest in the human spirit. It does not cultivate vision, imagination, or aesthetic or spiritual sensitivity. It does not encourage gentleness, generosity, caring or compassion. Increasingly in the late 20<sup>th</sup> Century, the economic-technocratic-statist worldview has become a monstrous destroyer of what is loving and life-affirming in the human soul. (p. 2)

Furthermore, I worry that I may find it difficult to fully be aware of my own cultural baggage in order to manage it – as a student of the sciences, I have bought into a deterministic, linear, dualistic and discontinuous worldview (Capra, 1975). This view is irreconcilable with the notion that "throughout the living world we find systems within systems" (Capra, 1996, p. 37), realities within realities (Cajete, 1994), a universe that speaks of fractal interrelation (Bai & Banack, 2006; Capra, 1975; Capra, 1996, Davis & Sumara, 2000), a world of interconnectedness in which nature is the metaphysic (Kawagley & Barnhardt, 2008), a world in which we see both



Western science and Indigenous science as cultural realities embedded within their respective cultures (Cajete, 1994). I try to let go of Cartesian dualisms and the mechanical universe that blind me so that I, too, can better see that “the whole world is, intricate and complex variations of the same theme: Life” (Bai & Banack, 2006, p. 15) so that I may be more respectful and understanding of Indigenous worldviews.

Nonetheless, as a *Qallunaat*, a non-Inuit, I can still be a positive presence in the life of Inuit youth given my attitudes and strong desire to care (Berger, 2007). I will have to audit my actions, my beliefs, my motivation in every step of the process to ensure relational accountability (Wilson, 2001), ensuring that I am respecting and accountable to all-my-relations: to the rocks, to the plants, to the animals, to the stars and to the people (Peat, 2002). I strive to respect Nunavut’s people by engaging in decolonizing actions that speak louder than respectful words so that I may fully respect the Inuit youth with whom I work, their communities, their culture, their worldviews.

As such, I know that I have had to, and continue to need to actively work to decolonize both myself and my science teaching in order to curb and hopefully repair colonial legacies; as Orr (1991) suggests, “the goal of education is not mastery of a subject matter, but of one’s person” (p. 56). I realize that my teaching practices require a drastic change from that of Pinar’s (1992) educational coach to one in which my role was even more behind the scenes: I would strive to be an educational facilitator, a “sociocultural mediator who is acutely aware of the sites of contested knowledge in the room” (Nieto, 1999, p. 70).

I look back at my efforts knowing full well that exploring possibilities and new ways of thinking may be all that can realistically be asked for in a lifetime. While this chapter strongly represents where I stood before doing the research described within this thesis, the research effectively became the decolonizing of yet another touchstone (Strong-Wilson, 2007) in my personal journey. As can be seen in the following chapter, there is still much to address. “The people of Nunavut are learners” (Mason, 2006, p. 145) – I pray that I may continue to learn to think in ways that allow me to learn alongside them.

## Chapter 2: Literature Review

### *RE: Considering the Nature of (Multicultural) Science (Education) (for all)*

#### *Introduction*

“Multicultural education is a continuing process” (Banks, 1995, p. 391) and this is certainly the case for multicultural science education as well. The shift from universalism, the *one-size-fits-all* approach to science education, to a cross-cultural perspective is a change that is much needed in light of the disservice and harm the *one-size-fits-all* model has done, and continues to do to Indigenous youth (Aikenhead, 2006; Brayboy & Castagno, 2008; Cajete, 1988; Kawagley & Barnhardt, 2005; McIvor, 1995).

By considering the multicultural science education debate in which culturally relevant bodies of scientific knowledge are being contested as knowledge (Cobern & Loving, 2001, 2007; Matthews, 1994; Siegel, 1997b, 2001; Snively & Corsiglia, 2001; Southerland, 2000; Stanley & Brickhouse, 1994, 2001), this literature review looks to assess the current state of multicultural science education, the impasses produced by this debate and how it relates to Indigenous science education.

Where many of the impasses are rooted in the Eurocentric underpinnings of this debate (Cobern & Loving, 2001; Lewis & Aikenhead, 2000), and the reluctance to see the debate as Eurocentric, the literature review will draw from worldview theory to look at the lens that is Eurocentrism (Battiste, 2005; Blaut, 1993), and the need for Eurocentric educators to take this inward look at their own culture (Battiste; Bishop, 2002; Mazzochi, 2006; Rasmussen, 2002; Strong-Wilson, 2007) so that they can better see the other to ensure their educational efforts are less oppressive (Barnhardt & Kawagley, 2008; Battiste, 2000a; Kanu, 2003, 2006; Meyer, 2002).

In this literature review, I argue for a postcolonial curriculum which first begins from Indigenous worldviews (Hookimaw-Witt, 1998; Kawagley & Barnhardt, 2005, 2008), to border cross (Giroux, 1992, 2005) into the ‘world’ of science (Aikenhead, 1996, 1997, 2002a, 2002b, 2006; Cajete, 1999, 2009; Fler, 1997; McKinley, 1998) with the aid of a culture broker (Aikenhead, 1997, 2001; Nieto, 1999; Pomeroy, 1994; Snively & Corsiglia, 2001) and second,

actively engages youth in the re-examination of the nature of science as a curricular component (Chomsky, 1995; Rudolph, 2000) as an act of reclamation and resistance (Kanu, 2003, 2006; Riecken *et al.*, 2006).

While the shift from universalism to cross-cultural perspectivism is one that is much needed, it is certainly one that will take time (Lewis & Aikenhead, 2000). In reconsidering the nature of science education for all, it may not be necessary that “we reject [science] or transcend it, replacing it with something else” (Chomsky, 1995),<sup>8</sup> rather we can “widen the circle” (Saul, 2008) to create a postcolonial, intercultural scientific “third space” (Bhabha, 1994) which, with the help of a tour-guide culture broker (Aikenhead, 1997), can lead to respectful, meaningful learning.

### *Multicultural Science Education*

#### *Multicultural science education – a shifting practice.*

Multicultural science education is a construct, a process, and an educational reform movement with the goal of providing equitable opportunities for culturally diverse student populations to learn quality science in schools, colleges, and universities. (Atwater & Riley, 1993, p. 664)

The above definition hints at the “fundamental complexity of the multiculturalism movement” (Southerland, 2000, p. 307) in the field of science education. What is understood to be “quality science” by certain theorists, “inquiry characterized by reliability on evidence and reason with the goal of understanding an objective, external, physical world” (Southerland, p. 290; see also Cobern & Loving, 2007, 2001; Haack, 1998; Matthews, 1994; Siegel, 1997b, 2001), is inherently at loggerheads with what is entailed by “providing equitable opportunities for culturally diverse students” (Atwater & Riley, 1993, p. 664) – the only “quality science” many theorists perceive is Western science. Cobern and Loving (2001) state that “the West judged the rest of the world by its own measure of choice, Western science and Western technology, and used education to enforce change on those societies found deficient” (p. 53).

---

<sup>8</sup> It reassures me, nonetheless, that “[t]here are many ways to be scientifically literate ... [and that] within some fairly broad limits it probably doesn’t matter much which path is taken” (DeBoer, 2000, p. 597).

On the other hand, there are many theorists who believe otherwise (e.g., Barnhardt & Kawagley, 2005, 2008; Snively & Corsiglia, 2001; Stanley & Brickhouse, 1994, 2001) – a group growing in number as both science and education are becoming recognized as situated practices.

Scientific research is also being recognized as a situated practice which is dependent upon an intersection of particular experimental systems, communities of researchers, organizational modes, as well as historical circumstances, all of which contextualize the generation of scientific knowledge (Buchwald, 1995; Galison, 1997; Knorr-Cetina, 1999; Pickering, 1995a, b; Rheinberger, 1995; Rouse, 1987, 1996). Similarly, the educational field, as a whole, has also made the shift to situated practices, as culture and student learning are now recognized as linked (Brown, 1992; Brown et al., 1989; Davis & Sumara, 2000; Holbrook & Rannikmae, 2007; Lave, 1993; Pea, 1993; Ramirez & Castenada, 1974; Resnick, 1987, Vygotsky, 1981; Wertsch, 1991; Winzer & Mazurek, 1998). Science education, like its two constituting parts, has also been shifting towards a situated practice that draws upon student's culture-specific scientific knowledge, be it called ethnoscience (Rakow & Bermudez, 1993), Indigenous science (Ogawa, 1995), Indigenous Knowledge, Traditional Ecological Knowledge (TEK) (Snively & Corsiglia, 2001) or something else.

*Universalism vs. cross-culturalism – multicultural science education debated.*

During this shift, it has been strongly disputed as to which systems of knowledge describing nature could be, or should be, considered “science,” and their place in the science classroom (Cobern & Loving, 2007, 2001; Matthews, 1994; Siegel, 1997b, 2001; Snively & Corsiglia, 2001; Southerland, 2000; Stanley & Brickhouse, 1994, 2001). While opinions vary from one theorist to another, some have clearly taken sides, either they reject the idea that non-Western culture-specific science can be considered “equal” to Western science (the Universalists), or accept it, and promote, as referred to in the literature, either multiculturalism, cross-culturalism, or perspectivism. Matthews (1994) argues that:

Universalists regard science as an intellectual activity whose truth-finding goal is not, in principle, affected by national, class, racial or other differences: science transcends human differences... This universalist view recognizes that while aspects of culture do

influence science, nevertheless cultural considerations do not determine the truth claims of science. (Matthews, 1994, p. 182)

While universalists are not necessarily opposed to the notion of introducing culture-specific scientific bodies of knowledge into the science classroom, by diminishing everything else, “the implicit curriculum message is that the *only* science is [W]estern science” (Hodson, 1993, p. 686, emphasis in original). Cobern and Loving (2001) and Siegel (1997b) exemplify this:

Exposing non-Western students to ideas which are not part of their culture, and – sensitively and respectfully – indicating to them that some of their cultural beliefs (e.g, animism) are not respectable scientifically, does not fail to treat them with respect. (Siegel, 1997b, p. 104)

Bringing TEK into the science classroom is an excellent thing to do... it helps students see what is unique about science – what science can do that other domains of knowledge cannot do.... Not all thoughts are equal. Not all ways of thinking are parallel. (Cobern & Loving, 2001, pp. 63-64)

On the other hand, those proposing a multicultural, cross-cultural, or perspectivist science education, while not always agreeing on whether or not cultural content can be inter-mixed, do agree that all bodies of knowledge should receive equal recognition – and that the debate has strong Eurocentric underpinnings (Lewis & Aikenhead, 2000). Lewis and Aikenhead (2000) define Eurocentrism as:

the idea that the people, places, and events of Western European cultures are superior and a standard against which other cultures should be judged. Conversely, non-Western cultures are inferior, and relevant only if they have a relationship to Western culture. (p. 53)

Due to Eurocentric behaviours, the term ““white teacher” has become virtually synonymous with resistance, “resistance to acknowledging the significance of constructions of race to identity formation and of perceiving themselves as white and therefore implicated in systems of domination” (Strong-Wilson, 2007, p. 115). Until universalists also recognize the Eurocentric nature of the debate, that the introduction of non-Western bodies of scientific bodies of knowledge are not held as concurrent systems not because of their value, but how they are valued, the debate will continue just as it has been – “generating a lot of heat, but very

little light” (Southerland, 2000, p. 289) onto the problem. Nonetheless, the nature of the debate has changed by “accepting that all systems of knowledge about nature are embedded in the context of a cultural group; that all systems are, therefore culture-laden; and that (Western) science is the system of knowledge about nature that is predominant in Western culture” (Lewis & Aikenhead, 2000, p.3) and that even the strongest of universalists agree that multicultural science education is the direction that we should be taking in order for all students to benefit from science education (Siegel, 1997b).

As it stands, the debate continues – but instead of discussing the Eurocentric underpinnings of what is contested, theorists choosing to continue the debate have turned to the philosophical underpinnings of the debate (e.g., Cobern & Loving, 2007).

*Meaningful multicultural science education (for all).*

Taking a step back, science education has much to offer to the students it does reach – it quickly becomes apparent as to why science educators would want to reach all students under the banner of science-for-all which includes multicultural science. Science education, and the scientific literacy resulting from it, can be both empowering and emancipatory (Barton *et al.*, 2003; Hodson, 2003, 2005; Millar, 2006; Ratcliffe & Grace, 2003). Despite good intentions, how ‘multicultural’ science education is enacted varies greatly in how it goes about reaching all students, and which students are reached (Zembylas, 2005).

All youth can gain from an increased scientific literacy. This might especially be the case for Indigenous youth (Snively & Williams, 2006). Indigenous science educator McIvor (1995) echoes this sentiment, and adds that scientific literacy is not only important for Indigenous people, but also pressing in light of the recent increases in control in land management, conservation, development and use.

The multicultural debate often lumps together all bodies of cultural knowledge which are not the dominant, Western science. Indigenous science in general, and IQ, the Inuit traditional knowledge in which Inuit Indigenous science is located, are no exceptions to this rule (Snively & Corsiglia, 2001; Stanley & Brickhouse, 2000). Cajete (1999) states that “Indigenous science is a broad category that includes everything from metaphysics to philosophy to various

practical technologies practiced by Indigenous past and present”(p. 83), and similarly to Western science, “has models which are highly contextual to tribal experience, representational and focused on higher order thinking and understanding” (p. 85).

“There is no one way to do or think about science” (Kawagley, Norris-Tull, & Norris-Tull, 1998, p. 139). In addressing how anyone does, or thinks about science, a step back looking at what shapes these approaches is first required. All the various ways of understanding the natural world around us are rooted in how we perceive it, our lens upon the world, our worldview.

### *Worldviews*

#### *Perspectives on perspectivity.*

If we look to science as “a *rational* perceiving of reality” (Ogawa, 1995, p. 588, emphasis in original), a definition which respects the notion that there are many valid bodies of science, it is important to note that there are many ways in which the world, or reality, can be perceived. There are a multitude of words that, at their core, speak of how we perceive our realities: lens (Kincheloe, 2006), landscape (Greene, 1978a), worldview (Mazzochi, 2006), points-of-viewing (Goldman-Segall, 1998), horizon (Gadamer, 1975/1998), topos (Bernstein, 1992), and many others. Indigenous scholars most often use worldview to describe perspectivity. Kawagley, Norris-Tull and Norris-Tull (1998) describe worldview as “a means of conceptualizing the principles and beliefs – including the epistemological and ontological underpinnings of those beliefs – which people have acquired to make sense of the world around them” (p. 134). Such a definition speaks to, and of, ways of knowing (Indigenous epistemologies) and ways of being (Indigenous ontologies).

In addressing worldviews and, more particularly in the decolonizing of Indigenous science education as delivered by non-Indigenous educators, we can draw from Gadamer’s (1975/1998) hermeneutical notion of horizon, “the range of vision that includes everything that can be seen from a particular vantage point” (p. 302). As hermeneutics is about “producing change as well as discerning meaning” (Strong-Wilson, 2007, p. 118), the notion of horizon invites a self-critique: “to acquire a horizon means that one learns to look beyond what is close

at hand-not in order to look away from it but to see it better” (Gadamer, 1975/1998, p. 305). It also lays out, within it, the conditions for beginning to see that which *the other* sees –“we must always already have a horizon in order to be able to transpose ourselves into a situation” (Alcoff, 2006, p. 305).

*The Western worldview – a reflexive point of departure for the Western educator.*

For non-Indigenous educators, in order to even begin to understand the worldview of Indigenous people, it is vital to begin understanding their own, my own, worldview. On the following, Mazzochi (2006) states that non-Indigenous people:

need to open ourselves to participating in the experience of others, and yet we should also be aware that this opening can only start from where we already are-from our point of view or the tradition to which we belong. (p. 465)

From any given worldview, there are limitations regarding what we can see. It is crucial that we non-Indigenous educators realize the limitations of our own point of view, as well as the curriculum which stems from it, to realize the danger of imposing viewpoints upon others; as Hookimaw-Witt (1998) states, “help offered to so-called underdeveloped people never came without a price” (p. 160). Eurocentric worldviews have often created cultural binaries and dualisms whose effects have been nothing but destructive upon Indigenous communities as they lessen the perceived value of cultural knowledge, or worse, exclude it all together (Battiste, 2005). Apple (1990) argues that the shift from “*what* knowledge is most worth... [to] *whose* knowledge is most worth” (p. vii, emphasis in original) is a step away from the winner/loser dualities that are implicit within these cultural conflicts from which power imbalances stem. Rasmussen (2002) reminds *Qallunaat*, non-Inuit, to “examine and change their own destructive behaviour” (p. 87), and uses a quote from Buddha to reinforce this: “first, cease to do evil, then learn to do good, then purify the mind.”



*Looking inward – deconstruction of the destructor.*

We are often bound and entrenched by our own realities. For white educators, the awareness of such realities, and of colonial legacies, past and present, may be difficult, as states Bishop (2002):

Coming to understand one's identities as an oppressor is often an enervating process... it involves accepting your inheritance of a shameful and evil past... [as well as] a balance between understanding oneself as an individual and as part of a collective reality.... With so little understanding of ourselves as part of a collective entity, it becomes very difficult to figure out our own responsibility for patterns larger than ourselves. (p. 113)

Through *diffusionism*, or a forced spread of culture, the Eurocentric consciousness, the "consciousness in which all of us have been marinated" (Battiste, 2005, p. 124), erases, assimilates and lessens others, making it difficult to hear the voice of *the other*. Blaut (1993) defines:

Eurocentrism [as] the colonizer's model of the world in a very literal sense: it is not merely a set of beliefs, a bundle of beliefs. It has evolved, through time, into a finely sculpted model, a structured whole; in fact a single theory, a general framework for many smaller theories, historical, geographical, psychological, sociological, and philosophical. This supertheory is diffusionism. (Blaut, 1993, pp. 10-11)

The Eurocentric supertheory of diffusionism is far more complicated than simple racism – it also encompasses the many Western metre sticks used to measure the worth of knowledge, as well as those whose knowledge is measured (Blaut, 1993). Universality is but one of the facets of diffusionism; in establishing "the dominant group's knowledge, experience, culture and knowledge as the universal norm" (Battiste, 2005, p. 124), the other's knowledge and culture is lessened, or worse, not acknowledged. Addressing Eurocentrism becomes larger than simply addressing a set of prejudices and attitudes: for the Eurocentric educator, it means taking a good, hard look at oneself, and one's own culture (Strong-Wilson, 2007). It means coming to the realization that all our respective worldviews upon the world, as well as the cultures and sub-cultures from which they stem, are shaped and forged by our social, political, colonial, economic surroundings and cultural heritage. It means examining the lens upon which we view the world. We must be critical of our own ontology, our own construction of reality (Kincheloe, 2006).

The question remains, however: can the dominant truly look at their own ontological construction of reality without leaving it (Lather, 2007)? Were this not enough of a challenge in itself, the heightened awareness of colonial legacies, past and present, resulting from such a journey may lead to a sense of hopelessness and immobilization due to the number of levels upon which we may feel guilty (Bishop, 2002). Nonetheless, one cannot move forward without first taking a step – EuroCanadian educators need to model the change they wish to enact. That step forward is vital as “to do nothing is to reinforce the *status quo*; not to decide is to decide; if you are not part of the solution, you are part of the problem” (Bishop, 2002, p. 110, emphasis in original). Once more aware of who we are, the often Eurocentric educator may then begin to see the other for who they are.

*Education as a poison – the importance of culture in education.*

To not acknowledge a student’s culture, as an educator, is to perpetuate the notion of education as a “poison” (Weil, 1972); an education that disrespects the ways of knowing and ways of being of a people is an education that is oppressive (Barnhardt & Kawagley, 2008; Kanu, 2003, Meyer, 2002). This sense of oppression is pronounced for Indigenous peoples (Cajete, 1986, 1999; Christie, 1991; Fler, 1997; Harris, 1978; Linkson, 1998; McKinley, McPherson Waiti, & Bell, 1992; Snively, 1990; Sutherland, 1998). Practices that do not account for, or fail to recognize, students’ culture were, and continue to be, assimilative, colonial and damaging (Battiste, 2000; Churchill, 1999; Hodson, 1998; MacIvor, 1995; McTaggart, 1991; Roberts & Wills, 1998).

*Seeing science for what it is - a hard pill to swallow.*

Western science, scientists and science educators have, in many cases been, and continue to be, recalcitrant, resistant and opposed to the idea that “what is taken to be universal, value-free truths is actually situated knowledge” (Brickhouse, 2001, p. 282). Ogawa (1995) states that every culture has its own science, its Indigenous science. Ogawa’s use of the word, while sharing Cajete’s (1999) meaning of science as performed by Indigenous peoples

with Indigenous concerns in mind, intends to level the playing field: that all forms of science are socio-cultural bodies of knowledge.

Within any culture, including the dominant Western culture of North America, there are 'realities and realities,' there are subcultures, and further subcultures within those (Cajete, 1994). Western Modern Science (Ogawa, 1995), or alternately White Male Science (Pomeroy, 1994) (WMS), is a subculture within Western culture. Furthermore, within WMS, it could also be said that the cultures of biologists, geologists, chemists and physicists are distinct despite some overarching similarities. Humans live, co-exist and move within many of these subcultures (Aikenhead, 1996, 1997, 1998). These subcultures, as elements that contribute to the creation of one's personal worldview, have a large role in how science, in the business-as-usual sense, is learned. For students to learn and construct an understanding of WMS, they must work through both their individual, personally constructed understanding of the natural world and socio-culturally specific sciences (Ogawa, 1995). As such, for youth, even Eurocentric youth, there is a great risk of cultural clash in the process of learning Western science as WMS may be at odds with their individual science. These cultural clashes are accentuated for Indigenous youth as Western science and Indigenous science can often be at odds with one another (Kawagley & Barnhardt, 2008). Generally, most youth do not, or do not want to, think like (Western) scientists (Aikenhead, 2004; Aikenhead & Jegede, 1999; Fensham, 2004; Jegede & Aikenhead, 1999), they identify it as a foreign culture to be avoided (Aikenhead, 1996; Atkin & Helms, 1993; Calabrese Barton, 2002; Coburn & Aikenhead, 1998; Costa, 1995; Eisenhart, Finkel & Marion, 1996; Jegede, 1996; Reiss, 2000; Roth & Désautels, 2002).

In delivering a one-size-fits-all science education that is dominant in more ways than one, we white educators prevent ourselves from seeing, from knowing many things about Aboriginal cultures which is an important part of who Aboriginal people are (Cajete, 1999; Sleeter, 2001). In order to lessen the clashes between Western science, personal science and Indigenous science, it is safe to say that science education needs to be more sensitive, respectful and responsive to the cultural needs of all students.

*Indigenous worldviews – a respectful point of departure for teaching Indigenous youth.*

For curriculum to be responsive to the needs of Indigenous youth, like any other youth,<sup>9</sup> we must start from their worldview; as Hookimaw-Witt (1998) says, “competence as an Aboriginal person can be reached only when the curriculum is based on the culture from which the youths draw their identity” (p. 163). Past and present educational structures in many Indigenous communities do not stem from ways of knowing or ways of being (Hookimaw-Witt, 1998; Kawagley & Barnhardt, 2008), much less use them as a point of departure. We must begin from Indigenous worldviews for Indigenous youth – too often has beginning from the Western been a disservice and destructive to Indigenous youth.

“If education does not genuinely empower children, then pretending that it does will only confuse them further” (Watt-Cloutier, 2000, p. 118) – in beginning from Indigenous worldviews, education can prepare Indigenous youth for the future, make them independent and knowledgeable, enabled to make their culture survive (Witt, 1998). When we begin with Indigenous modes of learning, such as coming-to-knowing, developing cultural identity and self-esteem is facilitated (Cajete, 1999; McKinley, 1998; McKinley, McPherson Waiti, & Bell, 1992; Ritchie & Butler, 1990).

*Cross-cultural science curriculum – weaving worldviews.*

In many North American Indigenous communities, the reality is that Indigenous worldviews are not the only one present. “Indian Education is inherently a bicultural enterprise” (Hampton, 1995, p. 8) – it may prove beneficial for Indigenous youth, when starting from their worldview, to learn of both, “but not at the expense of what they already know and the way they have come to know it” (Barnhardt & Kawagley, 2008, p. 226). Creating curriculum which respectfully encompasses both Western and Indigenous science, a curriculum that is hybrid, a curriculum that is neither one nor the other (Kanu, 2002b), while not being an easy task, is not one that is impossible.

---

<sup>9</sup> For non-Indigenous youth, Indigenous people have much to share (Cajete, 1994) – there is much that can be gained from attempting to learn from another vantage point – as well as learning from the views that Indigenous youth would share when they are in more comfortable educational settings. “When the Dene elders spoke of survival, they meant survival for us all, not just Dene people; when the Cree elders hold a pipe in a ceremony and pray, they pray for us all, not just for Cree people” (Chambers, 1999, p.148).

The foundations of Indigenous knowledge, as Cajete (2009) states, inherently incorporate a certain fluidity and flexibility that aims to Indigenize<sup>10</sup> non-Indigenous knowledge and technology. Of the four foundations, traditional, empirical, revealed and contemporary, the last foundation involves participation in 'modern' practices so that it may complement the other foundations.

The following, as proposed by Barnhardt and Kawagley (2008), is but one of the many ways in which both Indigenous and Western science can compliment one another:

When choosing an eddy along the river for placing a fishing net, it can be explained initially in the [I]ndigenous way of understanding, pointing out the currents, the movement of debris and sediment in the water, the likely path of the fish, the condition of the river bank, upstream conditions affecting water levels, the impacts of passing boats, etc. Once the students understand the significance of the knowledge presented, it can then be explained in Western terms, such as flow, velocity, resistance, turbidity, sonar readings, tide tables, etc. to illustrate how the modern explanation adds to the traditional understanding and vice versa. (Barnhardt & Kawagley, 2008, p. 235)

In looking to create hybrid spaces, the classical approach in Western philosophy has been to find a universal and neutral language in which dialogue can happen (Ceruti, 1986), a meta-viewpoint of sorts; such a language is not one that acknowledges difference. Such language can be culturally damaging, as the knowledge imparted in universal dialogue is not representative of all.

We can instead look at the web of relationships between worldviews. While Indigenous scholars (e.g., Barnhardt & Kawagley, 2008; Cajete, 1994) and Western, as well as Eastern, scholars (e.g., Bai & Bannack, 2006; Capra, 1975, 1996; Davis & Sumara, 2000) might not have engaged in dialogue with one another, they are, in different words, often saying similar things. Indigenous and Western science are both equally valid paths that can be walked upon in order to generate understanding. As Indigenous knowledge and ways of knowing are increasingly recognized as adaptive means of addressing complex systems (Bartholomew, 2003) and Western science continues its emerging focus on relationships and interconnectedness (what Indigenous people have long known about) there will be an increasing awareness of the

---

<sup>10</sup> It is important to note that the Indigenization of knowledge needs to, and can only be done by Indigenous people.

commonalities between the two different, bodies of knowledge. “There is a growing appreciation of the complementarity that exists between what were previously considered two disparate and irreconcilable systems of thought” (Barnhardt & Kawagley, 2005, p. 12), a sentiment Peat (2002) also shares:

It is at this point that a tantalizing paradox presents itself. On one hand it seems that the very activity and busy-ness of our analytic, linear Western minds would obstruct us from entering into Indigenous coming-to-knowing, yet, on the other, scientists who have been struggling at the cutting edges of their fields have come up with concepts that resonate with those of Indigenous science. (p. 6)

### *Border Crossing and the Culture Broker*

#### *Border crossing.*

Hampton (1995) states, “Indian education recognizes the need for transformation in relations between Indian and white as well as in the individual and society” (p. 41). In transforming a curriculum so that it better reflects the multiple worldviews inherently present in many Indigenous communities, in building a hybrid curriculum, we can use the points of resonance where Western science and traditional knowledge meet as a point of departure to ease the transitions between bodies of knowledge. We can look at how the worldviews involved interplay, and learn to move between them. Giroux (2005) metaphorically refers to this type of cultural transition as border crossing. While some may smoothly cross, it can be hazardous or impossible for others. Giroux’s (1992) coining of the term described the borders that the working class must confront, but it has since evolved to become a “referent for understanding the co-mingling – sometimes clash – of multiple cultures, languages, literacies, histories, sexualities and identities” (Giroux, 2005, p. 2). In the science education literature, Aikenhead’s (2001) prominent use of the expression as a referent has made it synonymous with the cultural borders that are crossed when entering the “world of science”: “success at learning the knowledge of nature of another culture depends, in part, on how smoothly one crosses cultural borders” (p. 340).

Fleer (1997) argues that, “moving between world views creates high levels thinkers” (p. 17). If cultural appropriateness alone does not stand as sufficient as a reason to justify cross-

cultural education, the argument that it creates better learners, and thus citizens, should add more substance. Aikenhead (2001) asserts,

The flexibility to move back and forth between cultures is a definite asset in society today. Some educators call this flexibility “empowerment,” others call it walking on two different paths. It can occur when cross-cultural science instruction creates a change in the relationships of social power and privilege in the science classroom. (p. 350)

By allowing youth “to *participate* in the culture of power, [the Western culture] while simultaneously learning how to *reflect* critically on the power relations of which they are part” (O’Loughlin, 1992, p. 807, emphasis in original), they not only learn aspects of Western culture, but they do so without losing something of their own cultural way of knowing (Aikenhead, 2001; Barnhardt & Kawagley, 2008). Through such education, critical thinking skills increase, as does a better understanding of the underlying power relations; the “discourses of power cannot be taught by means of an uncritical curriculum” (Hickling-Hudson & Ahliquist, 2003, p. 84).

#### *Culture broker – respectful role for the caring teacher*

According to education scholars such as Hickling-Hudson and Alquhist (2003) and Giroux (1998), assisting youth in “border crossing” into the culture of power is a primary role of the respectful, caring (science) educator. Science teachers need to aid youth in the creation of an intercultural, holistic scientific ‘third space’ (Bhabha, 1994) that respects and draws from multiple worldviews. It becomes the educator’s role to be critical of their own cultural role and of the borders that they guide the youth to cross in order to participate in the dominant culture’s power. The educator must ensure that the youth’s culture does not suffer and that the teacher can recognize potential suffering or damage. When an educator can ease transitions or facilitate cross-cultural learning, their role becomes one of a culture broker.

Bridges can be constructed in various ways between cultures (Cajete, 1999, 2009; McKinley, 1998), but too often the students (Aboriginal and non-Aboriginal alike) are left to manage these border crossings on their own (Phelan, Davidson & Cao, 1991). There is an ongoing critical need for teachers to gain cross-cultural experiences and skills in order to

effectively navigate the role of a tour-guide culture broker (Aikenhead, 1997) to bridge the two worlds of knowledge (Cajete, 2009).

The educator must be a culture broker (Van Willigen, 1986), a “sociocultural mediator who is acutely aware of the sites of contested knowledge in the room” (Nieto, 1999, p. 70). The culture broker is the teacher who substantiates, validates and builds upon personally and constructed ways of knowing (Michie, Anlezark, & Uibo, 1998; Pomeroy, 1994) while identifying explicitly border crossings, especially those which may be damaging, since not identifying them can lead to confusion (Aikenhead, 1997, 2002b; Linkson, 1998). The culture broker promotes discourse and dialogue (Cobern & Aikenhead, 1998; Driver, Asoko, Leach, Mortimer, & Scott, 1994) and identifies the colonizer and the colonized (Aikenhead, 1997; Snively & Corsiglia, 2001), acknowledging and discussing power relations within and out of the classroom. Culture brokers empower the youth with whom they work.

While caring is not sufficient, as “good intentions will not be enough to save the *Qallunaat* teacher from making potentially damaging cultural blunders” (Berger, 2007, p. 1), such teachers are better positioned to, first, realize that there is a need to be addressed, second, make the effort required to enact the change they envision, and third, learn of, and from, *the other* to make border crossings less treacherous.

### *Nature of Science as a Component of a Postcolonial Curriculum*

#### *Nature of science.*

Science, and how we define it, are “a *de facto* gate-keeping device” (Coburn & Loving, 2001, p. 52, emphasis in original) into the “world of science.” Making border crossing less treacherous for youth can be eased by, first, addressing that which makes the border crossing so difficult. As those who may benefit the most from science are often those who science most neglects (Chomsky, 1995) – it is asked of the educator who is concerned with both “quality science” and “providing equitable opportunities for culturally diverse students” (Atwater & Riley, 1993, p. 664) to reconsider that which keeps other students out: the nature of science.

Rudolph’s (2000) article, *Reconsidering the ‘nature of science’ as a curriculum component* proposes such a re-examination, and that this re-examination be integrated into



the curriculum to help youth see “not what science *is*, but what it *includes*” (p. 417, emphasis in original). In involving the youth within the process, they may become able to see, and perhaps shape, what science can be (Sammel, 2009).

### *Postcolonialism.*

Through such dialogue, this curriculum may become postcolonial. Before addressing the meaning of postcolonial, it is important to bring to attention Hall’s (1996) often asked question “when was the post-colonial?” The prefix post is often used (e.g., poststructuralism, postmodernism) to signal both the chronological end of an event as well as the moving beyond intellectual movements through reflexive criticism. In this context, Hall (1996) reminds that while the historical event that was colonization is past,<sup>11</sup> its legacies still remain; but in the continuous and ongoing critical examination and resistance of colonialism in its many forms, post-colonialism, like other posts can be both ‘after’ and ‘moving beyond’; any friction appearing in the use of ‘after’ is in fact positive friction. It is of critical importance to be reminded of what it is we are trying to ‘move beyond.’ As the colonists themselves have not left (Smith, 1999), making the first usage of postcolonialism null (Smith, 2006), I would argue that decolonizing is thus synonymous with postcolonialism’s second meaning.

Ghandi (1989) described post-colonialism as “the scene of intense discursive and conceptual activity characterized by a profusion of thought and writing about the cultural and political identities of colonized subjects” (p. 5). Kanu (2006), putting the “conceptual activity” into educational practice, states that “postcolonialism becomes the site where educational/curricular assumptions and norms are called into question in the struggle for more democratic social relations” (p. 8). As youth engage in the reconsidering of what the nature of science could be, the curriculum might become one that is “consisting of overlays of multiple discourses, and plural assumptions” (Kanu, 2003, p. 79) that addresses the way in which the colonized, the Inuit, have had their cultural sense of self erased (Battiste, 2005). In engaging in a cross-cultural dialogue that redefines the relations, the curriculum becomes postcolonial.

---

<sup>11</sup> While colonization as a historical event is past, the colonizers have not left, nor have many of their legacies. Furthermore, colonialism is to this day very present; neo-colonialism is just as damaging despite it being subtler.



### *Setting the Stage for Intercultural Dialogue*

The debate surrounding multicultural science education between those advocating for a universal account (e.g., Matthews, 1994; Siegel, 1997b, 2001) and those advocating for a science education that is more culturally responsive (e.g., Snively & Corsiglia, 2001; Stanley & Brickhouse, 1994, 2001) is a debate that continues. There is, however, no longer a place of innocence (Lather, 2007) in education for how students whose culture is not reflected in Western Modern Science should be taught. Science education, for these students, needs to stem from their own culture, from their own Indigenous science (Ogawa, 1995). For Indigenous students, this learning needs to reflect their ways of knowing and ways of being, it needs to reflect their worldview (Barnhardt & Kawagley, 2008; Cajete, 1999, 2009; Kawagley, Norris-Tull & Norris-Tull, 1998; McKinley, 1998). For non-Indigenous educators working with Indigenous youth, it is especially important to recognize how their own worldview can negatively impact the education they deliver to their students, especially if their worldview is Eurocentric (Battiste, 2005; Kanu, 2003; Mazzochi, 2006; Strong-Wilson, 2007). While these two worldviews are often incongruous, there are many points of resonance between the two (Barnhardt & Kawagley, 2008; Peat, 2002) – it then becomes the role of the science educator to assist youth in border crossing (Aikenhead, 2001; Giroux, 2005) between the two worldviews (Cajete, 2009) by acting as a culture broker (Aikenhead, 1997, 2001; Cobern & Aikenhead, 1998). As the nature of science is a gate-keeping device preventing the two bodies of knowledge from interacting in a dialogical manner, it becomes the ideal location to engage in decolonizing/postcolonial resistance (Kanu, 2006; Rudolph, 2001).

The youth in Iqaluit, Nunavut, the location of this research, are well situated for such an intercultural dialogue and act of resistance. Iqaluit, as Nunavut's capital, is both rich in Inuit Qaujimaqatugangit, rich in Indigenous Knowledge, and as research hub of the north, rich in Western scientific knowledge. These bodies of knowledge do have a pre-existing dialogical relationship in Iqaluit or in Nunavut education. This research further facilitates or encourages this dialogue and involves the youth as participant-observers. It is through this process that this research aids youth in the creation of a postcolonial, intercultural, holistic scientific 'third space' (Bhabha, 1994) that respects and draws from multiple worldviews.

The upcoming chapter (3) establishes a methodological framework that aims to facilitate such an intercultural dialogue centered on topics of science. Findings in which this literature review is reflected will not appear until chapter 5, where elements of this dialogue, both implicit and explicit, are brought forward. Further information regarding Iqaluit, Nunavut as a community will be discussed within the body of Chapter 4.

Chapter 3: Methodology  
*RE: Conceptualizing the Reel/Real*

*Prelude to Methodologically Messy Moments*

In the early stages of the research process, I found myself at a loss when investigating many of the pre-established methods and methodologies readily available, both in the qualitative and quantitative realms. Searching for actions that speak louder than words in the context of research (Menzies, 2004), as well as a research methodology that was an extension of myself (Richardson, 1994), the development of an alternative methodology to fit the research question felt like it “was not a choice but a fundamental requirement of the nature of the research” (Somerville, 2007, p. 226), and “the only way to respond to the postcolonial questions and research conditions in which I find myself” (Somerville, 2009, p. 1).

At first, like Somerville (2007), I felt as if there was “no methodology to tell me how to do it differently, and no models to follow from others who had trodden down the same path” (p. 226). While multiple different methodological accounts offered pieces of what I was tentatively searching for, none of them alone pulled the pieces together. I had to accept that the methodology I needed was not fixed or inside a box. Yet I knew I would still have to locate established anchoring concepts and points to academically justify my methodological choices. The following three sections, (1) Research which places respect first, (2) Participant-driven videography, and (3) Video-auto-ethnography (the latter two being the conjoined elements of what I have tentatively called the “twin lens methodology” approach) are the methodological elements that were conjoined in a manner that resembles a pastiche quilt more than an established research framework. It is “experimental” in the qualitative sense of the word responding to the situated dilemmas and decisions that emerged in the research process.

It is only after the data collection that I stumbled upon a flexible methodological framework that addressed the way in which the research had been framed: postmodern emergence. Postmodern emergence is a new research methodology (Somerville, 2007) that “emphasizes the irrational, messy and embodied process of becoming-other-to-one’s self in research” (Somerville, 2009, p. 209). Becoming-other-to-one’s self is a process in which

researchers can see themselves under a new light, by taking a different vantage point as if they themselves were other to themselves. It is in these messy, discomforted moments that the methods and methodology of this research became clear(er).

This chapter sets out to describe and justify a generalized and experimental framework for research that allows both an explicit and implicit intercultural dialogue around the topic of science. Intended to be respectful, this framework was created to look at science education from the viewpoint of those receiving as well as those delivering. The following chapter sections addresses this twinned approach: (1) research which places respect first, followed by the dual elements of the twin lens methodology; (2) participant-driven videography; and (3) video-auto-ethnography. These chapter sections are followed by (4) my ethical preparations for fieldwork, which speaks to the twin ethics process required for research in Nunavut, and (5) data sources, analysis methods and coding tools.

While parts of chapter 3 address some of the information pertaining to the methods, much of the information regarding the specific field location (e.g., participants, location) is to be found within the body of chapter 4.

### *Research That Places Respect First*

First and foremost, my research strives to do the least colonial harm by working towards some type of relational benefit by attending to the three R's of Indigenous research as defined by Weber-Pillwax (1999): Respect, Reciprocity and Relationality.<sup>12</sup> My research aims to try and provide some service to the well-being of the community of Iqaluit, in particular by honouring and drawing from the Inuit Holistic Lifelong Learning Model (Figure 1, p. 40). This research seeks to respect Nunavut, its people, their values and beliefs (for a description of these, see Figure 2, p. 41).

---

<sup>12</sup> Or alternately, the 4 R's or 5 R's or Indigenous research, respect, responsibility, reverence, relationality, and reciprocity, that are fostered by traditional teachings (Archibald, 2002). I chose the 3 R's for their simplicity – and that, in my opinion, responsibility and reverence are deeper components of respect that take serious time and investment.

<b>Walking in Two Worlds:</b> Indigenous and Western Knowledge Traditional Knowledge Principles	<b>Informal and Formal Learning:</b> Informal Learning Formal Learning
--	--

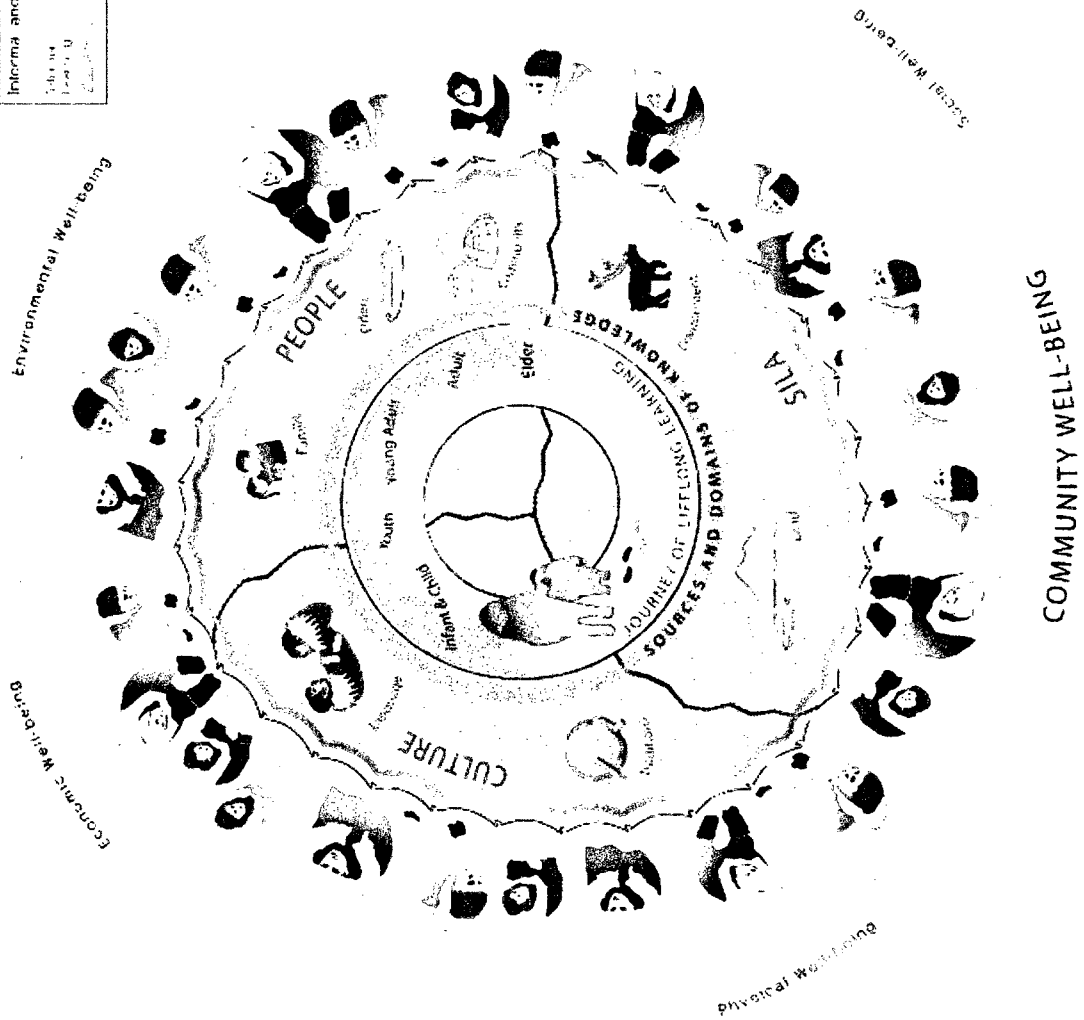
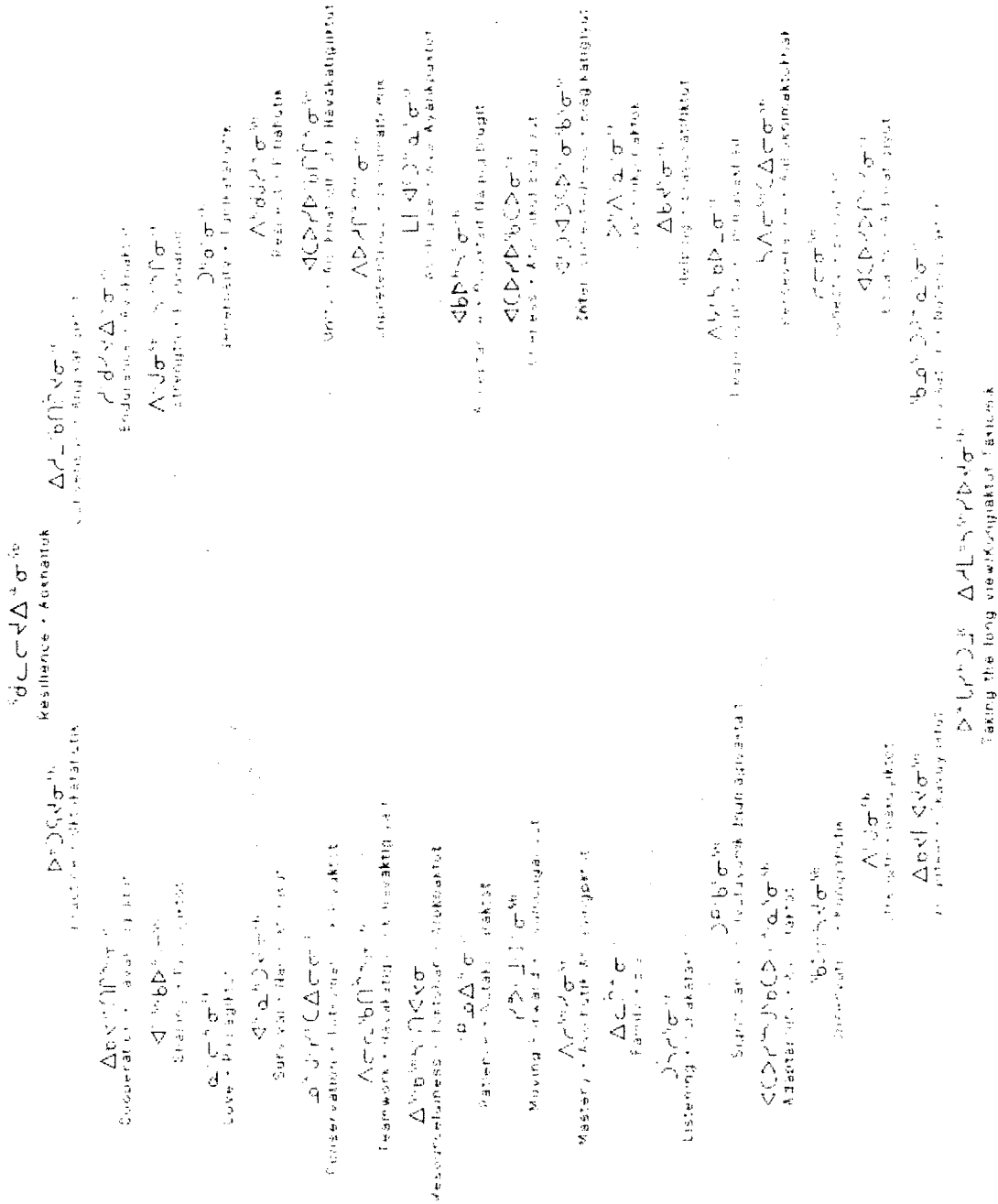


Figure 1. Inuit Holistic Lifelong Learning Model (Canadian Council on Learning)

# INUIT VALUES AND BELIEFS



• as described by the Government of Nunavut's 36 Inuit Qaujimajatuqangit (IQ) values and beliefs

Figure 2. Inuit Holistic Lifelong Learning Model: Inuit Values and Beliefs (Canadian Council on Learning)



I continuously and critically assessed my research's design and actualization according to Smith's (1999) *Decolonizing Methodologies: Research and Indigenous People*, as well as the Inuit Tapiriit Kanatami and Nunavut Research Institute's (2006) *Negotiating Research Relationships with Inuit Communities: a Guide for Researchers*, Steinhauer's (2002) "Thoughts on Indigenous Research Methodology" and Kanu's (2006) *Curriculum as Cultural Practice: Postcolonial Imaginations*. These texts were used as referents and critically informed all stages of the research. I drew from them what I imagined<sup>13</sup> respectful, reciprocal and relational research could be and then more importantly, how they needed to be enacted by a EuroCanadian researcher-educator in the context of Iqaluit and when working with Inuit youth. The first three methodological accounts put a strong emphasis on research being respectful, that there be a primary focus on relational accountability, and the respecting, honouring, manifesting and articulating of an Indigenous worldview (Weber-Pillwax, 2001b; Wilson, 2001). The ITK and NRI's *Negotiating Research Relationships with Inuit Communities* articulates this specifically for research in Inuit communities. While I am unable to articulate an Inuit worldview and can only frame and interpret one from my own Eurocentric worldview, I choose to address this issue by prominently highlighting many Indigenous voices as prominent and unaltered within this thesis. The fourth text, Kanu's (2006) *Curriculum as Cultural Practice*, re-imagines what curriculum could be in a postcolonial sense, stressing the importance of relations that "are no longer unidirectional or univocal, flowing from the colonialist to the colonized" (Kanu, 2003, p. 79), and critiquing those that remain so.

To strive to be relationally accountable in the project, I wanted the Inuit youth to gain in the process of participating in the research; whether from developing the technical movie-making skills prior to the data acquisition, from the opportunity to participate in research that involved their community, from the active engagement with diverse members of their communities, and from the participation in a dialogue that applies to them, but more often excludes their participation.

I want to fulfill my part of the research relationship, my responsibility to provide service by acknowledging, respecting, and being accountable to All-my-relations and to the people of

---

<sup>13</sup> Ideally, an Inuit person would have advised me on the methodological construction of this research to validate this.

Nunavut. I want to enact Menzies' (2004) assertion: "a commitment to truly decolonized research must be more than fine words: it must be an act and demonstrable in practice" (p. 17).

*Research objectives.*

Drawing upon the notion of qualitative research as *bricolage* (Denzin & Lincoln, 2005), my research was multi-modal in its search for resonance and harmony and in order to address the research question: "How can a meaningful relationship with science be facilitated through culturally responsive programs for Inuit youth?" The data collection occurred concurrently across two different research phases, a primary phase focused on my work with Inuit youth and a secondary phase focused on myself. Across these phases, this research aimed to:

- (1) Explore new means of delivering culturally responsive science curriculum that acknowledges, respects and honours multiple worldviews and perspectives,
- (2) Examine how Inuit youth define, document, and determine what science means to them, as well as discover through the youth's video-voice how "science" is enacted within their communities; and
- (3) Critically analyze the roles that I and other non-Indigenous educators can take on in delivering culturally responsive science curriculum in Indigenous communities.

The first two goals constitute those of the primary research phase (see p. 44). In this research phase, the Inuit (and non-Inuit) participants became digital video directors, producers, and editors. Through interviewing many (20+) community members using video-cameras, the youth participants represented their own video-voice on the nature of science.

The third goal constitutes the secondary research phase (see p. 48). To meet this goal, I (as researcher) critically assessed the role that I play in this research and how my actions, in both the context of this research and outside it, are affected by my worldview. I did this self-examination primarily through the means of a video-auto-ethnography.

As researcher, or *bricoleur*, or *tisserand*,<sup>14</sup> I wove together tenets of Indigenous/decolonizing methodology as a primary thread, then participant-driven videography

---

<sup>14</sup> *Tisserand* means weaver in French.

and video-auto-ethnographic methods – to allow for qualitative research as a *montage* (Cook, 1981; Monaco, 1981). I was trying to account for the perception and interpretation of multiple images, multiple voices, “not *sequentially*, or one at a time, but rather *simultaneously*” (Cook, p. 172, emphasis in original). Holistically, this research aimed to help students, as well as me, learn to see what the youth already know (Aylward, 2007) (through video): Inuit Qaujimagatuqangit and Western science are both valuable, yet different paths to knowledge, and that both can be walked upon.

### *Twin Lens Methodology – Participant-Driven Videography*

#### *Framework.*

In order to give Inuit youth the opportunity to “reconceptualize themselves as citizens,” to state “important social and political issues that affect their lives” (Giroux, 1998, p. 31), the primary phase of the data collection was intended to allow youth to express what science is, its nature and implications, through their community’s voices and their own – a postcolonial science education curriculum.

My research intended to allow youth to reclaim and reframe understandings of scientific knowledge, to “provide a safe place for [community members] and students whose histories lie outside those of the dominant culture” (Riecken *et al.* 2006, p. 266) to voice what science means to them. The sheer act of “utilizing video as a form of literacy to develop culturally grounded [understandings]... resists typical curriculum methodology” (Riecken *et al.*, p. 269) – it can allow youth, “as they rewrite the world in their own images, [to] resist others’ constructions of who they are” (Riecken *et al.*, p. 283), to build personal identity and pride.

The participant-driven videography methodological framework is inspired by and draws upon the practices of Riecken *et al.* (2006), as well as Barnhardt and Kawagley’s (2005) work. Riecken *et al.* describes the use of digital video as a means for Aboriginal youth to explore concepts of health and wellness. As Participatory Action Research (PAR), their project involved a collaborative research effort between researchers and teachers to develop and design a research project, then bring in youth as co-researchers. Barnhardt and Kawagley exemplify successful curriculum guidelines for students that respectfully integrate both Indigenous and

Western knowledge. They describe culturally responsive science and math educational practices for Alaska's Indigenous people, be it ethnomathematics, place-based education or situated science learning.

The participant-driven videography methods attempted to pull together the following four methodological frameworks: Decolonizing Methods, Participatory Action Research, Points-of-Viewing and Digital Video Design Ethnography. This phase of the research strives to be done with rather than on Indigenous people (Menzies, 2001). While the Inuit youth participating were better suited to conduct the first phase's research activities, I realize that I too had a part to play as facilitator. As such, I remained critically aware of my own decolonizing work. I worked towards assisting youth, trying to remain aware of what my role as facilitator involved.

This phase of the research strived to be a "process of collaborative learning realized by groups of people who join together in changing the practices through which they interact in a shared social world" (Kemmis & McTaggart, 2005, p. 563), a process which is participatory, practical and collaborative, emancipatory, critical, reflexive and aimed at transforming both the theory and practice (Kemmis & McTaggart) of science education for Aboriginal youth. This collaboration was not only between the participants and me, but also with the members of the community. Community are the voices through which the youth expressed not only their points of view, but also their points-of-viewing.

Points-of-viewing enables us to learn from one another; and perhaps to do so more meaningfully. Goldman-Segall (1998), who coined the term, asserts that, "we have moved our lens from the strict documentary, recording the world as it reveals itself to the filmmaker, towards a keener interaction" (p. 99) that might allow the viewing of events from multiple perspectives. This "keener interaction" continues from the acquiring of video-data through to the compilation of data and editing, as well as the primary modes of interaction involved in Digital Video Design Ethnography.

Digital Video Design Ethnography (DVDE) is rooted deeply in the idea that "perspective is the outcome of how we make sense of the world... [and] that diverse perceptions create diverse perspectives of reality" (Goldman, 2004, p. 158). DVDE recognizes that learning is a process and not a product, a process in which we all partake by asking "whose perspective is

portrayed in this video?” As there is not a single answer to such a question, design ethnography, an element of DVDE, uses observation, participation, recording, interpretation and conclusions in order to deal with these multiple perspectives. Computational tools<sup>15</sup> often used in design ethnographies lend themselves well to data analysis and collection of this nature, and also allow for the layering of multiple viewpoints in order to uncover larger trends. While the youth are not themselves video research ethnographers in my research, many of the processes in representing one’s video-voice are analogous.

*Methods and data.*

The first phase of the research involved a group of 7 youth from Iqaluit, Nunavut, ages 12 to 15, as this is the age group in which disinterest in science begins (Leap, 1982). Participants were both Inuit (4) and non-Inuit (3). In stage 1, the pre-data-collection stage, all 7 youth participated in a week-long movie-making camp in which they acquired, or further honed, the technical skills used in the process of cinematography, which include framing shots, sound editing, scoring, video-editing, lighting, so that they were able to better represent their video-voice. This programming is delivered through Actua programs, as it has been in the past. Youth involved in this program were invited to participate in the further stages of the research process but they were in no way obligated to partake beyond the initial movie-making camp. There was a risk that no youth would decide to participate in the data collection process at all. Fortunately, all of the youth decided to participate and they and their parents/guardians gave informed consent via a consent form.<sup>16</sup> In parallel, I solidified previously established community contacts with Western scientists and other members of the community so that there were contacts in place for stage 2 of the research. Unfortunately, I was unsuccessful in finding Elders to participate in the research because I was not inquiring in the right places and ran out of time to make this happen.

---

<sup>15</sup> In DVDE, computational tools refers, for the most part to software allowing for multiple methods of capturing, editing, manipulation and rendering of audio-video data that would otherwise be inaccessible via the analog, 8mm method.

<sup>16</sup> Also, 6 out of 7 participants agreed to be interviewed and have their names displayed within the research; a pseudonym is used for the participant who chose anonymity.

In stage 2, through video, I had planned for youth participants to interview Elders, Western scientists and other members of their community to explore what science meant to them, particularly its nature and implications. To achieve this, youth could have interviewed Elders to explore traditional knowledge (e.g., throat singing), and could have interviewed (Western) scientists to explore related Western scientific concepts (e.g., wave theory) in order to explore specific yet culturally relevant scientific notions (e.g., sound).

What happened in practice was that the youth interviewed Western scientists (2) who worked at the Nunavut Research Institute, Nunavut's head nurse, Fred Montpetit, and people who worked at the Inuit Broadcasting Corporation (n=1) and the Canadian Broadcasting Corporation (n=3). These interviews revolved primarily around the type of work those interviewed did. Youth also interviewed people on the street (n=6) about the weather, as well as participants in the science camp (n=12), and each other (n=5)<sup>17</sup> on their experiences with science.

In this process, which started halfway through the first week and ended halfway through the second, the youth were free to interview whoever they pleased, ask questions of their choosing, and keep the process as long or as short as need be – for it to be their points-of-viewing, I wanted them to have creative control of the entire process.<sup>18</sup> These interviews ranged in length from 10 minutes to 3 hours, resulting in roughly 15 hours of raw interview footage. Meetings were held a few times daily so that I, as primary researcher, could both facilitate the process and remain informed of each youth's progress.

Once the youth's interview process was over, the youth began the video editing process. They rooted through their interview footage in order to decide which parts to use and how to chronologically lay them out. While I had hoped they would assemble all the footage that represented their own voice regarding what science in Iqaluit meant to them, instead, they distilled each piece of interview footage down to 5 minute bites to show their parents at the end of week showcase. It was at this stage of the research that I decided to supplement the

---

<sup>17</sup> Of the 7 participants, one chose not to participate and one was not present that day.

<sup>18</sup> Youth were given no set framework, but were often given assistance in developing questions (e.g., youth were unsure as to what to ask an air quality specialist regarding the work they do, so we helped with some of the background research).

interview process with researcher-driven questions to the participants regarding their views on science; 6 of the 7 participants agreed to participate in these interviews.

In stage 3, the interview videos<sup>19</sup> were completed and the youth were invited to deliver a mini-dissemination of their videos, to peers, parents, friends, family and other members of the community. Also during this stage, I began to analyze the videos, both for what interviews contained, as well as my own interviews with the participants.

#### *Media ownership.*

In order to respect the well-established cultural protocols around the protection and preservation of Indigenous knowledge, as well as honour the reciprocal relationship between the participants and their community, primary ownership of the videos currently resides in the hands of the youth who created the videos, so that they are in control of their own cultural knowledge and knowledge re/production (Riecken *et al.*, 2006).

Given this project was indeed for my M.Ed. thesis at Lakehead University, I knew the data would be used for academic purposes in different locations than Nunavut and by non-Inuit people. As a data-source and data to be disseminated in my thesis, academic conferences, and future publications, I hold secondary ownership of the data and control its representation in academic forums. While this was a decision I made prior to the data collection, I verified with the participants as to whether or not this was something with which they agreed. In order to attribute credit where credit is due, primary owners of the videos will be invited to co-present data when possible and can allow or disallow further dissemination of such data. I follow Goldfarb (2002) who states that, “by producing media texts themselves, students learn that ... they can appropriate the means of production to produce new sorts of meanings” (p. 69).

#### *Twin Lens Methodology – Video-Auto-Ethnography*

##### *Framework.*

Smith (1999) asserts that “[Indigenous people] are the most researched people in the world” (p. 3). To partially redress this unbalance of a white/other researching Indigenous

---

<sup>19</sup> I also had access to videos that the youth made that did not directly pertain to this research, including Calvin and Hobbes skits, stop-frame animations.

people, I have used “video as my ethnographic partner” (Goldmann-Segall, 1998), turning the lens inwards at myself, to create a self-narrative that critiques how I am situated within a social context that is not my own (Spry, 2001); I see this inward lens process as a critical video-auto-ethnography. To achieve the third goal of critically analyzing respectful roles that non-Indigenous educators can adopt in delivering culturally responsive science curriculum, the critical video-auto-ethnography draws upon three distinct, yet interconnected, theories: (1) praxis; (2) participation as reciprocity/engaged pedagogy; and (3) critical ontology.

(1) Praxis is the act of linking practice and theory, or more specifically, in its early beginnings, critical action linked to political action in the real world (Freire, 1970/1993). Freire’s work assisted in aiding the oppressed in becoming aware of their personal “limit situations,” to imagine themselves beyond these “limits,” and to act accordingly in order to, ultimately, overcome their own oppression. Despite its liberatory promise, how Western scholars have enacted it has often been far from ‘emancipatory’ (Lather, 2007; Smith, 1999). Reason and Bradbury (2001) ask how are we to “understand the dynamics of power when participatory methods are employed by the powerful?” (p. 77), how do we avoid “the illusion of inclusion” (Reason & Bradbury, p. 75)? Lather (2007) argues that praxis should now involve the process of turning one’s lens inward, to, as Lather (2007) would say, “get lost” by adopting a “naked methodology.” This approach to research which is grounded in not knowing, is not meant to look for the naked truth but the naked self, the researcher who is vulnerable, human, discomforted, exposed – in order to further push the boundaries of knowledge.

(2) Participation as reciprocity recognizes the reciprocal relationship marked by responsibility and obligation between the researcher and those researched (Elam, 1997; hooks, 1995; Maturana & Bunnell, 1997). Part of my responsibility was for me to better understand the experiences being undergone by the youth. I thus partook in a data-collection exercise similar to that experienced by the youth in the second phase of the research, so that I could experience it myself, discover with them and, perhaps, grow with them. This sort of auto-ethnography provides an opportunity to self-educate, self-empower and self-emancipate (Langellier, 1999, p. 29). In addressing that which has fractured my horizons, my Western



worldview, I may be better positioned to be an ally (Bishop, 2002), and grow with, the youth with whom I have worked and continue to work.

(3) Critical ontology involves a good, hard look at one's own 'ways of being', one's ontology, to generate greater awareness of "how and why [one's] political opinions, religious beliefs, gender role, racial positions, and sexual orientation have been shaped by dominant cultural perspectives" (Kincheloe, 2006, p. 182) in order to develop a new consciousness of the self, its construction, its limitations, and what it can be. "Research in a critical ontological context changes not only what one knows but who one actually is. In this process the epistemological and ontological domains enter into a new relationship that produces dramatic changes" (Kincheloe, 2006, p. 186). Through critical ontological analysis of the nature of my own reality, a practice that is analogous to an analysis of the nature of science, I hope to attain new levels of self-consciousness (Lepani, 1998; Newland, 1997; Thayer-Bacon, 2000; Williams, 1999) so that, through heightened awareness, I can become better aware of the interplay between the very Western Cartesian Dualism which seeks to divide and Indigenous ways of being and the Indigenous knowledge which lives in everyday practices (Dei, 1995; Maurial, 1999; Woodhouse, 1996), as well as how they are interconnected, and more importantly, the forms of difference between the two.

Through the connecting of praxis, participation as reciprocity/engaged pedagogy, and critical ontology, within an auto-ethnographical setting, I anticipated creating an opportunity for further personal growth that would better situate me as an educator/researcher within the frame of this research. So that I could be more respectful and effective as an educator, I strived for this growth to involve a heightened sense of self-awareness of my Western worldview, as well as how this worldview interacts with, interconnects with, and differs from, that of the other, an Indigenous worldview.

#### *Methods and data.*

The data for this phase of the research was collected during all three stages of the primary data collection. Over the course of a 3 week time span, I video-logged (vlog) reflections on the research process for roughly 10-15 minutes daily, resulting in 150 minutes of data, which

create, like fieldnotes, a thick description helping me in “making the familiar strange” (Spindler & Spindler, 1992). While making the familiar strange is usual in auto-ethnography, video, unlike pen and paper, fully removes the safety net of perceived control. Auto-ethnographers who allow themselves to “get lost” and adopt a “naked methodology,” by being open, honest, vulnerable and discomforted (Lather, 2007) through the video process may often have results which border more on the strange than the familiar (Higgins, 2009).

In critically analyzing respectful roles that non-Indigenous educators can take in delivering culturally relevant science curriculum, I asked myself critically reflexive questions that address the topics below:

- (1) The nature of science, what it is, what it is perceived as and what it can be,
  - How is science, and how it is defined, as a gate-keeping device?
  - What myths are portrayed and perpetrated in science education?
  - Can science in fact move beyond what it currently is? What might it look like in practice for it to become something that is in fact respectful of multiple worldviews?
- (2) Respectful roles in the cross-cultural setting,
  - Where video does not allow for the same story to be told differently, does not respect the idea of flux inherent in Indigenous knowledge, is there, in fact, more to be gained from the process than the results?
  - Where the Western scientific worldview and Indigenous worldviews are often clashing, how does one bridge both while respecting the bodies of knowledge and the learner?
- (3) Caring and how one goes about enacting caring,
  - While I care *about* the youth, what respectful actions can I enact so that I care *for* the youth?
  - While caring is not sufficient, how does it better position me as a researcher/educator within the frame of this research?
- (4) My role as researcher in the primary phase,
  - As I make community contacts, how much am I pre-determining the direction the primary phase takes? (Stage 1)
  - How do I not affect the youths’ ability to exercise creative control of the direction this project takes in the facilitation, be it advisory or technological, I offer? Can I reduce this impact? (Stage 2)
  - Are the community members involved within the interview process being respectfully represented? Am I appropriately situated to make such judgments? (Stage 3)
- (5) My worldview, my sense of self (in all spheres) and how these impact all of the above.
  - How does my Western training in the ‘world of science’ (in physics) affect my conceptions of the nature of science, what it is, what it is perceived as and what it can be? Are these beliefs immutable, flexible, or changeable?

- How different is my understanding of what respect involves from perhaps one stemming from an Indigenous worldview?
- Can I distance myself from notions of validity, empirical worth and the likes in order to not impact the direction the youth take in both the video capturing and editing process?

*Twin lenses converge.*

As the twin lens methodology is one that is experimental, the interaction between the dual processes and what it made possible within the scope of this research will be discussed within the second half of the findings in chapter 6, rather than here within this chapter.

*Ethical Preparations for the Field*

The key difficulty for researchers lies within the multiple level of approvals necessary to achieve a respectful research relationship.... Refusal and redefinition is possible at every level.... All of this is then exacerbated by the wider history and legacy of colonialism that is a constant backdrop to any engagement in an Indigenous community. (Menzies, 2004, p. 25)

The research described within this thesis is certainly no exception to what Menzies (2004) describes. Negotiations with the organizations through which this research was conducted, as well the various institutional ethics processes through which research licenses were acquired, were not quick, short or simple processes. At the very heart of the matter was that the community itself had to approve the research to be conducted. Community members were to be the final judges of whether or not the research would benefit them.

For me, what is interesting and challenging to note is that through this process, I was required to envision potential situations and deal with them in advance, respectfully. The feedback received from ethics (both Lakehead and the Nunavut Research Institute) when preparing for this research gave me necessary direction to plan for situations that I had not foreseen earlier<sup>20</sup>. I was required to think as to how these notions of respectful research I had read about during the development of my proposal would be enacted within the framework of my research.

---

<sup>20</sup> Initially unforeseen situations include: what should be done should youth, or their guardians refuse to participate and having forms available in Inuktitut as well as English.

Following the completion of my research proposal and receipt of approval, I was ready to submit my research to institutional ethics boards for clearance. As a Lakehead University student, I was required to obtain clearance from Lakehead's Research Ethics Board. In order to perform research in Nunavut, I required a research license from the Nunavut Research Institute.

While the methodology was still being shaped at this point in time, how the research would be enacted, the time frames and methods, became more concrete through this process. The role that the Inuit participants would play within the research, as well as my own, also became clearer.

*Nunavut Research Institute research license.*

Any research being conducted in Nunavut requires a license from the Nunavut Research Institute (NRI). While the process of obtaining a research license through Lakehead and the NRI shares many of the same key components, where the Lakehead REB is in place to ensure that research "does no harm," the NRI's research license acquisition process asks "what good does this research bring?" The NRI ensures that research performed in Nunavut's communities serves these communities in one way or another. For this reason, it is not only the NRI who approves of the research, but also the community itself. The NRI Research Liaison is responsible for determining which members of the community and agencies should be consulted to reflect the wishes and wants of the community. If community stakeholders do not have anything negative to say regarding the research, the license is granted. In order to make both the description of the research and the consent form accessible to various stakeholders within the community for their approval, I had both documents translated so that they would be available in both English and Inuktitut.

The Lakehead REB deemed that this research would do no harm; the NRI deemed that this research would benefit the community. I had cleared both institutional ethics processes; I was ready to go to the field and collect data.

### Data Analysis Methods and Coding Tools

Through the data collection stage, multiple forms of data were collected (see Table 1). There was roughly 20 hours of raw video, both participant-driven and auto-ethnographical, at my disposal before I began the data analysis. I felt a great need to operate using reductionist methods, while at the same time, keeping a holistic vision of the ensemble to maintain an analytical balance that is respectful of the Indigenous voices found within (Castellano, 2004). In order to achieve this, many data sources are not directly represented within this thesis, but are reflected within the mind map, a source of secondary data that helped maintain a holistic view of the data as a whole.

Data Source	Code
<b>Video-auto-ethnography:</b> video-recorded reflexive work on my own experience with the research and my role within it as a <i>Qallunaat</i> researcher.	(VAE)
<b>Written auto-ethnography:</b> written reflexive journaling on my own experience with the research and my role within it as a <i>Qallunaat</i> researcher (to supplement and further contextualizes the video-auto-ethnography).	(WAE)
<b>Participant to Participant interviews:</b> 5 minute movie-making participant-driven interviews with the participants of the concurrently run science camp on science at camp and at school. 5 out of 7 participants were interviewed.	(P2PI)
<b>Researcher to participant interviews:</b> 10 minute researcher driven interviews with the participants of the movie-making camp on science, at school and in life (when the youth decided not to participate in the study as planned, this became my means as researcher to dig into their perceptions of science). 6 out of 7 participants were interviewed.	(R2PI)

Table 1. Data source codes

Once data were sorted and organized, multiple methods and tools were employed for the analysis, namely tag clouds, mind maps, and respectful reflexivity.

I felt motivated to begin data coding using Tag Clouds (see Figure 3) as they offer a rapid first glance at what the data looked like as a whole. Steinbock, Pea and Reeves (2007) defined a Tag Cloud as “any list of words visually weighted by their relative frequencies in a source text” (p. 2). While there is little academic research on tag clouds (Steinbock *et al.*), it is thought that visualizations of information can enhance cognition (Card, Mackinlay & Shneiderman, 1999)



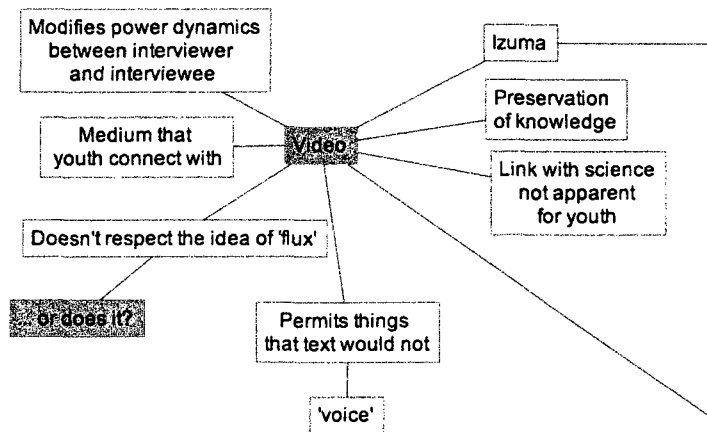


Figure 4. Excerpt of mind map

These ideas were conceptually mapped out using VUE (Visual Understanding Environment<sup>21</sup>); see figure 4. “At its core, the Visual Understanding Environment (VUE) is a concept and content mapping application, developed to support ... anyone who needs to organize, contextualize, and access digital information... [by visually mapping] relationships between concepts, ideas and digital content” (Tufts, n.d., ¶ 1).

Using VUE’s “basic visual grammar consisting of nodes and links,” I identified key ideas found within the data and visually connected these ideas in ways that were made either during data-capture or data-analysis. Through this process, I coalesced and compared data sources, the data becoming one data mind map. This technique offers one means of organizing and reducing what Chenail (1995) refers to as an “embarrassment of riches” (p. 2), excessive data that is often associated with qualitative research (Daley, 2004; Wheeldon & Faubert, 2009). My research was no exception given there were multiple data sources available for analysis, as well as cross-analysis (see Table 1, in which not all data captured is represented). While Tag Clouds offer a quick and efficient means of distilling information, it is but a visualized word count, unanalyzed breadth of data, but not the depth possible through data-mining, or more appropriately in the case of this research, weaving wider. Tag clouds were very useful to me in

<sup>21</sup> VUE is freeware that is available at <http://vue.tufts.edu/>

preliminary data analysis in order to guide further processes (e.g., where to dig deeper within the data) but lacked the sophistication of having researcher driven data interpretation and analysis (e.g., the means of actually digging deeper/weaving wider).

Mind mapping also offers the means of exploring the generative knowledge space found between the data sources (Somerville, 2007). As someone who reasons visually, being able to literally see and manipulate pivotal concepts that emerged from the data allowed me to generate, or perceive, connections between key concepts (and sub-concepts) I did not notice earlier. This generated mind-mapped meta-data increased my comfort level with, and understanding of, the data as a whole, and allowed me to focus on particular areas of the data, distilling and reducing the data to an amount that was more manageable within the framework of a masters' thesis. This permitted me to weave together disparate elements of the data. As such, the messiness earlier mentioned is not wholly represented within this thesis.

From the data collected and reduced through means of conceptual mapping via continual review and coding, two major themes emerged: (1) Participant Perceptions of Science and (2) Personal Perceptions on the Research/Education Process. These themes are further explored and justified using the various data sources (see Table 2) in chapter 5.



## Chapter 4: Data-Story

### *RE:Telling Tales from the Field*

This chapter intends to further contextualize the data analysis (Chapter 5) as well as the research findings (Chapter 6) by giving some of the flavour and context of what the data-collection was like and where it was situated. As such, this chapter serves to describe: (1) the reason why I returned to Iqaluit, (2) Iqaluit as a community, (3) a short description of the participants, as well as (4) how the movie-making camp played out.

#### *Where my heart lies.*

“Where does your heart lie?” is a question I was asked, and I asked myself many times in my first year of the master’s program. My eventual response was that it lay exactly where I had left it. I had left it in Nunavut, where tundra smells sweet, the sun shines for twenty-four hours in the summer and faces are friendly. I saw myself returning to Nunavut for my third consecutive summer for hands-on science and technology youth programming as a member of Actua’s Dream Team.

As part of Actua’s mandate of “providing young Canadians with positive, hands-on learning experiences in science, technology and engineering” (Actua, n.d.), the Dream team, a team which consists of veteran science educators, travels to many Northern First Nation and Inuit communities to deliver summer camp programming. These activities vary from hands-on science and engineering projects, some of which are culturally relevant, to engaging technology and media based programming, such as the movie-making program that was modified for the sake of this research.

I continue returning to these programs in Nunavut, and elsewhere, as it permits me to deliver the type of education that I myself crave – an education that is fun, informal, hands-on, yet in no way minds-off. More importantly, while I always head north as someone paid to teach, I find that more often than not, I am the one who is taught and gains and learns. My insistence on returning to Nunavut stems from a desire to return the service, to give back to the youth and their communities, who have given me so much. These programs are what have

been reigniting my personal educational passion in past summers, and this summer was not an exception.

### *Movie-making in Iqaluit.*

Iqaluit is Canada's fastest growing city with 18.1% growth from the 2001 to the 2006 Statistics Canada Census. Since 2006, it has continued to grow as well – with 6 184 inhabitants in 2006 (Statistics Canada, 2006), and over 7 250 (City of Iqaluit, n.d.) now. Approximately 85% of the population is Inuit, making it one home to one of the highest percentages of Indigenous peoples in the Arctic (City of Iqaluit, n.d.). Inuktitut is the dominant language in Nunavut with 60% speaking it as a first language, compared with 35% speaking English (City of Iqaluit, n.d.).

Entry into the community was established when both Actua and the Nunavut Research Institute agreed to allow me to piggy back the research onto the existing camp framework. Above and beyond the relationship that Actua has with the community, I too, as a returning instructor, have slowly begun to make those connections with veteran movie-making participants and other members of the community. My relationship with Actua and NRI has allowed me to navigate the territory required in the process of modifying the existing camp structure to adapt it to also conduct this research at the same time.

Actua is invited into the community on repeated occasions every year, both for camps and workshops. During summer programming, Actua reaches roughly 200 youth. Iqaluit, Nunavut was the site of a movie-making camp delivery for three years prior to this year's research, something which I have been part of since its inception. This program had been, in past years, well populated – usually reaching its capacity of 12-16 youth. It is also often attended by youth who already were actively engaged in the movie-making process. Some of these youth enjoy the program so much that they have returned for multiple summers. Thus, I foresaw no problems obtaining research participants.

### *Who's who at movie-making camp.*

The sample chosen for this study was the group of youth who were registered for participation in the Actua-delivered movie-making camp. These youth were selected for their

availability and interest in making movies, as well as potential interest in participating in the study. While at no point were these youth obligated to participate in this study, all the youth, and respective parent(s)/guardian(s), chose to participate to varying degrees within the research.

While there were a few ( $n = 2$ ) participants who were there for only a few days, we had 9 participants in total, with a core group of 7 who were there for most of the two weeks. This core group of seven youth in regular attendance was between the ages of 11 and 14, with 13 being the average age. Four of the 7 were of Inuit descent, as were the two who were there for only a few days. The other 3 participants were of European descent and had grown up down south in the provinces but were now living in Nunavut. Of the core seven, 3 participants were female and 4 were male. The research participants below have agreed to have their real names used within this research unless otherwise noted.

*Olivia (Inuit), the first participant to arrive, was also the movie-making team's veteran having produced a very well received hide-and-seek slasher flick the previous summer. Despite being groggy and thus quiet in the mornings, Olivia was always up to taking on whichever task was at hand. Olivia was a natural interviewer, and she would often improvise questions for her interviewees to have them dig deeper. As she became increasingly comfortable in this role, she was even caught on tape acting as a news anchor diva, unleashing her silly side that was sometimes dormant.*

Mitchell (non-Inuit), the second participant to arrive that Monday morning, shared with us all his endless enthusiasm for acting out larger than life roles. It did not take long for Mitchell to get over his Monday morning timidity and find his place in the movie-production team. Soon, he would often be the first to volunteer to conduct interviews with people he was meeting for the first time.

Evan (Inuit), while timid on-screen, was the behind-the-scenes go-to guy. He never shied away from meticulous work that needed to be done for the sake of completing projects, even if other participants considered it mundane. Evan did not only enjoy doing the editing work, he was rather good at it too. Between his analytical personality and the care he put into his work, he always delivered quality work, be it behind the camera or during post-production.

Kara (non-Inuit), having starred in many plays and productions when she used to live down south, was our most seasoned actor in the group. This led to her playing many different parts where the characters were delightfully over-the-top. Being a morning person, Kara was often the most chipper and awake of the participants at 9 in the morning.

Brandon (non-Inuit), Kara's younger brother, and also the youngest of the group, had no lack of energy. While this energy was occasionally difficult to harness when in resonance with Mitchell's energetic persona, it made for many memorable on-screen moments. Brandon's creative energy and musical ear were put to good use as the team's own sound score composer.

Flora (Inuit)(pseudonym), while appearing timid and reluctant at first, pleasantly surprised everyone when she was first cast in acting roles – she was able to get into character easily and quickly. Despite Flora's mask of resistance, which hinted at a home life that might have been demanding, smiles occasionally surfaced when she was enjoying what she was doing. The biggest smirk appeared as she pieced together a blooper reel of all the funny mix-ups that occurred while shooting the movies.

Robert (Inuit), the eldest of the group, was often the most level and even headed when it came time to make decisions. He always listened first and then calmly made suggestions. It is possible that some of this calm might have been fatigue; Robert often admitted how late he stayed up at night. This, of course, did not prevent him from letting loose when playing the role of Muhaha, the aptly named traditional Inuit bed-time-story monster who chases after children to tickle them to death. Lugging around a variety of personal electronics, Robert, an apt technophile, was always quick to learn different computing techniques to work with the captured video.

All participants fluently spoke English, which made camp delivery easier since neither my instructional partner<sup>22</sup> nor I spoke Inuktitut. It was not assessed as to whether or not Inuit participants' first language was Inuktitut or English. Nonetheless, language did not seem to be a barrier in communication.

---

<sup>22</sup> Amanda Stevado, an Actua veteran and engineer, was my co-instructor for the delivery of the camp content.

*On the set.*

Throughout the course of the first week, techniques were first introduced by the means of Nortel LearnIT<sup>23</sup> training videos, and put into practice through a variety of projects and activities. These videos covered many aspects of movie pre-production (e.g., shot lists, storyboarding, etc.), production (e.g., sound, lighting, camera-work) and post-production (e.g., video and audio editing, Foley Room sound effects, sound score, etc.). These activities were intended to develop the procedures and practices needed for the youth's own videos and included producing multiple interviews with a wide variety of participants, Calvin and Hobbes skits, storyboarding, and creating a sound score and Foley Room sound creation. By Wednesday of the first camp week, the basics of creating a movie from start to finish were covered. With the skill-set well established and put to the test, we were ready to discuss major movie productions to be undertaken and collectively created in the remaining week and a half.

This was when I explicitly introduced my intended study to the youth. I pitched the documentary project as Science as enacted in Iqaluit. The details of this topic had only been briefly mentioned to the participants earlier. As there was not much interest in these introductions, I became nervous about the force that I might be imposing this as the major movie production that they would be working upon. I now wondered what the purpose of this movie-making camp was and how would this impact the research I was conducting. In search of a middle road consensus in which we could all gain and learn, I laid things directly out to the youth, letting them know that I would appreciate their partaking in the research project, but once again reminding them that they were in no way obligated to do so. The resulting group consensus was that the youth wanted to create three different productions.<sup>24</sup> The first was an Oreo-eating-as-Olympic-sport mockumentary. The second was a movie about Inuit traditional scary stories for which they had found a book in the classroom we had been using. The third was the science documentary; they were willing to interview people with whom I had arranged interview times about science-related themes, and would consider compiling the whole into

---

<sup>23</sup> See <http://www.nortellearnit.org/> for more information.

<sup>24</sup> While this may potentially have limited findings that could have stemmed from the research process, this research strived to place respect first.

one documentary if there was time.<sup>25</sup> We were able to accomplish all three and all of them as collaborative projects in which all youth were involved.<sup>26</sup>

While the mockumentary and scary movie were progressing quickly, youth were also interviewing each other, as well as participants of a concurrently delivered science camp, using self-developed questions about the youth's experiences with school, science and technology. The youth also went on location to the Inuit Broadcasting Corporation (IBC), the Canadian Broadcasting Corporation (CBC), the Nunavut Research Institute (NRI) and the (new) hospital to interview people who worked there to ask them about what they did. When one of the participants cried out "expert!"<sup>27</sup> during our visit to the IBC, I knew the youth were especially excited about the visits to the IBC and the CBC as the locations where media was produced professionally. The other visits were also well received by the youth.

The young movie-makers were able to complete, at the very last minute, the two self-developed movie productions, as well as clean edits of their "on-location" interviews. While some of these projects squeaked in at the last minute, we were prepared to roll out the red carpet for parents, guardians and other community members dropping in for a screening of the produced movies on the Friday at the end of the second week.

During this open house, movies were met with laughs, awe, and a sense of pride. Both the youth and their parents/guardians were proud of the completed work that was produced over the course of the two-week period. There had even been so much produced<sup>28</sup> that we were not able to view all the movies that were created during this period (above and beyond the major movie productions); this would have to wait for home screenings of these movies, as all youth received a DVD copy of their hard labour. As the open house wrapped up, we recognized the youth's hard work with personalized "Oscars" for their very distinct contributions to the production of multiple movies, be it for acting, producing, directing, or

---

<sup>25</sup> As editing was not a favourite activity for any of the youth, which is what this would have involved in spades, though the documentary did not happen.

<sup>26</sup> One of the benefits of having a group of 7-8 youth is that that is roughly the number required "on set" both on-screen and off-screen to produce a movie.

<sup>27</sup> This is a local expression that would be analogous to "that's pro."

<sup>28</sup> And these were produced and edited to very reasonable lengths as well. We had pushed the youth to synthesize 3+ hour interviews into 5 minute snippets, just like they would do on TV. These movies included Calvin and Hobbes skits, stop-frame animations and additional interviews above and beyond the major movie productions.

other things. Between the smiles that the campers were wearing and those of community members, we knew the experience had been successful and positive for the youth.

It was not always apparent that the camp was well received by the youth – their expressions, like many teens, were often ones of apathy or disdain. Nonetheless, despite admittedly late bedtimes for the youth with the 24 hr summer daylight and looking groggy, they still made their way to the movie-making camp in the morning to continue working on their various projects. Given the fact that they would have otherwise been in bed,<sup>29</sup> it was occasionally difficult to get youth self-motivated about the movie-making process, but overall they were open to “working” a variety of (assigned) roles in the production team. While certain roles, for certain youth, were met with resistance, my instructional partner and I kept our ears to the ground to play off of the youth’s strengths and interests while giving them a chance to try a variety of on-screen and off-screen roles. Despite occasional expressions of apathy, which were probably one part fatigue and one part adolescence, the mask would occasionally crack, and faint smiles appeared when they watched the results of their hard labour every time they completed a movie.

---

<sup>29</sup> One of the youth actually fell asleep while operating the lighting during the shooting of a scene of the Inuit traditional scary stories movie.

## Chapter 5: Data-Analysis

### *RE:Viewing Videos*

#### *Data Themes*

The data collected through this research and presented in this thesis led to two major themes emerging during analysis: (1) Participant Perceptions of Science and (2) Personal Perceptions on the Research/Education Process. Table 2 below indicates these themes, as well as the subthemes explored within this chapter. These themes are further warranted and justified using various data sources<sup>30</sup> referenced by codes (see Table 1 – Chapter 3). Also, in this chapter, in order to differentiate between participants and parents who are either Inuit, or not, the following notation will be used: (IN) Inuit, (NI) non-Inuit.

<b>Themes</b>	<b>Subthemes</b>
Participant Perceptions of Science	School Science, it's Probably for Nerds
	What Counts as Science for Nunavut Youth
	Who Can Do Science (as Well as When and How)
	Contrasting Inuit Qaujimajatuqangit With School Science
	Science as a Culture to be Avoided
Personal Perceptions of Research/Education Process	My Auto-Ethnographical Experience as a Qallunaat Researcher and Science Educator in Nunavut
	"Good Enough" Research
	Striving for Respectful Research = Respecting Choices
	Cultural Self-Recognition

*Table 2. Theme map*

<sup>30</sup> As mentioned in chapter 3, not all data sources were included directly within this thesis. While the data supporting some of these claims might seem thin at times, I make them with confidence, as I draw from the data sources not represented. The mind-map, as a secondary source, made things clearer, as well as my time spent in the field.



### *Participant Perceptions of Science*

This research project was intended to be a different way that youth could express themselves through video and express how they perceive science within their own community. This research was originally intended to analyze student-produced videographies of their own perceptions of science as embedded in Iqaluit community life in order to enact the first two research objectives, (1) explore new means of delivering culturally responsive science curriculum that acknowledges, respects and honours multiple worldviews and perspectives, and (2) examine how Inuit youth define, document, and determine what science means to them, as well as discover through the youth's video-voice how "science" is enacted within their communities.

From the start, students made it clear (as they scrunched their brow, an Inuit way to say no) that they did not wish to make movies of their perceptions of science as their primary project during the 2 week period of the movie-making camp. Respecting their choice, I allowed the youth to change my intended focus of the camp. While at first I might have thought that the students' disinterest came from the association of an informal camp's project being perceived as a forced school project, as the camp progressed, I came to understand their initial response had more to do with how they perceived science than with a movie-making project. The youth enjoyed the movie-making process and were avid learners of videography while interviewing various community members and becoming more involved in community life. It soon seemed clear that the topic of science was what caused the youth's refusal.

Despite the different movie topics chosen by the youth, I realize now that there was still a lot of focus upon science as a topic. Knowledge of science was exchanged and gained when the youth shared their perceptions of and feelings about science through their own movie interviews (P2PI<sup>31</sup>), as well as my interviews with them (R2PI<sup>32</sup>) and many informal conversations over lunch (often discussed in either VAE<sup>33</sup> or WAE<sup>34</sup>). In the following section, I

---

<sup>31</sup> Participant to Participant Interviews

<sup>32</sup> Researcher to Participant Interviews

<sup>33</sup> Video-Auto-Ethnography

<sup>34</sup> Written Auto-Ethnography

share the participants' perceptions of science and science education, thus reflecting more strongly the aims of the second research objective rather than the first.

*School science, it's probably for nerds.*

When I interviewed the youth participants about the science education that they were receiving in their schools and classrooms, it was clear that their science education was not very memorable. Most of the youth (3 out of 5, P2PI) stated that they did not like science. Only one was tentative about his liking of science. Robert (IN) stated, “[I] don’t find it interesting” (P2PI); Mitchell (NI) said that science is “boring” (P2PI). Olivia’s (IN) experience with science was generally disconnected from her life, her interests, her culture, as illustrated in this particular exchange:

Mitchell: What do you think of when you think of science?

Olivia: Nerds?

Mitchell: Why? Are there a lot of nerds in science?

Olivia: Probably? (P2PI)

The identity associated with “thinking like scientists” that has implicitly been proposed to Olivia (IN) within her science education is one that she wished to avoid, and one in which she did not see herself, or at least not an identity that she wishes to be associated with, it is a culture to be avoided (Aikenhead, 2004; Fensham, 2004; Jegede & Aikenhead, 1999). When removed from her immediate peer group, however, and when asked if she liked science at school, Olivia (IN) said “yeah, it’s fun” (R2PI). This contradiction may have something to do with the social stigma that she perceives to be attached to school science or the recalling of a memorable experience within her science classroom. She was not the only one to renounce her earlier statement about science when in a less peer social situation – this was also the case for Robert (IN) and Mitchell (NI), but with caveats. Robert (IN) did not like the way he was learning scientific material and Mitchell (NI) found it “kind of easy” (R2PI). Neither reported being fully engaged in their science learning experience in school.

Returning to Olivia’s (IN) statement about “nerds” probably being in science, her inquisitive, unsure response in the interview may demonstrate a certain lack of knowledge, or hesitation as to what the “world of science” actually is. Yet, Olivia (IN) was the only one of the

5 interviewed who clearly put into words what science meant to her: “learning and teaching about chemistry, poison, germs and stuff like that” (P2PI).

Other youth, when asked about what they initially thought of when they thought of science, answered “test tubes” (Robert, IN, Mitchell, NI, Evan, IN, P2PI), “books... text books” (Brandon, NI, R2PI) and “Einstein and lab coats” (Flora, IN, quoted in WAE). This led me to believe that their understanding and perception of science was one that was very much rooted in the stereotypes that effuse Western science, and its subculture of school science. It is understandable that youth, such as Olivia (IN), do not want to associate themselves with the stereotypical lab coat wearing, middle-aged, white male whose time is spent in the laboratory (i.e, nerds). Flora (IN) rescinded her comment regarding the lab coats when she gave it more thought, noting that you did not necessarily have to wear a lab coat to do science. Barnhardt and Kawagley (2005, 2008) state that this is often the case for Indigenous youth – in the science classroom, they learn the language of (Western) science at the expense of their own culturally specific science, their ethnoscience or their Indigenous science (Ogawa, 1995).

It is interesting to note that Olivia (IN), once removed from her peer group, had a good laugh when confirming her earlier statement about science probably being for nerds. Despite this, she then stated that she in fact enjoyed science at school – “Yeah, it’s fun... because... we do experiments ” (Olivia, R2PI). Olivia, like some of the other participants, had memorable, involved experiences. For Mitchell (NI), it was microscopes. For Brandon (NI), it was “doing experiments [with] vinegar and baking soda... [making] stuff, [and going] outside” (R2PI). For Kara (NI), it was also experiments, “to see how everything reacts with each other. It’s fun to see the chemicals and everything” (R2PI). In the following passage, Olivia (IN) recounts her experience of an in-class boat design challenge:

We were using play-doh or something, like, we made a boat of it and then we put it in water, and then we were seeing how many pennies we can put in it, like, some people had more than a hundred. Some people only had 40 pennies in their boat. (R2PI)

Despite having had positive experiences, the students’ general understanding and perception of science suggests the Western, Eurocentric pedagogical nature of school science, namely rote-work (Barnhardt & Kawagley, 2005, 2008; Holbrook & Rannikmae, 2007). Robert,

in a later interview when asked as to why he did not enjoy science, replied that he does not “like doing textbook stuff” (P2PI). A chance meeting one evening with Sprouts participants (IN), the very young Actua science camp participants with whom I had worked prior to the movie-making camp, might confirm that in school there is no lack of “textbook stuff” to complete. The following is how the event was chronicled within my written auto-ethnographical notes:

When I asked two of the girls with whom I had worked in the Sprouts program as to how they felt about school, they told me the following:

Boring

Lots of work

As recent grade 2 graduates, they told me of how many worksheets they had to do – “two thousand in two days!”

I too, would find school boring and *minutieux* [meticulous] were I to be doing rote learning – in grade 2 no less! (WAE).

School science, the stereotypes of science which come with it and the Western teaching styles through which it is delivered makes science, for many youth, a culture to be avoided.

*What counts as science for Nunavut youth.*

Knowing that students had very mixed feelings about the intermixing of science and school, I asked them if they did any activities that they considered science or science-related outside of their school time. Here are a few examples:

I used to do experiments in my kitchen. (Olivia, IN, R2PI)

Camera stuff. (Mitchell, NI, R2PI)

I make volcanoes out of vinegar and that stuff [baking soda]. (Brandon, NI, R2PI)

While the bulk of the responses resemble what I’ve noted above in that they are very reflective of the types of activity that would be delivered within a science/technology classroom, but done in a more informal manner, there were a few examples of learning that were less prescribed:

Outside of school? ... uh... physics? Well, I admire like... it’s really cool how you just ... well... like... you know how the airplane doesn’t need wheels to take off, it just needs the propeller... We went camping one time and one flew right over us. (Brandon, NI, R2PI)

Um...sometimes I play with water! (Robert, IN, R2PI)

What is most interesting is the contrast between the two participants who did not state that they did any science-related activities outside of school, for different reasons. At first, I thought it might be because they might need examples when they did not answer – but this was not the case:

Marc: Do you like doing science-related stuff outside of school? ...like do some experiments in the kitchen, or go for a nature walk, or play pool then kind of really think about how you're hitting the ball and how everything plans out and stuff like that.

Evan: Yeah, but I don't think about it. (R2PI)

While for Evan (IN), science was something that he did not think about, and potentially embedded in his everyday life, Kara (NI), in the same situation replied: "I don't really consider it science" (R2PI). Where Evan is Inuit and Kara is not, this might speak to how strongly the notion of "what counts as science" is embedded and, almost religiously, enforced within Eurocentric culture (Frayn, 2006; Peat, 2002).

This is not the case across the board though. Though non-Inuit, Mitchell's views of what counts as science are broader than what a textbook would include, while not excluding such content:

... there's the microscope thing, and the computer technology stuff, and then the lab stuff, and then the out on the water and the land stuff, and then the... people who are like... outside, doing all that stuff, and then there's the people that are inside doing all that stuff. There's that plant stuff. Lots of stuff. (Mitchell, NI, R2PI)

Mitchell's (NI) views of what counts as science are in full growth, and he helped me grow mine when he asked: "is movie-making science?" (R2PI).

*Who can do science (as well as when and how).*

Despite participants not wanting to see themselves in "the world of science", it was well agreed upon by all interview participants (6 out of 6, R2PI) that science was something that

everyone could do. When further elaborating as to why they believed this, here are what some of the youth had to say:

Because it's not a ... a superhero or... it's not like magic... it's just science. (Olivia, IN, R2PI)

Because, like, anyone can be a part of it. (Brandon, NI, R2PI)

The above answers speak to the idea that one can do science if one chooses to do it. Robert (IN) and Evan (IN) might have had a bit of a different take on the matter. Evan (IN), as earlier noted, does not think about doing science when he was doing science informally, an opinion that is also reflected in Robert's comment:

... because it's just the little thing that you have to ... just... do. (Robert, IN, R2PI)

In this framework, science would then be more holistically interwoven into the fabric of everyday life. This resonates with authors such as Cajete (1999), Barnhardt and Kawagley (2008) and Peat (2002). You need not think about how you rationally perceive the world (Ogawa, 1995) or even how you use those perceptions to frame, and interact with the world around you – it is simply something you do.

#### *Contrasting Inuit Qaujimajatuqangit with school science.*

While all interview (R2PI) participants (6 out of 6) agreed that there were many ways in which science can be enacted, and that technology could be used, where did Inuit Qaujimajatuqangit fit in that picture? Inquiring into this, I posed an example where both traditional knowledge and modern technology were contrasted:

Let's say a father and a son go out boating and they each have their own boat and the father uses, like, the sun and the sky, and the direction of the waves to kind of find his way and the son is using a GPS and they both get to the same point – do you think they're both as good as one another? (Marc, NI, R2PI)

The answers below represent the general consensus that all of the participants had reached:

They're pretty equal because the father, he's using his knowledge and the son, he's using modern technology to help him around. (Robert, IN, R2PI)

Yeah, both ways, they work the same, they're just different. (Kara, NI, R2PI)

While all interview (R2PI) participants (6 out of 6) believed that both got the job done, certain campers commented on how both approaches, while being functional, might have their ups and downs:

I think the GPS would be better in the winter in the North because the sun wouldn't come up; it'll just be up a couple hours a day. (Evan, IN, R2PI)

Yeah, because the sun and the stars are a good way because but... except when it's in the daytime but a GPS it can't really... in a storm you can't really take off your gloves... but you can still see the stars... Because sometimes, in like a whiteout, you can't see that... but like, the battery could turn off but... in the GPS. So then, both have ups and downs. (Brandon, NI, R2PI)

Kara (NI), speaks to the notion of knowledge, lived or other, as culturally based:

Yeah, probably... like ... like, just people even just looking at the time, they look at the sun sometimes and stuff so whatever... that's the knowledge and it's not like ... modern stuff ... so everything just works together but it must be a lot harder to do it... the Inuit way because ... like, GPS just says it in front of you, but you actually have to think for the other part. (Kara, R2PI)

As a non-Inuit person, she is less likely to experientially learn way-finding techniques on open water than she is to learn how to use electronic device interfaces that are becoming ever more prevalent in Western culture.

On the other hand, Mitchell (NI), unprompted, took this opportunity to critique the culture of Western science as un-relational, non-reciprocal and disrespectful. As a non-Inuit person, Mitchell made it clear that he did not see himself as a part of, nor did he want to be a part of, Western science. As he talked about scientists tracking beluga whale populations, he spoke of them jumping to conclusions rather than consulting Inuit people who have much knowledge of beluga migration patterns, that they "have to look at it better instead of just trying to make up excuses" (Mitchell, NI, R2PI).

*Science as a culture to be avoided.*

It is not that Nunavut students, both Inuit and non-Inuit, do not like science per se, but rather its cultures, be it EuroCanadian formal school science or Western Modern Science. For Inuit students especially, they understood that science was to be avoided (or at least a culture with which one does not want to be seen as associated) because the Western worldview of any Western science does not reflect their own Inuit worldview, and the ways in which they participate in the physical world does not reflect their own ways-of-learning. As Robert so succinctly states: “I like the stuff we’re learning but I don’t really like how we’re learning it” (R2PI) with reference to the science education he had received so far.

Through diffusionism, the Eurocentric mode of erasing everything that it is not clearly eurocentric (Battiste, 2005; Blaut, 1993), and through negative experiences and stereotypes of science that the participants have repeatedly experienced, perception seem firmly engrained. It is clear through what the participants have voiced that they are not avoiding science because it is something that they cannot do themselves, but rather that it is something they do not wish to do. They do not want science, at least in the way that it is presented to them through the school science that they have received (Aikenhead, 2004; Aikenhead & Jegede, 1999; Fensham, 2004; Jegede & Aikenhead, 1999). Science, for the participants, is culture that both Inuit and non-Inuit students alike wish to avoid (Aikenhead, 1996; Atkin & Helms, 1993; Calabrese Barton, 2002; Coburn & Aikenhead, 1998; Costa, 1995; Eisenhart, Finkel & Marion, 1996; Jegede, 1996; Reiss, 2000; Roth & Désautels, 2002). I believe much of this has to do with the fact that the pervasive Eurocentric nature of school science has erased Inuit traditional knowledge from “counting” as science – making science a culture to be further avoided for Inuit youth as it does not reflect their culture, traditions, or beliefs.

Nonetheless, students both Inuit and non-Inuit alike recognized that Inuit Qaujimajatuqangit and Western science are equal but distinct ways to look at the world. A view that was more reflective of the Inuit participants in particular was that science can be, like Inuit Qaujimajatuqangit and other forms of Indigenous knowledges, the stuff of everyday life - it is not something you learn about, it is something you do (Cajete, 1999; Peat, 2002).



### *Personal Perceptions on Research/Education Process*

In order to work towards the third research aim, that of critically analyzing respectful roles that I as a non-Indigenous educator can take in delivering culturally responsive science curriculum, I turned the lens inward on myself as a non-Inuit science educator working in Nunavut. Through this process, I was able to open myself up to different ways of thinking above and beyond the Eurocentrism in which I marinate (Battiste, 2005) in order to better respect the participants of this research. The following findings reflect the most crucial reflexive work that was done in the field.

#### *My auto-ethnographic experience as Qallunaat researcher and science educator in Nunavut.*

One of the first things I was reminded of during the data collection process was that “this isn’t my turf” (WAE, p. 1) – it was not my territory, land or place:

I’m not on my turf... I’m trying, and will be trying to, as best as possible, figure out the rules of the game here so that I can adhere to them in order to be as respectful as possible. (VAE)

Having traveled to Iqaluit before, I already knew that I could not simply arrive in the North and assume that many of the cultural norms of the provincial south would apply, at least not without running the colonizing risk of replicating oppressive behaviours seen too often by Indigenous peoples (Smith, 1999). This sentiment was often exposed throughout my auto-ethnographical journaling, both video and written. The video-auto-ethnographical process in particular acted as my “anti-racist glasses” (Tompkins, 2009), and it was a much required exercise and reminder of my own culture, and the damage that it can bring.

My presence as a non-Inuit within a few of the Nunavut communities where I have worked has not always been one that was quickly, if at all, welcomed. During one camp delivery in Igloolik, the week prior to my arrival in Iqaluit, a couple of hours after the camp open house, the instructional team found one of the T-shirts we had given out with a new graffiti message of protest written, loud and clear: “WHITE PEOPLE SUQ.” The damage dealt by colonial legacies is still strongly experienced (Smith, 1999); I can understand why the T-shirt was

left for us to find, I did not understand how deep the wound is for Inuit people, and I was surprised by how deeply it stung given the ideals of respectful research that I was striving towards.

Throughout the research process, I strove to be respectful of the participants and their communities in order to avoid imposing further colonialism onto them (Rasmussen, 2002) While I was not able to reach all tenets of respectful research as I would not be delivering research that stemmed from an Inuit agency, did not ally myself with insiders, nor was I there long enough to develop deep trust that would have helped me find Elders to interview, I could at very least strive to balance respect for participants with research goals.

*“Good enough” research.*

Respectful research is research that is not on the participants, but rather with the participants (Menzies, 2001). It goes beyond acting to do no harm, but asks what the community will gain in the process. There were instances in the research process where I felt I would have to choose either being respectful, or placing research first – this is a false dichotomy which can be resolved by making research choices that are “good enough”, and making respectful choices that are much more than “good enough”. “Good enough” entails “thinking about research decisions in terms of what is lost and what is gained, rather than what might be ideal. Accounting for these good enough decisions is... the nitty-gritty of researcher reflexivity” (Luttrell, 2000, p. 500).

During the research, I was presented with many decisions that required “good enough” thinking. Like Luttrell (2000), I was concerned with issues of properly representing the voices of those participating in the research. Luttrell does not “believe that researchers can eliminate tensions, contradictions, or power imbalances, but [she does] believe we can (and should) name them” (p. 499). Where I work to be reciprocal, relational and respectful (Weber-Pillwax, 1999) with and to my participants, merely naming the “tensions, contradictions, or power imbalances” does not go far enough; while it might be “good enough” for research, it was not “good enough” for respecting the Indigenous participants with whom I was working, and their communities.

Often, I asked myself if the decisions I made were respectful, if they then compromise my research. Often, I felt that I would have to choose between research or respect. This feeling of having to choose was at its peak when I felt as if I would have to respect the participants' choice to not participate in the study as described, focusing on making a movie about science as enacted within Iqaluit, or continuing the research process forcefully, as demonstrated in my video auto-ethnographical journaling:

Finding my role within this project isn't necessarily the simplest for me. I wonder how I'd feel if the whole thing didn't fly at all? If I'm going to be doing respectful research, when I'm stuck in a position where I have to choose one of the two, either being respectful or being a researcher, which one takes precedence? I think I'm putting priority on being a respectful researcher above, simply put, a researcher. I guess in those regards, I'm not laying out an easy path for myself, especially if it's one I decide to continue walking upon... the last thing I want to be doing is reinforcing colonial legacies, shoving [Western science] down [Inuit] kids' throats.... How to reconcile the two? .... I guess these are the kinds of decisions you have to make, isn't it? I'm working on finding the *middle way*. (VAE)

Striving for respectful research became a process of “good enough” (Luttrell, 2000) decision making on a middle road: a space in-between where a non-Inuit tries to enact both research and respectful relations. This process finds a type of ‘no harm’ (Rasmussen, 2002) balance between the two that brings more ethical weight and dilemma to each research/relationship encounter that can never be described as simple or easy. As a non-Inuit researcher, too many times have I felt during the data-collection phase that “I had to choose” (VAE) between the two — the research objectives or the in-situ relationship building between Inuit youth and *Quallunaat* educator. Often, the ideas of what would be best for respectful inter-cultural relationship building<sup>35</sup> and what would be best for fulfilling the science education objectives were diametrically opposed. I would not choose research over respectful relations for concern of reproducing colonialism, nor would I choose one-dimensional or one-sided relations at the expense of deeper research questions as the purpose of my scholarship relied upon certain questions that needed to be investigated. Scribbled in the corners of my

---

<sup>35</sup> Given the context – it would have been disrespectful to relations with the community, should an Inuit organization have asked me to conduct this research (one of the tenets of respectful research), to allow the youth to not undertake the project. In this case, “respectful research” and “respect” are not meant to be read as the same.

notebook, I wrote that “Respect > Respectful Relations> Research” (WAE in the margins), I had resolved to make “good enough” decisions regarding research to allow myself to aim towards making good decisions regarding respect. While this dualism of research and respect is a false dichotomy, finding the path through the middle in which I was forcibly choosing one or the other was a dynamic space that generated much creative tension (Somerville, 2007, 2009).

Through “good enough” research decisions (Luttrell, 2000), I, a *Qallunaat* researcher in Nunavut, could, and would, conduct research while honouring my first commitment to respect. Respect, in my opinion, is at the heart of decolonization. This is in no way a naïve respect that is but good intentions, but a respect that involves the 3R’s of Indigenous research, triangulated: Respect, Reciprocity and Relationality (Weber-Pillwax, 1999). This involves knowing the youth, their culture, their communities, their ways of learning, their ways of being and furthermore, acting on this knowledge. It means having educational dynamics that flow in both directions, not only from the teacher to the pupil (Kanu, 2003, 2006). Respect, as I see it, goes beyond doing no harm – it makes the distinction between caring about and caring for (Noddings, 1999) the youth.

The inherent reflexivity and flexibility in the research methods and methodology made it possible to enact these “good enough” research decisions in order to honour my first commitment to respect (Weber-Pillwax, 1999). How would I be able to enact this respect as a science educator? And how as a researcher? Through the process of addressing these questions, within a creative, flexible methodological framework, decolonizing momentum was generated which transformed both practice and practitioner. My experiences as a researcher working to decolonize myself and aiming for respectful research impacted upon the ongoing video ethnography methodology as a process, causing it to shift, take shape and evolve.

*Respecting participants = respecting choices.*

The pivotal, and most prominent moment when I felt as if I were trapped between choosing respecting my participants and following the course of the research was when participants had made it explicitly clear that they did not wish to create videographies about

how they perceived science as enacted within their communities. Brows were scrunched, a clear physical sign in Inuit culture that translates to displeasure, or a resounding no.

If I had forced or cajoled the youth to participate in a project that they were not interested in, I would have oppressed them and re/performed education as colonization. My actions as a Qallunaat researcher would have been damaging, as they would have been diametrically opposed to many Inuit values and beliefs that are tied to Inuit lifelong learning (see Figure 2), namely: Pivaktait Nagogiblugit (Acceptance), Tuhakatok (Listening), Ayuiktatok (Adaptability), Havakatigihutik Havatigiyeahit (Teamwork), Havakatigiiktot (Cooperation) and, most glaringly, Pitiahutik (Respect). Striving for respectful research, one of the primary goals of this study, would have been but shallow words with which the actions did not correspond.<sup>36</sup> Research that is respectful can mean respecting the choices of the participants, even if they are opposed to the expected course of the research.<sup>37</sup>

#### *Cultural self-recognition.*

As a white, non-Inuit, science educator, I often struggle with the notion that I might not know the first thing about what being respectful in Nunavut might mean or entail. I also struggle with the fact that all my experiences in Nunavut have been but a few weeks of time. How can I make any positive contribution in such a short time?

Many white, non-Inuit people come to Nunavut for only the summertime. They do not contribute to the communities that they visit, only taking from them. Gearhead and Shirley (2006), who work at the Nunavut Research Institute, articulate the Inuit perception of the many *Qallunaat* researchers who appear seasonally, in numbers:

In some parts of the Canadian Arctic, local Inuit refer to researchers as “siksiks” — ‘ground squirrels’ in Inuktitut. For many northern communities, researchers and siksiks seem to share similar characteristics: they appear suddenly, usually in the summer months, scurry around on the tundra doing who-knows-what, and then disappear just as quickly without anyone’s knowing exactly what they were up to. Sometimes siksik is used in a friendly, joking manner. Other times the nickname expresses negative feelings

---

<sup>36</sup> While this was the pivotal moment in which I felt I had to choose between the two, other notable actions included mediated democratic discussions regarding camp content, schedule, and roles within the team. These did not conclude until all members could agree, and all had voiced what they wanted.

<sup>37</sup> Unless this research is directed by an Inuit agency, in which case allowing participants to deviate from the intended research course might be disrespectful to the community relations.

toward researchers: a mistrust that stems from a history of non-communication, miscommunication, and misunderstanding. (p. 63)

I too, am a *siksik*, though I never intended to be. I have not stuck around a Nunavut community long enough to take root and become a part of the community and have its inhabitants come to know me. I have not had, or taken the time to build relationships, founded on communication and mutual understandings. I am always “just passing through” (VAE). “I beat myself up about what I can do within the span of one week within the community, and the fact that parents occasionally call me on it, as well as other instructors” (VAE). I worried that I, in my limited time, would become that which “I dread, the notion of ... being another who knows what’s best for the *other*” (WAE). I am worried of being yet another white educator as colonial missionary (Rasmussen, 2002).

It continues to be clearer and frustrating to me that some of my deeply ingrained ways of perceiving the world and operating within it, such as science (as I have understood it in the past), are Eurocentric. While my actions and teaching might lack the bluntness of brutal colonial legacies such as residential schooling, my neo-colonialism is more subtle and implicit, always in danger of working to erase anyone and anything that is not Eurocentric (Battiste, 2005; Blaut, 1993). By virtue of marinating in a Eurocentric colonial system such as Canadian schooling, the Eurocentric worldview has become first nature, the primary lens through which I understand what education can be, even in Nunavut. I had to work hard through the video-auto-ethnographical process of critical self-reflection to keep myself open, in a space of not knowing, to better see other ways to see the world beyond Eurocentric modes of perception which inherently prevent me from doing such.

When the camp participants scrunched their noses at the description of the research project, they were telling me that they wanted none of the science message, the science culture I was bringing. Respecting the participant’s wishes, I agreed that that science would not be the focus of the movie-making camp, even if it were difficult for me to shift and understand that this could still result in an experience that was purposeful and educative (for both myself and the participants). Committed to the notion of both engaged pedagogy (hooks, 1994) and

decolonizing education, I worked to see through my own Eurocentrism, in order to break down my own walls that prevented me from seeing science through different worldviews.

Through “good enough” (Luttrell, 2000) research decisions, I could, at the very least respect the choices that research participants made while collecting data that counts as research. When partnered with the video-auto-ethnographic process, I was also able to better see that which might prevent me from being respectful to, and of, my Inuit participants, my own Eurocentrism.

## Chapter 6: Findings

### *RE:Defining Decolonized Science Education (through multiple lenses)*

Respectful research calls for actions that speak louder than words (Menzies, 2004). In addressing only science education, we risk addressing Indigenous Traditional Knowledge in a token manner, and worse, addressing youth culture as a pedagogical obstacle that can be resolved through appropriate pedagogy (McKinley, 2000). In addressing only the science educator, we neglect the already disenfranchised youth who regularly experience education as disservice — a daily stripping away of their Indigenous identity and culture through disregard and ignorance (Battiste, 2000; Churchill, 1999; Hodson, 1998; MacIvor, 1995; McTaggart, 1991; Roberts & Wills, 1998).

Respectful research should be enacted as it is read in this phrasing: respect must come first and before any act of research. It is my belief that through critically self-reflexive “good enough” research decisions (Luttrell, 2000) by the decolonizing EuroCanadian, research can still be performed while working towards respect and honour. A commitment to “truly decolonized research must be more than fine words: it must be an act and demonstrable in practice” (Menzies, 2004, p. 17). Educational research that strives to be respectful in the context of science education, if it is to be a commitment to Indigenous/Inuit youth, integrated to honour the character, values, and traditions of their community (Mason, 2006), requires much more than simply knowledge about respectful research. It requires active involvement in the task of decolonizing science education and the non-Indigenous, often White, science educator (Belczewski, 2009).

In committing to the characters, values and traditions of an Indigenous community, it is critical to recognize, especially for non-Indigenous educators, the interplay between Indigenous and Eurocentric worldviews (Barnhardt & Kawagley, 2005, 2008; Battiste, 2000, 2005; Strong-Wilson, 2007). Non-Indigenous educators schooled in the Western school of thought need to be able to, beginning from their own worldview as it is the only possible point of departure, learn to open themselves up to that of the other (Mazzochi, 2006). Within the scope of this research, the methodological structure permitted such a process for me as researcher, on the



one hand, video allowed me to better 'see' that which the youth were seeing (Goldman-Segall, 1998), their perceptual horizon, as well as better 'see' my own through video-auto-ethnography. Through this interplay, shifting my own horizon to better suit the needs of the youth with whom I worked became possible – I was able to further decolonize both myself, and my teaching.

This chapter serves to illustrate both conclusions regarding what it might mean to engage in the process of decolonizing science education, as well as pick up where chapter 3 left off to revisit the twin lens methodology described and what it permitted within this research.

### *Science Education as a Decolonized Practice?*

I appreciate now (sic?) there are many multiple ways of working with students to begin a journey of speaking back to Whiteness within science education and ways of unpacking our own racialized subjective positions. But I wonder if there is a science curricula that does not indoctrinate. I wonder if there really is an authentic "decolonizing science practice"... Given the pervasiveness of assimilationism in Western science education... it is not surprising that most science education includes the mandate of *improving scientific literacy* and then proceeds to define it, or refer to it by way of usual contemporary science education definition... the system is pushing for assimilation of students into Western science ontology. (Sammel, 2009, p. 653)

Perhaps, as Sammel states, there is no authentic decolonized science education practice. If we understand decolonizing science education as a process, similar to that of decolonizing educators, it is clear that decolonization is not an end result but rather a journey (Belczewski, 2009; Root, 2009) and a journey that we cannot afford avoiding, or one where we can remain neutral or distant like a "perfect stranger" (Dion, 2008). The decolonizing of science education and non-Inuit science educators are inextricably linked and can gain positive momentum from one another. Too often, non-Indigenous Eurocentric educators are fearful of addressing the "difficult knowledge" of one's own colonial legacies. A Eurocentric "white teacher" is often synonymous with someone who resists opening oneself to other perspectives (Strong-Wilson, 2007). To a lesser extent, many non-Indigenous educators, myself included, feel that they are not adequately "prepared" to decolonize their science education practices and they are often unaware of first needing to begin with themselves. I argue that through

addressing both the educator and the pedagogy simultaneously, a decolonizing synergy occurs that forges both science education practice and a non-Indigenous science educator into decolonizing processes, held in a dialogical balance (Bohm, 1996).

“This dialogue should take place with the unknown and the otherness... By shifting our perspective, and looking at other paths to knowledge that humans have developed and lived, we might create the necessary conditions for hitherto unknown knowledge to be revealed” (Mazzochi, 2006, p. 465). My dialogue with “the unknown and the otherness” (Mazzochi, p. 465) took place in my interactions with both the youth, as well as with myself and my own deeply rooted Eurocentric beliefs. The majority of science education research focuses too often on how marginalized or discriminated youth need to change, or have changed, or on how the science curriculum must change, but rarely does it focus on how the researcher needs to change (Sammel, 2009).

*Something has to change.*

Many times have I heard the sentence “something has to change” uttered from non-Aboriginal teachers working with Aboriginal youth. More often than not – the “something” in this sentence is directly referring to the Aboriginal youth with whom they are working. In having a discussion about what counted as science, the youth, both Inuit and non-Inuit, in their cross-cultural environment, displayed evidence of implicit dialogue between bodies of knowledge – Western Modern Science and Inuit Qaujimajatuqangit. Nonetheless, it seemed as if this was minimally directly discussed, likely as the result of the non-dominant body of knowledge, IQ, having been erased from the science curriculum (Barnhardt & Kawagley, 2005, 2008, c.f.; Desmoulins, 2008, c.f.). Nonetheless, the youth were quick to voice that these two bodies of knowledge were equivalent, yet different (see Chapter 5). The youth seemed to seamlessly understand that knowledges each had their time, place and purpose. Ideally, further research would reveal that dialogue more directly as well as involve more members of the community. What struck me at the time about the youth’s perceptions of science was that it was not the youth who had to change; the change needed to be directed at me and my understandings of science. The youth understood that IQ and WMS were equal, yet distinct

bodies of knowledge. They also understood that there were many ways of enacting science and anyone could do or participate in science. I had misread this educational field site and situation. It was not that science was inaccessible to the participants, but rather that they wished to avoid the rigid categorizations of science and science education. Too often, Inuit and other Indigenous youth are told (and often, not lightly or indirectly) that they must change themselves and their cultural identities in order to receive a (Western) education (Barnhardt & Kawagley, 2008; Sutherland & Dennick, 2002). In their reluctance, the youth were pointing towards the fact that it was I, the non-Inuit science educator, who needed to change – both myself as science educator, as well as the “science” I was delivering, representing and implicitly imposing. Like Sammel (2009), I would adopt the credo that “for my own pedagogy there is a dualistic purpose to science education. One aspect is to help my students become better learners and teachers of science; and the other is to re-imagine and explore science with them” (p. 655).

Science education, regardless of how culturally sensitive, might never become decolonized if it continues to have as its final objective an implicit assimilation into the ontology of Western science (Sammel, 2009). In the act of decolonizing science education, it is crucial to try to enact a science that it is not laden with colonial baggage, a science which is moving forward as open, inclusive, flexible, and adaptable (Cajete, 1999).

Through science education enculturation, non-Indigenous educators implicitly tell Indigenous youth what they can gain by entering into the “modern world of science,” but seldom do educators ask the reverse: what does Western science gain, as a body of knowledge, when it is dialogically interfaced with Indigenous knowledge? “There is little doubt that modern science can gain a lot from such dialogue” (Mazzochi, 2006, p. 466). It is not only Indigenous peoples who can gain from learning Western “modern” science but there is also much to be learned and gained by Eurocentric educators and students from Indigenous peoples’ Traditional Knowledge such as IQ (Barnhardt & Kawagley, 2008; Mazzochi, 2006; Peat, 2002).

### *Border crossing revisited.*

Science education practices need to become more culturally responsive and genuinely for all, including for Indigenous youth. As was indicated by participants' responses in this research, it may well be that for students who: (1) do not see themselves included in the all that science education aims to reach, be it that "science is probably for nerds," that they do not see themselves in the image of Albert Einstein, or that the science they do is not recognized as science (in the Western sense), and (2) are implicitly or explicitly told to learn science at the expense of their own culture (Barnhardt & Kawagley, 2008), the consequences include not wanting to think like scientists (Aikenhead, 2004; Fensham, 2004; Jegede and Aikenhead, 1999) and actively avoiding the Eurocentric culture of science (Aikenhead, 1996; Atkin & Helms, 1993; Calabrese Barton, 2002; Coburn & Aikenhead, 1998; Costa, 1995; Eisenhart, Finkel & Marion, 1996; Jegede, 1996; Reiss, 2000; Roth & Désautels, 2002). To address these students, there has been a variety of responses, the most prevalent of all is the ideal of "science for all" (AAAS, 1994). While science for all strives to reach all youth, it is often criticized for placing the science before the all (Zembylas, 2005). It is too often a "science" education that befits and benefits a white, male (Pomeroy, 1994), Eurocentric (Ogawa, 1995) group. While the scientific literacy that comes from learning science can still be a means to empower (Barton *et al.*, 2003; Ratcliffe & Grace, 2003; Hodson, 2003, 2005; Millar, 2006), it is often not the case when it is done at the expense of culture. Other scholars have proposed solutions such as anti-racist science models (e.g., Sutherland & Dennick, 2002), socio-cultural models of science (e.g., Lemke, 2001), multicultural science (e.g., Cobern & Loving, 2000) or cross-cultural science (e.g., Aikenhead, 1996, 2001). Aikenhead's work on cross-cultural science education across both Aboriginal and Western worldviews is often cited within the context of Indigenous science education literature, particularly his work revolving around the idea of Indigenous youth border crossing into Western science with the aid of a culture broker.

While border crossing (Aikenhead, 2001; Giroux, 1992, 2005) has been proposed as an empowering method, if the emphasis is still on Indigenous youth to cross into the "world of science," too much is still at risk for Indigenous peoples. Science, as many scholars agree, should not be learned at the expense of losing one's cultural knowledge (Barnhardt &

Kawagley, 2008). If Inuit and other Indigenous youth do not Indigenize this knowledge (Cajete, 2009; Smith, 1999) or make it their own, they may risk learning science at the expense of their own culture, crossing borders in one direction, unable to cross back or come home to their own cultural community. While Cajete (2009, 1999), McKinley (1998), Barnhardt and Kawagley (2008) all point in a direction that may seem obvious for Indigenous scholars, non-Indigenous White educators need to explicitly learn this or else we risk perpetuating a neo-colonial science education.

*Science as my medium.*

As a science educator who has/was empowered by using “science as my medium” (VAE), it is crucial that I re-examine critically and constantly whether science can be a means to liberate Indigenous youth? I constantly tackle the problematic of this strange position. Having grown up with White privilege (McIntosh, 1995; Tompkins, 2002), the significance of the youth’s refusal to do science as the primary topic of the movies took a while to impact my approach.

My approach had been some vague idea of meeting the youth participants halfway for the science study. My patronizing good intentions at the start of the science camp made it difficult for me to recognize that the youth had already begun our project from a halfway or in relation place. It was I who needed to change – I need to change my starting place of relations or relationality with the youth, my perceptions and my practices. I would no longer focus on helping these students to border cross into my “world of science,” but rather perforating these epistemological borders and widening the circle, in order to help youth see what they already know (Aylward, 2007), that they have been in the circle of science for their whole lives and with their communities in this place of Nunavut.

*Twin Lens Methodology – Video as a Tool for Multi-Perspectivity*

Within the scope of this research, video became both “a way of seeing ourselves” (Bloustien, 2003, p. 2), a means for personal reflexivity, as well as a means to provide voice to those whose (Indigenous) voices have normally been diminished or extinguished. Through the

participants videographies, video became the means to work towards the first two research goals: (1) to explore new means of delivering culturally responsive science curriculum that acknowledges, respects and cherishes multiple worldviews and perspectives; and (2) to examine how Inuit youth define, document, and determine what science means to them, as well as how it is enacted within their communities through their own (video-)voice. Also, through the video-auto-ethnographical methodology, video became the means (3) to critically analyze respectful roles that I as a non-Indigenous educator can take in delivering culturally responsive science curriculum.

Video, while often used as a tool to increase objectivity, was used within this research as a tool to increase subjectivity, as a tool for multi-perspectivity within the self. This chapter section argues that video can be an important decolonizing methodological tool for multiple participants and multiple uses. It became a means of motivating and capturing participant perspectives through video-voice; in creating a discomfited space to look inwards at myself as a Eurocentric education researcher from a different critical point-of-view; as well as the vantage point and knowledge generating space that is created in the synergy of the two.

*Video – a tool for multi-perspectivity.*

Pea (2006) writes, “the learning sciences have shifted from a view of learning principally an internal cognitive process, toward a view of learning as “mind in context” – a complex social phenomenon involving multiple agents interacting in social and organizational systems, with one another, and with symbolic representations and environmental features” (p. 1323). Learning needs to be understood in light of both physical and socio-cultural environments (Brown, 1992; Brown et al., 1989; Lave, 1993; Pea, 1993; Resnick, 1987) and technological multi-media provides one means to capture and observe multiple “channels” of simultaneous interaction, making it possible to achieve a broader understanding of learning and other human phenomena. Complex phenomena can be documented in a fashion that is not only richer than prior means have allowed for, but also without the inconvenience and intersubjectivity problems that are associated with textual field notes. The consumer revolution in video technology has made the technology required for the capturing and visioning of video widely

accessible, both in terms cost and user-friendliness – the technological barrier that once had been prohibiting extensive use of video-as-data has been lowered (Pea, 2006). In this research, I practiced what Pea and others have described as the gains of video ethnography but my research pushed this methodology into colonized/decolonizing contexts. Video multi-perspectivity is the flexible media needed to richly document the human phenomena of decolonized science learning and research in Nunavut.

*Methodological outcomes: twin lens methodology – a generative knowledge space.*

Through the multiple lens methodology of video-auto-ethnography, I had to ask myself some hard epistemological questions about my roles as a southerner *Quallunaat* researcher in Nunavut, about my aims as a science educator of Inuit youth, and about my own colonized position and movement towards decolonization. “How can I open myself to what I do not know yet?” (Somerville, 2009, p. 210). How do you “think without the thing you think you can’t think without?” (Lather, 2008 in Root, 2009). How does the Eurocentric educator begin to be able to see that which she or he cannot see (Tompkins, 2002)? Education researchers must open ourselves to this knowledge of colonization and decolonization (Somerville, 2009, 2007), not towards some defined naked truth, but the naked self (Lather, 2007), the whole self who is open to “conflict, struggle and pain... anger, tears, confusion, laughter and frustration” (Tompkins, p. 413). I learned that it was only in getting myself completely lost, trying to lose or shift my ingrained colonized stance, that a new relationship or relationality between self and (Indigenous) others can begin to be imagined and a decolonizing process can begin.

By beginning this process, “we should also be aware that we can only start from where we already are – from our point of view or the tradition to which we belong” (Mazzochi, 2006, p. 465), from our own horizon. Strong-Wilson (2007) cautions that for Eurocentric educators, these horizons are deeply embedded. This entrenchment is often an inability to see diversity due to homogenous interaction patterns, that is people interacting mostly with others like themselves (Tompkins, 2002). Once brought to attention, there is often an overwhelming sense of guilt, or fear, which can lead to inaction (Bishop, 2002), or worse, a sense of urgency that precipitates further colonial legacies (Peat, 2007). In all these cases, we are “masking

power with innocence,” we act as if “nothing has gone on before” (McKinley, 2000, p. 75), as if our good intentions, when partnered with lack of specific knowledge make us “innocent subjects”. Lather (2007) proclaims that gone is the place of innocence in research, if there ever was one to begin with. The problem is not going away, it is one that must be seen and shouldered, and that there may be many answers to be found in the ruins of ethnography (Lather, 2007).

As McKinley (2006) declares that, “education for social change ... [is] about disrupting hegemonic ways of seeing” (p. 76). Driven by a twin-lens methodology, this research attempted to resist dichotomous models of colonized/colonizer by disrupting my views or unmasking my power in order to see that which makes me colonized while simultaneously trying to see that which the youth considered important through the lens of their video-cameras.

The first lens (of the twin-lens methodology) or the first set of frames was the participant-driven videographies which allowed for Inuit and non-Inuit youth to explore and document some of the ways that science is enacted in their communities. Through this process, youth were enabled to both participate in and critique (through video-editing) discourses of power (Bland & Atweh, 2003; Lankshear, 1994; Riecken *et al.*, 2006), particularly the discourses of power in school science. The video camera permitted the youth to interact with the community and to speak as a fellow community member with the knowledge-holders they were interviewing. By watching and co-facilitating the youth’s video voice, I was better able to perceive a trans-cultural horizon from which this new perspective merged new/Western with traditional/Inuit.

The second lens (of the twin-lens methodology) was my own self-reflexive video-journaling or my video-auto-ethnography (VAE). The VAE created a space for me to work on decolonizing my own touchstones (Strong-Wilson, 2007), because it allowed me to better see, from a viewpoint distanced from my own horizon, the deeply embedded “difficult knowledge” of Eurocentric ontologies, epistemologies and axiologies. Like many white educators, I too am resistant to shifting my horizon (Strong-Wilson) because I lack the ability to see how deeply lodged my Eurocentric tendencies have become. Through the video-auto-ethnography process



I was able to shift my horizon away from that which is damaging. Through the dual processes, the relation between my self (as other) and the youth participants as others was transformed. During the VAE, video permitted a dynamic recasting of the relationship between 'my self' and 'my self as other' (Bloustien, 2003). The videographies of video-voice by the youth brought me the youth's perspective or horizon closer for viewing – and thus allowed a reflexive examination of my own relationship with these youth.

The twin lens of video methodologies permitted a new vantage point between the multiple, blurred horizons resulting from the trans-cultural informal camp environment – a meta-viewpoint (Ceruti, 1986) that is also a space of not knowing from which new knowledge can be generated (Somerville, 2007, 2009). While I had little to no idea of what I was to expect, I continued to wait, unknowing, committing blindly, lost, uncertain and vulnerable. Although I felt lost, I came to the situation with a good mind and good heart, trusting that knowledge would come to me when I needed it.

#### *Video voice.*

As Robert so succinctly stated, video permitted the youth to “go to places that [they] normally wouldn't see” (Robert, IN, R2PI). Through the student-driven videography process, students had the opportunity to engage with people they normally would not, in locations they would not normally visit through school and on a level which their age would not normally permit interaction. It was not the usual case for the participants to be able to enter the premise of the Inuit Broadcasting Corporation to meet with members of the television crew, nor was it the norm for them to be able to engage with them in a serious conversation in which they were able to humbly stand as close to an equal. Video permitted many modes of interaction that were not usually available to them (Riecken *et al.*, 2006).

“Video permits many things that text would not” (VAE) for the youth – it allows them to communicate that which they could not otherwise. It is a means of infusing the otherwise silenced voice with meaning (Jocelyn Burkhart, 2009, personal communication). When contrasting what the youth had to say regarding their own experiences as participants within this research project, their thoughts were far richer in the interplay created by video (P2PI,

R2PI) than when questioned about similar ideas through paper and pencil modes.<sup>38</sup> Video modifies power dynamics between interviewer and interviewee (Giroux, 1998; Riecken *et al.*, 2006) – as was seen in the “transformation” of camera-based relationships as the camp progressed. “The camera was able to provide the means of giving the participants an authoritative voice” (Bloustien & Baker, 2003, p. 72), authoring what they wanted to document, to see and to create through video. This included all the youth, whether they were in the shot or view frame or providing support behind the lens.

Video voice, as a component of the twin lens video methodology, gave me the means to see a decolonizing path for science education in Nunavut. From this video-intensive study, I began to be able to share horizons and viewpoints with the Inuit youth as they were sharing theirs. The following sub-sections delineate video voice’s qualities within an educational endeavour, as well as how it works in an Indigenous context. These video methodology qualities include the following: (1) student-driven, (2) involving community, (3) enriched by facilitation, (4) and respectful of flux (?).

*Video voice ... is student-driven.*

When I released my control of the project to make it more student-driven, the youth took charge of the videography, making it their own, filming things that interested them – namely Inuit scary stories, as well as an Oreos-eating-as-an-Olympic-sport mockumentary. Student control also applied to the interviews that the youth conducted. My idea of video as “science documentary” was not the students’ idea, and their reluctance to engage in science videos became obvious and unavoidable. So, I placed the choice of whether they wished to engage in the science project in their hands. While I did push for the youth to engage in video, I was willing to drop the science focus. The youth ended up deciding to partake, but on their terms. They completed interviews with members of the community that had been predesigned and then later decided not to compile this interview data into a documentary. After the success of the first interview, the students engaged with community adults and conducted all the predetermined interviews; however, the students did not compile the video data into

---

<sup>38</sup> As could be seen on pencil and paper participant exit surveys.

video-documentaries. Even after editing and cutting the interviews that took a lot of time, effort and work by the students, they decided to not continue with the documentary production. They had already produced what they wanted by taking ownership of the video work and processes.

*Video voice ... involves community.*

The learning experience of the Actua camp was not only student-driven, but also community driven. The youth were learning from, and about, places and people in their community with which they might not have usually engaged. Between the youth interviewing and the community members being interviewed, there was also a power differential that may have impeded these interactions before, or even acted as a barrier. Video facilitated the interactions and power imbalance of children interviewing (professional) adults by not only empowering the individual behind the lens (interviewer) but also the whole micro-community who were recording (Brayboy, 2005; Riecken *et al.*, 2006). While working with video, not one of the members on the team was shy, or disengaged, whether their role was lighting, boom mike, videography, or interviewing.

*Video voice ... is enriched by facilitation.*

While video's strength lies in the fact that it is another way that youth can learn to express themselves, a mode of expression very familiar in the age of social networking, it rarely happens in educational contexts when such valuable learning experiences could be mentored and facilitated.

Robert (IN), the in-house technophile stated that the Actua camp, "It's just been... fun for me because I usually wouldn't have anything to do" (Robert, IN). While many of the youth have at their disposal the technological and technical means (Pea, 2006) to interview members of the community, they may not feel safe, purposeful or welcomed by going about it on their own. This is especially true for the youth who did not have the technical knowledge prior to the camp. The purpose, format and setting of the educational camp allowed the youth to explore the technologies with a great level of support and comfort. Lastly, video voice became my

means as an instructor of better perceiving and understanding that which the youth could not or did not communicate otherwise. It played a pivotal role in allowing me to better see what the youth can see so that I may, through my own video-auto-ethnographical process, move my perceptual horizon (Alcoff, 2006; Mazocchi, 2006) closer to theirs.

*Video voice ... is respectful of flux (?).*

While initially worried about the fact that video might not reflect the Indigenous notion of flux, I had heard that it was now often used as a means of traditional storytelling. As storytelling is one of the more sensitive areas at risk of being reduced to a static re-telling, or representation, I was curious. During the Alianait festival in Iqaluit prior to my arrival, many Elders, given their age and involvement in their own communities, were unable to make it to Iqaluit to tell their stories in person – instead, a single-time use video was created, which took into account the time and place it was to be used in.

As Cajete (2009) states, Indigenous knowledge itself is in flux, ever changing in the presence of modern knowledge that, through indigenizing (Smith, 1999), becomes part of Indigenous knowledge. From my experiences, this is the case with video. Studios such as Izuma and IBC have re-appropriated the video camera and created video that is by Inuit people, for Inuit people. Techno-media education can be a means of increasing self-determination (Riecken *et al.* 2006).

*Video-auto-ethnography.*

My experience with video-auto-ethnography was one in which I felt exposed, particularly to myself as a researcher, which allowed me to see that which I could not normally see (Lather, 2007). It is a process that “makes you more vulnerable,” (VAE) a process that was gritty, raw and emotional. It is a process that can make you think about how you normally think without using that which you think with (Lather, 2007). It was, for me, a difficult learning process in which I learned to accept that sometimes I would have to wait for the words (Somerville, 2009). Not only did I wait for the words, but I also had to trust that the right words would surface.

I find it especially difficult after you sit there for a while and you watch yourself and then you hit that lull where ... you haven't said anything [for 30 seconds or longer]...video put me in a vulnerable position, in which [I could] ... get lost and discover new things in the process... [in those] awkward pauses... in that less comfortable position. (VAE)

The word cloud (Figure 3 featured in chapter 3) of my video-auto-ethnography had the following words prominently displayed:

like	[don't] know
guess	kind of
[not] necessarily	[I] think [that]
maybe	might

This is indicative of the very tentative nature of the words I used before the camera. Within this tentative space, I was outside of my comfort zone, working at the edge of self, within a space in which shifting could occur.

Despite the VAE being an artificially created discomfort, one that remained somewhat controlled, it still was a means of tapping into my personal neuroses, into “deeper rooted hidden stuff” (VAE). Video can put you “in a vulnerable position, in which you ... get lost and discover new things in the process” (VAE). In this discomfort, I was lost – but in finding my way back, I was better able to see myself for who I was, and to shift my self. Despite science being my chosen medium to empower as an educator, I now recognize how broad science can be above and beyond Western science and the points of resonance between Western science and ethnosciences. I now better recognize that science is but another lens with which the world can be viewed, a lens that should not be preferentially treated over other lenses such as spirituality. Most critically, I learned to let go of ‘science’ when it interfered with the educational process. I was, through this process, better suited to address my own Eurocentrism and “shed the colonial cloak” (Lisa Korteweg, 2010, personal communication) that was comfortably perched upon my shoulders.

In vulnerable and emotionally wrought situations, most people unconsciously revert back to an egocentric version of self (Wallace, 2009), the most basic state of awareness (Wilber, 2007). Video creates this tension that humanizes. “I am neither subject nor object but a

subject who feels he is becoming an object” (Barthes, 1981, p. 14). Video became the means of becoming other in a self-reflexive liminal sense, to create the tension/generative space between becoming self and becoming other-to-self for personal transformation to occur. This process involves “researchers working at the limit, the edge of self” (Somerville, 2007, p. 240).

Becoming self is an idea that is well developed in post-structural feminist theory (Davies, 2000a). While there is an “assumption that as humans we are in a continual process of becoming” (Somerville, 2007, p. 234), within the scope or viewfinder of this research, the notion of becoming self is also driven by a desire to construct new images (Corner, 1995) of a new self through video. Video can be the means to “reinvent ourselves the way we would like to be seen” (Bloustien, 2003, p. 2), by addressing the way we are perceived and the way we perceive ourselves. In this way, I argue that the video methodologies of this study were critical for shifting my perceptions and opening myself towards a decolonizing process. Video methods became the creative processes which opened spaces for new knowledge to occur in this deeply relational space of science camp in Iqaluit, as well as opening new modes of thought and feeling that was other than Eurocentric.

*Theoretical outcomes: twin lenses converge – decolonizing triangulation.*

“Digital technologies have made all this more possible and may even be integral to this new theory of representation” (Somerville, 2007, p. 239). Technology made it possible to represent a multi-perspective(s) array of data through the capturing of video (Pea, 2006) through twin methods: video-voice by the youth and VAE by myself as teacher-researcher. This dual process of twin lenses, I also refer to as Decolonizing Triangulation or the dynamic recasting of self/other relationships (Somerville, 2009) to create a transformative momentum that can aid in decolonizing both the practice and practitioner simultaneously. This process addresses decolonizing as a cyclical process, rather than a linear journey: as I revisit, and return back to where I began, I can realize growth.

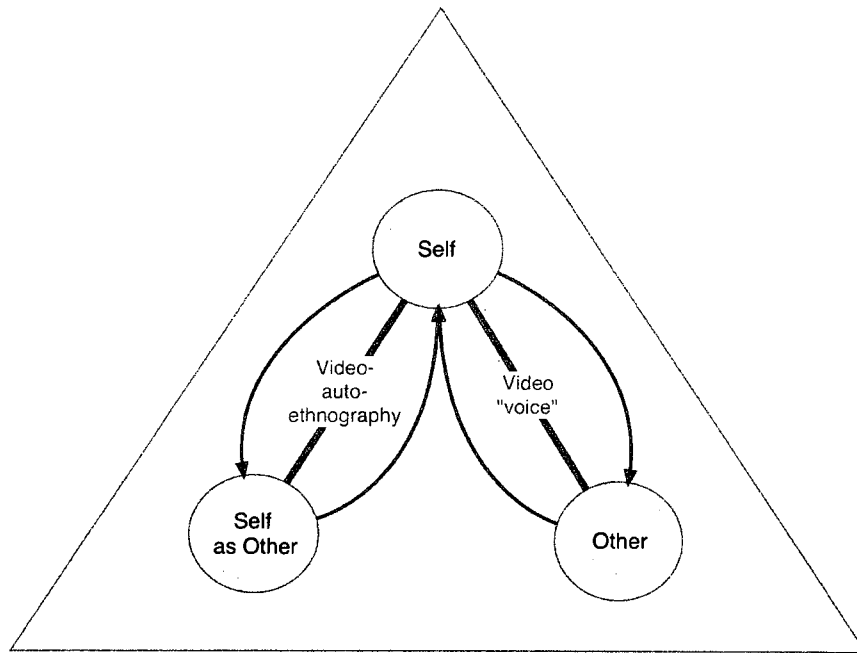


Figure 5. Decolonizing Triangulation

Through opening myself to new knowledge this methodological construct becomes the means to generating decolonizing momentum. This momentum, as I see it, drives the twin-process generative space in which knowledge, different to that of the dominant colonial story, or touchstone (Strong-Wilson, 2007), is realized. Through the VAE process, my touchstone, my horizon is brought to light, allowing me to perceive it, to address it, and ultimately, shift it.

Teachers, including white teachers, need to be full, autobiographical participants in reclaiming ... stories [which form their horizon] from the recesses of memory so as to see them in a broader, historical ... perspective ... and thus, in participating in [a]... project of decolonizing through the moving of horizons. (Strong-Wilson, 2007, p. 128)

Through perceiving the participants' video voice, a clear direction in which shifting was required presented itself. In contrasting where I was with where I needed to be from the vantage point that the twin-lens methodology created, decisional forks appeared, opportunities for critical decolonizing experience. In these instances, while it is possible to reluctantly fall

back to the pedagogical status quo, it was also possible to walk the good path of the decolonizing journey.

Through opening myself to this process, my understanding of what science, as well as education, can be has been transformed within this generative space, as well as what research that strives to be respectful, research that is respectful of participants and their communities, might entail. Fueled by both introspective reflection and implicit dialogue which occurred with the youth, my personal views of science education shifted, once again, away from what science education is perceived as towards something different, something that is more open and holistic – and most importantly, respectful.

Such a process is critical for non-Indigenous educators, such as myself, who are unable to see the world through an Indigenous lens. By bringing the worldviews close, non-Indigenous educators can, at very least, better respond to, and respect, the cultural needs of Indigenous youth with whom they work.

#### *Decoloniz(ed/ing) Science Education Through the Video (Twin) Lens*

I return now to the research question, how can a meaningful relationship with science be facilitated through culturally responsive programs for Inuit youth? When I began this project, I intended to create a holistic, science knowledge space, where the contribution of both worldviews is respected and acknowledged, an intercultural “third space” (Bhabha, 1990). This space was to be created through use of video, which Riecken et al. (2006) argue is a self-determined communication tool for cultural rejuvenation. Youth participants would have interviewed Elders, Western scientists, and other community members to explore what science is, its nature, and its implications, and what it means to these youth who must navigate interfaces between Inuit knowledge and Western science. I thought that this might be the most meaningful way to deliver culturally responsive science education.

When it came time to discuss this research project with the youth, however, it became very apparent from the scrunched brows in the room that even if it were to have been culturally responsive and meaningful, it would not be respectful of their wishes as participants to facilitate such an education. They made it clear in their later communications that science,



as they understood it and perceived it (either Western or school science), was a culture that they wished to avoid. While the participants saw (Western) science as something that was broader than what they did in school, something that anyone could do and a body of knowledge that was equivalent and comparable to Inuit Qaujimagatuqangit, they did not wish upon themselves the nerdy stigma that went with it.

In being confronted with this information, I have come out of this research project asking “whose science” needs to be delivered in a more culturally responsive way. It is not only the way science is taught in Nunavut schools that needs to change, but rather the science itself, as well as those who are facilitating it – it was me, as science educator who needed to change. I had intended to approach science education with the idea of meeting the youth participants halfway. While well intentioned at the start of the science camp, it was difficult for me to recognize that the youth had already begun our project from a halfway or in relation place. Upon returning from the field and reading Sammel (2009), I clearly saw a finger pointed at me: I have been one of the educators who would be unable to enact a truly decolonized practice if my end goal was always to soften the borders in the world of Western science. While attempting to create a level cross-cultural scientific playing field for distinct culture-laden bodies of knowledge, I came to the realization that this is not enough. The Eurocentric lens which drives Western science is too pervasive: even if youth are aided to border-cross into the “world of science,” they often learn at the expense of their own culture unless they learn to Indigenize the knowledge. Indigenous youth require opportunities to cross back, border crossing in one direction alone is not sufficient for education that is (truly) decolonized or culturally respectful.

By resisting and redefining the nature of science and what counts as science we can also help Indigenous youth reclaim science and the “world of science,” we can help them see what they already know (Aylward, 2007), that they have been in the circle of science for their whole lives and with their communities.

Where it not for the twin lens methodology, I would not have been able to open myself to this knowledge, at least not to this extent. This flexible framework permitted me to, in the first instance, address my own Eurocentric worldview without utilizing it, and in the second

instance, better perceive the Indigenous worldview of the Inuit participants in order to bring the two worlds closer to one another, not by shifting that of my participants, but rather my own. Through this process, it became clear and evident, from the vantage point that was methodologically created, what was impeding my educational practices (through VAE) as well as the direction shifting was required (through video voice). This twin process provided the synergy required for me to continue along my own personal decolonizing journey as both an educator and an ally.

While the youth did not partake in the research project as it was originally planned, which could be construed as limiting the results, it is in fact one of the project's strengths. It speaks to the idea that even with "good enough" research decisions throughout the process, it is still possible to conduct meaningful research. Most importantly, this can be accomplished without it being at the expense of the participants.

Like Belczewski (2009), my mentor in Aboriginal science education, "my personal decolonizing journey, in which I work toward decolonizing my teaching practices and myself, has just begun – but it is a worthwhile journey and one I can take delight in pursuing" (p. 200). The findings within this thesis are but steps along a journey towards finding both a role that I can play as an educator/researcher, and an education that I, and others, can facilitate that is truly for youth. This is a commitment to respectful practices that could also count as research resulting from a search for actions that speak louder words.

## **Afterword**

When I was uncertain as to what I would be writing about once the data collection was complete, one of the participants told me: “That’s easy! Just write about Bob Marley.” This is for that participant.

Get up, stand up  
Stand up for your rights  
Get up, stand up  
Don't give up the fight

(Get Up, Stand Up – Bob Marley)

## References

- Actua. *Actua*. Retrieved on 1/18/2009 from <http://www.actua.ca>.
- Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education*, 26, 1-52.
- Aikenhead, G. S. (1997). Toward a First Nations cross-cultural science and technology curriculum. *Science Education*, 81, 217-238.
- Aikenhead, G. S. (1998). Teachers, teaching strategies and culture. *Science Education International*, 9(3), 7-10.
- Aikenhead, G. S. & Jegede, O. J. (1999). Cross-cultural science education: A cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, 36, 269-287.
- Aikenhead, G. S. (2001). Students' ease in crossing cultural borders into school science. *Science Education*, 85, 180-188.
- Aikenhead, G. S. (2002a). Integrating Western and Aboriginal sciences: Cross-cultural science teaching. *Research in Science Education*, 31, 337-355.
- Aikenhead, G.S. (2002b). Cross-cultural science teaching: Rekindling Traditions for Aboriginal students. *Canadian Journal of Science, Mathematics and Technology Education*, 2, 287-304.
- Aikenhead, G. S. (2004). *The Humanistic and Cultural Aspects of Science & Technology Education*. A plenary paper presented to the 11th International Organization for Science and Technology Education (IOSTE) Symposium Lublin, Poland, July 25-30, 2004.
- Aikenhead, G. (2006). Cross-Cultural Science Teaching: Rekindling Traditions for Aboriginal Students. In Kanu, Y. (Ed.), *Curriculum as cultural practice: postcolonial imaginations* (pp. 223-248). Toronto, ON: University of Toronto Press.
- Alcoff, L. (2006). *Visible identities*. Oxford: Oxford University Press.
- Apple, M. W. (1990). *Ideology and curriculum*, 2<sup>nd</sup> ed. New York: Routledge.
- Apple, M. W. (1995). Preface. In Haig-Brown, C. (Ed.), *Taking Control: Power and Contradiction in First Nations and Education* (p. ix). Vancouver: University of British Columbia Press.

- Apple, M. (2007). Social movements and political practice in education. *Theory and Research in Education*, 5, 161-171.
- Archibald, J. (2002). Editorial: Sharing Aboriginal knowledge and Aboriginal ways of knowing. *Canadian Journal of Native Education*, 25(1), 1-5.
- Atkin, M., & Helms, J. (1993). Getting serious about priorities in science education. *Studies in Science Education*, 21, 1-20.
- Atwater, M. M. & Riley, J. P. (1993). Multicultural science education: perspectives, definitions, and research agenda. *Science Education*, 77(6), 661-668.
- Aylward (2007). Discourses of cultural relevance in Nunavut. *Journal of Research in Rural Education*, 22(7).
- Bai, H. and Banack, H. (2006). "To see a world in a grain of sand": complexity ethics and moral education. *Complicity: An International Journal of Complexity and Education*, 3(1), 5-20
- Banks, J. (1995). Multicultural education and curriculum transformation. *The Journal of Negro Education*, 65(4), 390-400.
- Barton, A.C., Ermer, J. L., & Burkett, T. A. (2003). *Teaching science for social justice*. New York: Teachers College Press.
- Bartholomew, D. (2003). Indigenous education (theme issue). *Cultural Survival Quarterly*, 27(4)
- Battiste, M. (2000a). Maintaining aboriginal identity, language, and culture in modern society. *Reclaiming Indigenous voice and vision*, 192-208.
- Battiste, M. (2005). You can't be the global doctor if you're the colonial disease. In Tripp, P. & Muzzin, L.J. (Eds.), *Teaching as Activism* (pp. 121-133). Montreal, QC: Queen's University Press.
- Barnhardt, R. and Kawagley, A. (2005). Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology and Education Quarterly*, 36(1), 8-23.
- Barnhardt, R. and Kawagley, A. (2008). Indigenous knowledge systems and education. *Yearbook of the National Society for the Study of Education*, 107(1), 223-241.
- Barthes, R. (1981). *Camera lucida*. New York: Noonday press.
- Belczewski, A. (2009). Decolonizing science education and the science teacher: a white teacher's perspective. *Canadian Journal of Science Education*, 9(3), 191-202.

- Berger, P. (2007). Some thoughts on Qallunaat teacher caring in Nunavut. *Journal of Teaching and Learning*, 4(2), 1-12
- Bernstein, J. (1992). *The New Constellation: Ethical-Political Horizons of Modernity/Postmodernity*. Cambridge: MIT Press.
- Bhabha, H. (1994). *The location of culture*. New York: Routledge.
- Bishop, A. (2002). *Becoming an ally: breaking the cycle of oppression in People*, 2<sup>nd</sup> Ed. Toronto, ON: Fernwood.
- Bland, D.C, & Atweh, B. (2004). A critical approach to collaborating with students as researchers. In E. McWilliam, S. Danby & J. Knight (Eds.), *Performing educational research: Theories, methods and practices* (pp. 331-344). Australia: Post Pressed.
- Blaut, J. (1993). *The colonizer's model of the world: geographical diffusionism and Eurocentric history*. New York: Guilford Press.
- Bloustien, G. (2003). Envisioning ethnography – exploring the meanings of the visual in research. *Social Analysis*, 47(3), 1-8.
- Bloustien, G., & Baker, S. (2003). On not talking to strangers: researching the micro worlds of girls through visual auto-ethnographic practices. *Social Analysis*, 47(3), 64-80.
- Bohm, D. (1996). *On dialogue*. New York: Routledge.
- Brayboy, M. (2005). Toward a tribal critical race theory in education. *The Urban Review*, 37, 425-446.
- Brayboy, B. M. J. & Castagno, A. (2008). How might Native science inform “informal science learning”? *Cultural Studies of Science Education*, 3, 731-750.
- Brickhouse, N. W. (2001). Embodying science: a feminist perspective on learning. *Journal of Research in Science Teacher*, 38(3), 282-295.
- Brown, A. L. (1992). Design experiments: theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences* 2, 141-178.
- Brown, J. S., Collins, A., & Duiguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher* 18, 32-42.
- Bruner, J. (1985). Models of the learner. *Educational Researcher*, 14(6), 5-8.

- Buchwald, J. Z. (1995). *Scientific practice: theories and stories of doing physics*. Chicago: University of Chicago Press.
- Calabrese Barton, A. (2002). Urban science education studies: A commitment to equity, social justice and a sense of place. *Studies in Science Education*, 38, 1-38.
- Cajete, G. (1986). *Science: a Native American perspective*. Unpublished doctoral dissertation, International College, Los Angeles, CA.
- Cajete, G. (1988). *Motivating American Indian students in science and math*. Michigan: Eric Digest.
- Cajete, G. (1994). *Look to the mountain: An ecology of indigenous education*. Durango, CO: Kivaki Press.
- Cajete, G. A. (1999). *Igniting the spark: an Indigenous science education model*. Durango, CO: Kivaki Press.
- Cajete, G. (2009). *Re-building sustainable Indigenous communities*. Keynote presentation at Dream Catching conference, Winnipeg, MB
- Calabrese Barton, A., Ermer, J. L., Burkett, A. T. & Osborne, M. D. (2003). *Teaching Science for Social Justice*. New York: Teachers College Press.
- Capra, F. (1975). *The Tao of physics*. Boston: Shambhala.
- Capra, F. (1996). *The web of life: a new scientific understanding of living systems*. New York: Anchor Books.
- Card, S.K., Mackinlay, J.D., & Shneiderman, B. (1999). *Readings in information visualization: using vision to think*. Massachusetts: Morgan Kauffman.
- Castellano, M. (2004). Ethics of aboriginal research. *Journal of Aboriginal Health*, 98-114.
- CCL-CCA. (2007). *Inuit holistic lifelong learning model*, Retrieved on 5/11/2009 from [www.ccl-cca.ca/pdfs/RedefiningSuccess/CCL\\_Learning\\_Model\\_IN.pdf](http://www.ccl-cca.ca/pdfs/RedefiningSuccess/CCL_Learning_Model_IN.pdf)
- Ceruti, M. (1986). *Il Vincolo e la Possibilità*. Italy: Feltrinelli.
- Chambers, C. (1999). A topography for Canadian curriculum theory. *Canadian Journal of Education*, 24(2), 137-150.
- Chenail, R.J. (1995). Presenting qualitative data. *Qualitative Report*, 2(3).
- Chomsky, N. (1995). Rationality/science. *Z Papers*. Retrieved on 01/03/09 from

- <http://www.chomsky.info/articles/1995----02.htm>.
- Christie, M. J. (1991). Aboriginal science for the ecologically sustainable future. *Australian Science Teachers Journal*, 37(1), 26-31.
- Churchill, W. (1999). *Struggle for the land: a native north American resistance to genocide, ecocide, and colonization*. Winnipeg, MA: Arbeiter Ring Publishing.
- City of Iqaluit (n.d.) *Welcome to the city of Iqaluit*. Retrieved on 01/03/2010, from <http://www.city.iqaluit.nu.ca/i18n/english/demo.html>.
- Cobern, W. W. & Aikenhead, G. S. (1998). Cultural aspects of learning science. In B.J. Fraser & K.G. Tobin (eds.), *International handbook of science education* (pp. 39-52). Dordrecht, the Netherlands: Kluwer Academic Publishers.
- Cobern, W. W. & Loving, C. C. (2001). Defining "science" in a multicultural world: implications for science education. *Science Education*, 85, 50-67.
- Cobern, W. W. & Loving, C. C. (2007). An essay for educators: epistemological realism really is common sense. *Science & Education*, 17, 425-447.
- Cook, D. A. (1981). *A history of narrative film*. New York: W.W. Norton.
- Corner, J. (1995). *Television form and public address*. London: Edward Arnold.
- Costa, V.B. (1995). When science is "another world": Relationships between worlds of family, friends, school, and science. *Science Education*, 79, 313-333.
- Daley, B. (2004). Using concept maps in qualitative research. *Paper presented at Concept Maps: Theory, Methodology, Technology*, Pamplona, Spain.
- Dasenbrock, R. (1992). Teaching multicultural literature. In R. Trimmer & T. Warnock (Eds.), *Understanding others: Culture and cross-cultural studies and the teaching of literature* (pp. 35-46). Urbana, IL: National Council of Teachers of English.
- Davies, B. (2000a). *A body of writing: 1990-1999*. Lanham, MD: AltaMira Press.
- Davis, B. and Sumara, J. (2000). Curriculum forms: on the assumed shapes of knowing and knowledge. *Journal of Curriculum Studies*, 32(6), 821-845.
- DeBoer, G.E. (2000). Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching*, 37, 582 – 601.



- Dei, G. (1995). Indigenous knowledge as an empowerment tool. In Singh & Titi (Eds.), *Empowerment: Toward sustainable development* (pp. 93-117). Toronto, ON: Fernwood Press.
- Desmoulins, L. (2008). *E/Raced: Aboriginal Youth Identities and Schooling*. Published Ph.D. dissertation, Lakehead University, Thunder Bay, ON.
- Denzin, N. K. & Lincoln, Y. S. (2005). *Handbook of qualitative research, 3<sup>rd</sup> edition*. London: Sage.
- Denzin, N. K. & Lincoln, Y. S. (1994). *Handbook of qualitative research, 1<sup>st</sup> edition*. London: Sage.
- Dewey, J. (1916). *Democracy and education: an introduction to the philosophy of education*. New York: MacMillan.
- Dillon, R. (2007). *Respect*. Retrieved on 01/03/2009 from <http://plato.stanford.edu/entries/respect/>.
- Dillon, R. (1992a). Respect and Care: Toward Moral Integration, *Canadian Journal of Philosophy*, 22, 105-132.
- Dion, S. (2008). *Braiding histories: learning from Aboriginal peoples' experiences and perspectives*. Vancouver, BC: UBC Press.
- Driver, R., Asoko, H., Leach, J., Mortimer, E. & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher*, 23(7), 5-12.
- Durant, J. R. (1993). What is scientific literacy? *Science and culture in Europe*, 129-137
- Eisenhart, M., Finkel, E., & Marion, S. (1996). Creating the conditions for scientific literacy: A re-examination. *American Educational Research Journal*, 33, 261-295.
- Elam, H. J., Jr. (1997). *Taking it to the streets: the social protest theatre of Luis Valdez and Amiri Baraka*. Michigan: University of Michigan Press.
- Ermine, W. (1998). Pedagogy from the ethos: an interview with Elder Ermine on language. In Stiffarm (Ed.) *As we see... Aboriginal Pedagogy* (pp. 9-28). Saskatoon, SA: University of Saskatchewan Extension Press.

- Fensham, P. (September 23/24, 2004). Engagement with science: an international issue that goes beyond knowledge. Lecture given at the Science and Mathematics Education Conference, Dublin City University/St Patrick's College, Dublin.
- Fleer, M. (1997). Science, technology and culture: supporting multiple worldviews in curriculum design. *Australian Science Teacher's Journal*, 43(3), 13-18.
- Freire, P. (1970/1993). *Pedagogy of the oppressed*. London: Continuum.
- Frayn, M. (2006). *The human touch: our part in the creation of the universe*. New York: Metropolitan Books.
- French, J.C, Chapin, A.C., & Martin, W.N. (2004). Multiple Viewpoints as an Approach to Digital Library Interfaces. *Journal of the American Society for Information Science and Technology*, 55(10), 911–922.
- Gadamer, H.G. (1975/1998). *Truth and method*. London: Continuum.
- Galison, P. (1997). *Image and logic: a material culture of microphysics*. Chicago: University of Chicago Press.
- Gay, G. (2000). *Culturally responsive teaching: Theory, research and practice*. New York: Teachers College Press.
- Gay, G. (2002). Preparing for culturally relevant teaching. *Journal of Teacher Education*, 53, 106-116.
- Gearhead, S. & Shirley, J. (2006). Challenges in community-research relationships: learning from natural science in Nunavut. *Artic*, 60(1), 62-74.
- Ghandi, L. (1989). *Postcolonial theory: a critical introduction*. New York: Columbia University Press.
- Giroux, H. (1992). *Border crossings: cultural workers and the politics of education*. New York: Routledge.
- Giroux, H. (1998). *Channel surfing: racism, the media and the destruction of today's youth*. New York: Martin's Press.
- Giroux, H. (2005). *Border crossings: cultural workers and the politics of education, 2<sup>nd</sup> edition*. New York: Routledge.

- Goldfarb, B. (2002). *Visual pedagogy: media cultures in and beyond the classroom*. Durham, NC: Duke University Press.
- Goldman, R. (2004). Video perspectivity meets wild and crazy teens: a design ethnography. *Cambridge Journal of Education*, 34(2), 157-178.
- Goldman-Segall, R. (1998) *Points of viewing: children's thinking*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Greene, M. (1978). *Landscapes of Learning*. New York: Teachers College Press.
- Grosz, E. (1999). Becoming... an introduction. In Grosz (Ed.), *Becomings: explorations in time, memory, and futures* (pp. 1-11). Ithaca, NY: Cornell University Press.
- Haack, S. (1998). Manifesto of a passionate moderate. *The University of Chicago Press*.
- Hall, S. (1996). When was the post-colonial? Thinking at the limit. In Chambers & Curtis (Eds.), *The post-colonial question: common skies, divided horizons* (pp. 242-260). New York: Routledge
- Hampton, E. (1995). Towards a redefinition of Indian education in Battiste & Barman (Eds.), *First Nations Education in Canada: the Circle Unfolds* (pp. 5-46). Vancouver, BC: UBC Press.
- Harris, J. W. (1978). Aboriginal science, western science and the problem of conceptual interference. *Australian Science Teacher's Journal*, 24(3), 61-67.
- Hickling-Hudson, A. & Ahlquist, R. (2003). Contesting the curriculum in the schooling of Indigenous children in Australia and the United State: from eurocentrism to culturally powerful pedagogies. *Comparative Education Review*, 47, 64-89.
- Higgins, M. (2009). *Video-auto-ethnography: RE:considering the nature of science in a northern Québec science camp*. Unpublished.
- Hodson, D. (1993). In search of a rationale for multicultural science education. *Science Education*, 77(6), 685-711.
- Hodson, D. (1998). Towards a curriculum framework for multicultural science and technology education. In Hodson (Ed.), *Science and technology education and ethnicity: an Aotearoa/New Zealand perspective* (pp. 11-20). Wellington, New Zealand: The Royeahl Society of New Zealand.

- Hodson, D. (2003) Time for action: Science education for an alternative future. *International Journal of Science Education*, 25(6), 645-670.
- Hodson, D. (2005). What is scientific literacy and why do we need it? *The Morning Watch*, 33(1-2).
- Holbrook, J. and Rannikmae (2007). The nature of science education for enhancing scientific literacy. *International Journal of Science Education*, 29(11), 1347-1362.
- Hookimaw-Witt, J. (1998). Any changes since residential schools? *Canadian Journal of Native Education*, 22(2), 159-170.
- hooks, b. (1994). Engaged pedagogy. In *Teaching to transgress: Education as the practice of freedom* (pp. 13-22). New York: Routledge.
- hooks, b. (1995). Performance practice as a site of opposition. In Uguw (Ed.), *Let's get it on: the politics of black performance* (pp. 210-221). Seattle: Bay Press.
- Ingold, T. (2004). Foreword. In D. G. Anderson & M. Nuttall (Eds.), *Cultivating Arctic landscapes: Knowing and managing animals in the circumpolar north* (pp. viii-xiii). Oxford: Berghahn Books.
- Inuit Tapiriit Kanatami & Nunavut Research Institute. (2006). *Negotiating Research Relationships with Inuit Communities: a Guide for Researchers*. Retrieved on 01/03/09 from [www.itk.ca](http://www.itk.ca).
- Jegade, O. J. & Aikenhead, G. S. (1999). Transcending cultural borders: Implications for science teaching. *Research in Science and Technological Education*, 17, 45-66.
- Jegade, O. (1996). Whose education, whose worldview, and whose framework? An Indigenous perspective on learning. A paper presented at the conference on "Pathways: Indigenous education: past, present, future." University of South Queensland, Toowoomba, Australia.
- Kanu, Y. (2002b). Understanding curriculum and pedagogy as attunement to difference: teacher preparation for the 21<sup>st</sup> century. *Journal of Professional Studies*, 9(2), 50-60.
- Kanu, Y. (2003). Curriculum as cultural practice: postcolonial imagination. *Journal of the Canadian Association for Curricular Studies*, 1(1), 67-81

- Kanu, Y. (2006) *Curriculum as cultural practice: postcolonial imaginations*. Toronto, ON: University of Toronto Press.
- Kawagley, O., Norris-Tull, D. & Norris-Tull, R. (1998). The Indigenous worldview of Yupiaq culture: its scientific nature and relevance to the practice and teaching of science. *Journal of Research in Science Teaching*, 35(2), 133-144.
- Kemmis, S. & McTaggart, R. (2005). Participatory action research: communicative action and the public sphere. In Denzin & Lincoln (Eds.), *The Sage Handbook of Qualitative Research*, 3<sup>rd</sup> edition (pp. 559-603). London: Sage.
- Kincheloe, J. L. (2006) Critical ontology and Indigenous ways of being: forging a postcolonial curriculum. In Kanu (Ed.), *Curriculum as cultural practice: postcolonial imaginations* (pp. 181-202). Toronto, ON: University of Toronto Press.
- Knorr-Cetina, K. (1999). *Epistemic cultures: how the sciences make knowledge*. Cambridge: Harvard University Press.
- Langellier, K. M. (1999). Personal narrative, performance, performativity: two or three things I know for sure. *Text and Performance Quarterly*, 19, 125-144.
- Lankshear, C. (1994) *Critical Literacy*. Australia: Australian Curriculum Studies Association.
- Lather, P. (2007). *Getting lost: feminist efforts toward a double(d) science*. New York: State University of New York.
- Lanzing, J. W. A. (1996). *Everything you always wanted to know about... concept mapping*. Retrieved on 03/01/09 from <http://utto1031.to.utwente.nl/artikel1/>.
- Lave, J. (1993). Situating learning in communities of practice. In Resnick, Levine and Teasley (Eds.) *Perspectives on Socially Shared Cognition* (pp. 17-36). Washington, DC: American Psychological Association.
- Leap, W. (1982). *Dimensions of math avoidance among American Indian elementary school students*. Washington, DC: National Institute of Education.
- Lemke, J. L. (2001). Articulating communities: sociocultural perspectives on science education. *Journal of Research in Science Education*, 38(3), 296-316.
- Lepani, B. (1998). *Information literacy: the challenge of the digital age*. Retrieved 10/10/09 from <http://www.acal.edu.au/lepani.htm>.

- Lewis, B. & Aikenhead, G. (2001). Introduction: shifting perspectives from universalism to cross-culturalism. *Science Education*, 85, 3-5.
- Linkson, M. (1998). Cultural and political issues in writing a unit of western science appropriate for primary aged Indigenous students living in remote areas of the northern territory. *Science Teachers Association of the NT Journal*, 18, 90-100.
- Luttrell, W. (2000). "Good Enough" Methods for Ethnographic Research. *Harvard Educational Review*, 70(4), 499–523.
- Mason, R. (2006). A kinder mathematics for Nunavut. In Kanu (Ed.), *Curriculum as cultural practice : postcolonial imaginations* (pp. 131-148). Toronto: University of Toronto Press.
- Matthews, M. R. (1994). *Science teaching: the role of history and philosophy of science*. New York: Routledge.
- Maturana, H. and Bunnell, P. (1997). *What is wisdom?* Unpublished.
- Maurial, M. (1999). Indigenous knowledge and schooling: a continuum between conflict and dialogue. In Semali & Kincheloe (Eds.), *What is Indigenous knowledge? Voices from the academy*, 59-78, Falmer.
- Mazzocchi, F. (2006). Western science and traditional knowledge. *EMBO reports*, 7(5), p. 463-466.
- McIntosh, P. (1995). White privilege and male privilege: a personal account of coming to see correspondences through work in woman's studies. In Anderson & Collins (Eds.), *Race, Class and Gender: An Anthropology* (pp. 76-87). Florence, KY: Wadsworth.
- MacIvor, M. (1995). Redefining science education for Aboriginal students. In M. Battiste, & J. Barman (Eds.), *First Nations education in Canada: The circle unfolds* (pp. 73–98). Vancouver, BC: University of British Columbia Press.
- McKinley, E. (1998). Science curricula and cultural diversity: Are we doing enough for the aspirations of Maori? In D. Hodson (Ed.), *Science and technology education and ethnicity: An Aotearoa/New Zealand perspective* (pp. 48–58). Wellington, New Zealand: The Royeahl Society of New Zealand.
- McKinley, E. (2000). Cultural diversity: masking power with innocence. *Science Education*, 85(1), 74-76.

- McKinley, E., McPherson Waiti, P., & Bell, B. (1992). Language, culture and science education. *International Journal of Science Education*, 14, 579–595.
- McTaggart, R. (1991). Western institutional impediments to Australian Aboriginal education. *Journal of Curriculum Studies*, 23, 297–325.
- Menzies, C. (2001). Reflections on research with, for, and among Indigenous peoples. *Canadian Journal of Native Education*, 25(1), 19-36.
- Menzies, C. (2004). Putting words into action: negotiating collaborative research in Gitxaala. *Canadian Journal of Native Education*, 28(1&2), 15-32.
- Meyer, T. (2002). *Media Democracy: How the Media Colonize Politics*. Oxford: Polity Press.
- Michie, M., Anlezark, J., & Uibo, D. (1998). Beyond bush tucker: Implementing Indigenous perspectives through the science curriculum. *Science Teachers Association of the NT Journal*, 18, 101–110.
- Mi'kmaq-Maliseet Institute (MMI). *Mi'kmaq-Maliseet Institute*. Retrieved on 15/02/10 from <http://www.unb.ca/fredericton/education/mmi/index.html>.
- Millar, R. (2006). Twenty first century science: Insights from the design and implementation of a scientific literacy approach in school science. *International Journal of Science Education*, 28(13), 1499-1521.
- Miller, J. (2000). What's left in the field... a curriculum memoir. *Journal of Curriculum Studies*, 32(2), 253-266.
- Miller, R. (1989). Editorial. *Holistic Education Review*, 1(1), 1-4.
- MIs, K. (2004). *From concept mapping to qualitative modeling in cognitive research*. Retrieved on 17/02/10 from [www.cmc.ihmc.us/papers/cmc2004-159.pdf](http://www.cmc.ihmc.us/papers/cmc2004-159.pdf).
- Monaco, J. (1981). *How to read a film: the art, technology, language and history of film* (Rev. ed.). Cambridge: Oxford University Press.
- Newland, P. (1997). *Logical types of learning*. Retrieved on 17/02/10 from <http://www.envf.port.ac.uk/newmedia/lecturenotes/EMMA/at2n.htm>

- Nielsen, G. (1995). Bakhtin and Habermas: toward a transcultural ethics. *Theory and Society*, 24(6), 803-835.
- Nieto, S. (1999). *Affirming diversity. The sociopolitical context of multicultural education*. London: Longman.
- Noddings, N. (2002). *Starting at Home. Caring and social policy*. Berkeley, CA: University of California Press.
- Noddings, N. (1999). Two concepts of caring. *Philosophy of Education*, Retrieved on 4/24/2009 from <http://www.ed.uiuc.edu/EPS/PES-yearbook/1999/noddings.as>.
- Novak, J. D., & Cañas, A. J. (2008). *The theory underlying concept maps and how to construct and use them: technical report*. Pensacola, FL: Florida Institute for Human and Machine Cognition.
- Nunavut Social Development Council (1998). 5.32 Article 32.
- Ogawa, M. (1995). Science Education in a multiscience perspective. *Science Education*, 79, 583-593.
- O'Loughlin, M. (1992). Rethinking science education: beyond piagetian constructivism toward a sociocultural model of teaching and learning. *Journal of Research in Science Teaching*, 39, 791-820
- Orr, D. (1991). *What is education for? Six myths about the foundations of modern education, and six new principles to replace them*. Langley, WA: Context Institute.
- Pea, R. (1993). Practices of distributed intelligence and designs for education. In Solomon (Ed.), *Distributed Cognitions: Psychological and Educational Considerations*, 47-87. Cambridge: Cambridge University Press.
- Pea, R. (2006). Video-as-data and digital video manipulation techniques for transforming learning sciences research, education and other cultural practices. In J. Weiss et al. (Eds.), *The International Handbook of Virtual Learning Environments*, 1321-1393. London: Springer.
- Peat, D. (2002). *Blackfoot physics: a new journey into the Native American universe*. Newbury Port, MA: Weiser Books.
- Peat, D. (2007). *Gentle Action*. Pari, Italy: Pari Publishing.



- Phelan, P., Davidson, A., & Cao, H. (1991). Students' multiple worlds: negotiating the boundaries of family, peer, and school cultures. *Anthropology and Education Quarterly*, 22, 224–250.
- Philip L. J. (1998). Combining quantitative and qualitative approaches to social research in human geography—an impossible mixture? *Environment and Planning*, 30(2), 261 – 276.
- Pickering, A. (1995a). *The mangle of practice: time, agency, and science*. Chicago: University of Chicago Press.
- Pickering, A. (1995b). Beyond constraint: the temporality of practice and the historicity of knowledge in J. Z. Buchwald (Ed.), *Scientific Practice: Theories and Stories of Doing Physics* (pp. 42-55). Chicago: University of Chicago Press.
- Pinar, W. (1992). “Dreamt into existence by others”: curriculum theory and school reform. *Theory into Practice*, 31(3), 228-235
- Polanyi, M. (1966). *The Tacit Dimension*. Garden City, NY: Doubleday & Co.
- Pomeroy, D. (1994). Science education and cultural diversity: mapping the field. *Studies in Science Education*, 24, 49-73.
- Rakow, S. & Bermudez, A. (1993). Science is “ciencia”: meeting the needs of Hispanic American students. *Science Education*, 77(6), 669-683.
- Ratcliffe, M. & Grace, M. (2003). *Science Education for Citizenship: Teaching Socio-scientific Issues*. Milton Keynes, England: Open University Press.
- Ramirez, M. and Castenada, A. (1974). *Bicultural democracy, bicognitive development and education*. New York: Academic Press.
- Rasmussen, D. (2002). Qallunology: A pedagogy for the oppressor. *Philosophy of Education*, 85-94.
- Reason, P. & Bradbury, H. (2001). Introduction: inquiry and participation in search of a world worthy of human aspiration. In Reason & Bradbury (Eds.), *Handbook of action research: participative inquiry and practice* (pp. 1-14). London: Sage.
- Reiss, M.J. (2000). *Understanding science lessons: Five years of science teaching*. Milton Keynes, England: Open University Press.
- Resnick, L. (1987). Learning in School an out. *Educational Researcher*, 16(9), 3-21.

- Rheinberger, H.-J. (1995) From experimental systems to cultures of experimentation. In G. Wolters & J. G. Lennox (Eds.), *Concepts, Theories, and Rationality in the Biological Science* (pp. 107-122). Pittsburgh: University of Pittsburgh Press.
- Richardson, L. (1994). Writing: a method of inquiry, in Denzin & Lincoln (Eds.), *Handbook of Qualitative Research*. London: Sage.
- Richardson, L. (1997). *Fields of play: (constructing an academic life)*. Piscataway, NJ: Rutgers University Press.
- Richardson, L. (2001). Getting personal: writing stories. *Qualitative Studies in Education*, 14(1), 33-38
- Riecken, T., Conibear, Michel, Lyeahll, Scott, Tanaka, Stewart, Riecken, J. and Strong-Wilson (2006). Resistance through Re-presenting Culture: Aboriginal Student Filmmakers and a Participatory Action Research Project on Health and Wellness. *Canadian Journal of Education*, 29, 265-286.
- Ritchie, S., & Butler, J. (1990). Aboriginal studies and the science curriculum: affective outcomes from a curriculum intervention. *Research in Science Education*, 20, 249–354.
- Roberts, M., & Wills, P. R. (1998). Understanding Maori epistemology: a scientific perspective. In H. Wautischer (Ed.), *Tribal epistemologies: Essay in the philosophy of anthropology* (pp. 43-77). Sydney, Australia: Ashgate.
- Root, E. (2009). This land is our land? This land is your land: exploring decolonizing journeys of white outdoor environmental educators. Published M.Ed. thesis, Lakehead University, Thunder Bay, ON.
- Roth, W-M., & Désautels, J. (2002). *Science education as/for sociopolitical action*. Bern, Switzerland: Peter Lang.
- Rouse, J. (1987). *Knowledge and power: toward a political philosophy of science*. Ithaca, NY: Cornell University Press.
- Rouse, J. (1996). *Engaging Science*. Ithaca, NY: Cornell University Press.
- Rudolph, J. L. (2000). Reconsidering the 'nature of science' as curriculum component. *Journal of Curriculum Studies*, 32(3), 403-419.

- Sammel, A. (2009). Turning the focus from 'other' to science education: exploring the invisibility of Whiteness. *Cultural Studies of Science Education*, 4, 649-656.
- Saul, J. R. (2008). *A fair country: telling truths about Canada*. Toronto, ON: Viking Canada.
- Siegel, H. (1997b). Science Education: multicultural and universal. *Interchange*, 28, 97-108.
- Siegel, H. (2002). Multiculturalism, universalism, and science education: in search of common ground. *Science Education*, 86, 803-820.
- Sleeter, C. (2000/1). Diversity vs white privilege. *Rethinking Schools Online*, 15(2). Retrieved 20/11/04 from [http://rethinkingschools.org/archive/15\\_02/Int152.shtml](http://rethinkingschools.org/archive/15_02/Int152.shtml).
- Sleeter, C. (2001). Preparing Teachers for Culturally Diverse Schools: Research and the Overwhelming Presence of Whiteness. *Journal of Teacher Education*, 52, 94-106.
- Smith, L. T. (1999). *Decolonizing Methodologies: Research and Indigenous People*. London: Zed Books.
- Smith, L. T. (2006). Introduction. *International Journal of Qualitative Studies in education*, 19, 549-552.
- Snively, G. (1990). Traditional Native Indian beliefs, cultural values, and science instruction. *Canadian Journal of Native Education*, 17, 44-59.
- Snively, G. & Corsiglia, J. (2001). Discovering Indigenous science: implications for science education. *Science Education*, 85, 6-34.
- Snively, G. & Williams, L. (2006). The aboriginal knowledge and science education research project. *Canadian Journal of Native Education*, 29(2), 229-244
- Soja, E. W. (2000). *Postmetropolis: critical studies of cities and regions*. Oxford: Blackwell.
- Somerville, M. (2007). Postmodern Emergence. *International Journal of Qualitative Studies in Education*, 20(2), 225-243.
- Somerville, M. (2009). 'Waiting in the chaotic place of unknowing': articulating postmodern emergence. *International Journal of Qualitative Studies in Education*, 21(3), 209-220.
- Southerland, S. A. (2000). Epistemic universalism and the shortcomings of curricular multicultural science education. *Science & Education*, 9, 289-307.

- Spindler, G. & Spindler, L. (1992). Cultural process and ethnography: an anthropological perspective. In LeCompte, Millroy & Preissle (Eds.), *Handbook of qualitative research in education* (pp. 53-92). San Diego, CA: Academic Press.
- Spry, T. (2001). Performing autoethnography: an embodied methodical praxis. *Qualitative Inquiry*, 7, 706-732.
- Stairs, A. (1995). Learning processes and teaching roles in Native education: cultural base and cultural brokerage. In M. Battiste and J. Barman (Eds.), *First Nations Education in Canada: the circle unfolds* (pp. 139-153), Vancouver: University of British Columbia Press.
- Stanley, W. B. & Brickhouse, N. W. (1994). Multiculturalism, universalism, and science education. *Science Education*, 78, 387-398.
- Stanley, W. B. & Brickhouse, N. W. (2001). Teaching sciences: the multicultural question revisited. *Science Education*, 85, 35-49.
- Statistics Canada. (2006). *2006 Community Profiles*. Retrieved on 05/02/10 from <http://www12.statcan.ca/census-recensement/2006>.
- Steinbock, D., Pea, R. & Reeves, B. (2007). *Wearable tag clouds: visualizations to facilitate new collaborations*. Retrieved on 15/08/09 from [www.steinbock.org/pubs/steinbock-wearable\\_clouds.pdf](http://www.steinbock.org/pubs/steinbock-wearable_clouds.pdf)
- Steinhauer, E. (2002). Thoughts on an Indigenous research methodology. *Canadian Journal of Native Education*, 26(2), 69-81.
- Strong-Wilson, T. (2007). Moving horizons: exploring the role of stories in decolonizing the literacy education of white teachers. *International Education*, 37(1), 114-131.
- Sutherland, D. L. (1998). Aboriginal students' perception of the nature of science: the influence of culture, language and gender. Unpublished Ph.D. dissertation, University of Nottingham, Nottingham, UK.
- Sutherland, D. and Dennick, R. (2002). Exploring culture, language and the perception of the nature of science. *International Journal of Science Education*, 24(1), 1-25
- Teurfs, L. (1994). *Finding a shared meaning, reflections on dialogue*. Retrieved on 20/05/2009 from [http://seedsofunfolding.org/issues/04\\_06/features\\_1.htm](http://seedsofunfolding.org/issues/04_06/features_1.htm).

- Tompkins, J. (2002). Learning to see what they can't: decolonizing perspectives on Indigenous education in the racial context of rural Nova Scotia. *McGill Journal of Education*, 37(3), 405-422.
- Tompkins, J. (2009). "So who do you think you are?": researching in intercultural places. Presented at Research That Matters, Lakehead University's Faculty of Education's Graduate Students' Conference, Thunder Bay, ON.
- Thayer-Bacon, B. (2000). *Transforming critical thinking: thinking constructively*. New York: Teachers College Press.
- Tufts (n.d.) *Visual Understanding Environments*. Retrieved on 01/03/2010 from <http://vue.tufts.edu/>.
- Turner, V. (1982). *From ritual to theatre: the human seriousness of play*. New York: Performing Arts Journal Publications.
- Van Willigen, J. (1986). Cultural brokerage. In Willigen (Ed.), *Applied Anthropology: An Introduction* (pp. 129-140). Westport, CN: Bergin & Garvey Publishers, Inc.
- Vygotsky, L. (1981). Cognitive structure and conceptual change. *Academic Press*, 53-69.
- Wallace, D. (2009). *This is water*. London: Little, Brown & Company.
- Watt-Cloutier, S. (2000). Honouring our past, creating our future: Education in northern and remote communities. In M. B. Castellano, L. Davis & L. Lahache (Eds.), *Aboriginal education: Fulfilling the promise* (pp. 114-128). Vancouver, BC: UBC Press.
- Weber-Pillwax, C. (1999). Indigenous research methodology: exploratory discussion of an elusive subject. *Journal of Educational Thought*, 33(1), 31-45.
- Weber-Pillwax, C. (2001b). Coming to an understanding: a panel presentation. What is Indigenous research? *Canadian Journal of Native Education*, 25, 166-174.
- Weil, S. (1972). *The need for roots: prelude to a declaration of duties toward mankind*. New York: Harper and Row.
- Wertsch, V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. Cambridge: Harvard University Press.

- Wheeldon, J., & Faubert, J. (2009). Framing experience: concept maps, mind maps and data collection in qualitative research. *International Journal of Qualitative Methods*, 8(3), 68-83.
- Wilber, K. (2007). *Integral Spirituality: A Startling New Role for Religion in the Modern and Postmodern World*. Boston: Integral Books.
- Williams, S. (1999). Truth, speech, and ethics: a feminist revision of free speech theory. *Genders*, 30. Retrieved on 27/04/09 from <http://www.genders.org>.
- Witt, N. W. (1998). *Opening the healing path: the cultural basis for a solvent abusers' treatment program for the Attawapiskat First Nation*. Unpublished doctoral dissertation, OISE/UT.
- Winzer, M. and Mazurek, K. (1998). *Special education in multicultural contexts*. Upper Saddle River, NJ: Prentice Hall.
- Woodhouse, M. (1996). *Paradigm wars: worldviews for a new age*. Berkeley, CA: Frog.
- Wilson, S. (2001). What is an indigenous research methodology? *Canadian Journal of Native Education*, 25, 175-17.
- Zembylas, M. (2005). Science education: for citizenship and/or for social justice? *Journal of Curriculum Studies*, 37(6), 709-722.