**Journey with Indigenous Knowledge and Science Education**

**Karen West**

**University of Alberta**

Abstract

Exploring ways of coming to know, are demonstrated through a Wholistic

exploratory analysis of literature of ways of Indigenous knowledge can be brought into

students learning through curricula, pedagogy and also through activities in the classroom.

This analysis it supports understandings that holds the responsibility of

Educators for their learning with Indigenous knowledge through Treaty education, ways of

Incorporating, Infusing and Including Indigenous knowledge, Decolonizing education and

also Reconciliation for Education as foundational entry points with both Indigenous

knowledge and science education. In using theoretical praxis of Wholistic Theory alongside

Cultural Interface to support the research question of how and where Science educators can enter their journey to guide students through Indigenous knowledge and Science education? The

implications of this research may help to facilitate teachers that are hesitant or resistant

to find an entry point in their journey, and to build and strengthen relations with all through knowing where and when to begin along with the context of where and when to address Indigenous knowledge and Science education.

*Keywords: Treaty education, Incorporating, Infusing, Including Indigenous knowledge, , Reconciliation for Education, Decolonizing education, Cultural Interface, Wholistic Theory*

**Journey with Indigenous Knowledge and Science Education**

 To begin this paper I would like to acknowledge Treaty 6 territory, the land we share in our learning. Beaver Hills House is the traditional name of the place we all call Edmonton in nēhiyaw, *amiskwacîwâskahikan* (personal communication, Donald, 2019). Through my journey during my Master’s at the University of Alberta and also in my personal life, I have sought to honour and acknowledge my ancestors; and ask with good intentions, and forgiveness as they continue to guide me in a good way. In following my cultural teachings, I locate myself, through my relations and place. *Karen West nitisiyīkāson.* My name is Karen West. I grew up in Treaty 6 territory in Whitecourt, Alberta. My relations connect me to Sucker Creek First Nation in Treaty 8 territory. My ancestors being nēhiyaw and Métis on my Mother’s side and European descent on my Father’s side, together they have provided me with a breadth of experiences.

 My research is rooted in a personal journey of coming to know, to know myself as a science educator, as a mother, as a daughter and also as nēhiyaw, Learning within the practices of my culture have guided me to ways in which I can share my own experiences with others. As a classroom educator helping others begin or continue their journey, I have hands-on experiences with students struggle. These struggles present as lack of engagement, lack of motivation, or lack of confidence. This is especially congruent with Indigenous students, and having a background with teaching Science at multiple locations and also Indigenous programs I have direct experience in both Indigenous and non-Indigenous settings.

 When I began my journey, entering my Masters, I had clouded intentions which I now acknowledge were influenced by colonial institutions and educational systems. My initial motivation was to develop a program a science intervention program, specifically for Indigenous students, for the purpose of increasing their engagement and achievement in Science. However, the more I reflected, the more contrition I felt, bringing me to see my proposal was superficial and not a sincere reflection of my goals. Wholistically I will attempt to answer the research question, How and where Science educators can journey students learning through Indigenous knowledge and Science education? My journey has brought me to a more closely aligned purpose; my heart is interconnected in relations with Indigenous knowledge and science education through exploring pathways in which treaty education, ways of incorporating, infusing and including indigenous knowledge, decolonizing education, and also reconciliation for education are all important in coming to know. These paths guide educators to support students, teachers, as well as to repair relations as a whole. A guided wholistic exploration of the above, my hope is that this work may guide others in their research, expand conversations amongst educators and support future work in repairing Indigenous-Canadian relations. In doing this work, I am balancing my approach from my personal experiences with my cultural knowledge and that with formal education. The format, descriptors and language nuances are in relation with this balance.

**Purposeful Positionality Through Embracing Theoretical Perspectives**

 In bringing in theory, I also wish to attend to Indigenous Wholistic Theory, not in the entirety nor to the extent to the extent which it is addressed by Kathy Absolon (2010) in her article *Indigenous Wholistic Theory: A Knowledge Set for Practice* (Absolon, 2010). What I will to attend to is to, approach a “Wholistic” lens of research across the fields of treaty education; incorporating, infusing and including indigenous knowledge; decolonizing education; and also Reconciliation for education. I will bring in attention to the how Absolon (2010) states that “Indigenous Wholistic Theory is whole, ecological, cyclical, and relational” (p. 76); and how these qualities can become entry points to guide conversations with science education. I will not scope out how this research extends into the analysis of where understandings are located within the wholistic view; however, I do pose the idea for future researchers to address how to connect this theoretical lens in greater detail, within this research field.

 I was first introduced to Martin Nakata’s work through Aileen Moreton Robinson’s (2016) book *Critical Indigenous Studies.* Robinson describes Nakata’s (2007) theoretical understanding of cultural interface in which cultural interface “presupposes that the entanglements of Indigenous and non-Indigenous knowledges must be cultural. Thus at this interface, culture is privileged and by implication transcends any other form of embodied knowledge differentiation” (Moreton-Robinson, 2016, p. 108). Using cultural interface as a framework may guide directions in which we may converse on “discursive entanglements” (p. 223), which could be used to support students learning the of the complexities and can be extended to Science education and Indigenous knowledge (Nakata, 2007). It is these areas of entanglements that are important to guide educators to allow multiple understandings to exist and breathe with authenticity. They hold implications for students’ experiences of learning within the classroom; and how they support rebuilding relations for all to share this land.

**Importance of this Scholarly Work**

 One of the main foci of this paper is to encompass multiple paths in which we can come together in sharing, communicating and rebuilding relations within the context of science education in Alberta. I hope this work will help guide educators, administrators and curriculum developers in opening and expanding their journey with Indigenous knowledge. Finding paths to enter into learning not as an expert but as an entry into relationships in which we are collaborators. Together we can talk through approaches with Indigenous knowledge and science education in our own journeys. To clarify how I am addressing journey, is that we are all on our own journey in learning and where we enter learning with Indigenous knowledge occurs at various stages, unique for each person. Changing learning from “about” to “with” Indigenous knowledge holds possibilities to reframe students and educators feelings of resentment, frustrations, and hesitation to those of ease, confidence and equal relations.

**Possibilities, Problem and Limitations within Alberta Context**

 As many Indigenous scholars explain the complexities and nuances of relationships with land and the interconnectedness of Indigenous identity are strengthened through cultural practices (Cajete, 2000; Little Bear, 2000; Tuck & Gaztambide-Fernández, 2013). The Teacher Quality Standards within Alberta, lists one of the requirement as “using the programs of study to provide opportunities for all students to develop a knowledge and understanding of, and respect for, the histories, cultures, languages, contributions, perspectives, experiences and contemporary contexts of First Nations, Métis, and Inuit” (Teacher Quality Standards, 2018, Alberta Education). In conversations with many teachers across Alberta, I have found they are frequently unsure, unaware, or have voiced their hesitations as to how to address these mandates that require them to bring Indigenous knowledge into their lesson plans..

 The current Alberta Science Education rationale for grade seven to nine states: “To become scientifically literate, students must develop a thorough knowledge of Science and its relationship to technologies and society” (POS Science 7-8-9, 2003, p. 1). Program foundations found within the Program of Studies in Science 7-9 describes how scientific literacy is developed through experience by guided directions set out by Alberta Education (POS Science 7-8-9, 2003, p. 3). It is these four foundations: Foundation 1, science, technology and society, Foundation 2, knowledge, Foundation 3, skills and Foundation 4, attitudes, that guide five units within each grade (POS Science 7-8-9, 2003, p. 3-6). Foundation 2: knowledge, explicitly states that students will “Focus on subject matter of Science, including the theories, models, concepts and principles that are essential to an understanding of each area Science area” which include “Life Sciences, Physical Science, and Earth and Space Science” (POS Science 7-8-9, 2003, p. 4). The limitations of how Indigenous knowledge can authentically and relationally be brought into learning opportunities for students is limited by the framework as described through the foundations. My intentions are not to solely focus on policy, curriculum design, nor solely classroom lesson plans, but, to rather look wholistically for opportunities to open conversations for teachers, principals, curriculum consultants. I also pose the question to academics of science education to help stimulate future conversations within science and challenge them to extend this work to include conversations on multiple disciplines.

**Centrality to How We Come to Know within Science Education through a Holistic lens**

 Viewing education and the production of knowledge as contributing factors of my journey, in life is interconnected to the intergenerational effect that lies between Indigenous–Canadian relations. To this day my lack of connection to nēhiyaw language is the resultant impact of historical policies. These policies that have eroded my ancestors language which resulted in nēhiyaw words that linger somewhere between my head and heart awaiting the relationships held in its knowledge. I acknowledge my experiences and feel the intergenerational trauma extending from my mother, who continues to hold her inability to articulate it. I acknowledge my need to end this perpetual cycle of trauma. I must face it, and learn from it and grow as a mother, as a daughter and as a educator. In learning in my journey, alongside this research, I hold responsibility of honouring my ancestors close to my heart. I have always felt I have a great purpose. Through ceremony I have come to understand my purpose, and continue to feel my ancestors guiding me in the directions while presenting me with timely knowledge. I am guided by good intentions, a kind heart, and I apologize in advance for any misinterpretations that I may make within this literature review. The purpose of this research has the potential to repair lost identity, build relationships of both past and future, and build understandings both within the classroom and also people who share this land we all call home. All of this is through exploring possibilities that guide learning through science education and Indigenous knowledge.

**Literature Review**

 Within this literature review I enter relations through a metaphorical feast, in which scholars all come together and discuss, hold conversations while sharing a meal together in good spirits and in good relations. The metaphor of a feast, an attempt to use tongue in cheek, is not for humor, nor is it meant for insensitivities to the challenges faced, but more as a cultural way of bringing attention to areas that are needed for student success within our public education system. The way in which I am bringing in feast as a metaphor is through the representation of coming together, honoring relations, sharing, reconnecting, giving thanks, and building relations. The title of each section within this literature review is in accordance to our conversational feast which guide possibilities of relations within education. In understanding where possible entry points are situated; educators may find relations with their learning journey. There is no right or wrong place to begin; however, there are implications if we are not knowledgeable in the understandings of both epistemologies and worldviews.

 In selecting the research for this literature review, I encompass ways in which I have learned over the past two years by selecting data banks within the University of Alberta library system and searching keywords that align the scope of this review. Keywords included Indigenous, First Nation, Inuit, native, aboriginal, science education, indigenous science, reconciliation, treaty education, decolonizing education, and indigenizing education. I also honour Indigenous research by sitting with articles and reflecting on whether to include them within this review. Sometimes, these articles would enter my dreams or thoughts days later, guiding me to ways they are situated within this study. Through an analysis of literature within treaty education, incorporating, infusing, including, decolonizing, and reconciliation for education we may begin to unravel cultural entanglements of science and identify where science education can enter relations with Indigenous knowledge.

**Can I offer you a cup of Treaty?**

 Before we sit and share food at our feast, can we hold conversations with Treaty? To understand the past, and coming to know, we require understandings of Treaty with the context of Canada. In situating ourselves with our beverage, let’s introduce ourselves and enter into our conversations. Scholars, have all situated their work within an understanding of Treaty and Treaty education (Borrows, 2018; Kovach, 2013; Starblanket & Kiiwetinepinesiik Stark, 2018; Tully, 2018; Tupper & Cappello, 2008; Tupper 2014). In the overview of available research, areas of my literature will examine how Treaty and Treaty Education play a role in relations, are connected to place, and also how aspects of narrative guide us in our daily lives. Interpretations of treaty vary, and the degree of variance is connected to temporality, worldview, and stories (Kovach, 2013).

 **Relations.**

 In addressing both a holistic and relational understanding of Treaty scholars Kovach, Tupper and Cappello share their understanding in what treaty education should be and offer its value and importance within educational settings in how they engage in building relations (Kovach, 2013;Tupper & Cappello, 2008; Tupper 2014). Acknowledging how land is addressed within Treaty holds many complexities both historical and also foundational in the development of Canada and rooted in the relations of the people who share this land (Kovach 2013; Tupper & Cappello, 2008; Tupper, 2014). Many of the researcher’s work presented here, are impactful and also interconnecting within multiple sections of this literature review. Not all work presented here focus specifically within treaty or treaty education however it does hold value and importance in guiding this holistic analysis. Starblanket and Kiiwetinepinesiik Stark (2018) discuss the importance of scholars to look past treaty relations and “reimagine” relations that are extended “between humans, with creation, and between Indigenous governments and state institutions” (p. 177). Extending our understanding of relations to include more than human relations is vital step. As Borrows (2018) states “This [treaty agreements] includes the environmentally based ways of relating to the earth embedded in their own practices, customs and traditions” (Borrows, 2018, p. 63). Students engage, live and enter relations with the curriculum. Tupper and Cappello (2008) describes these relations as where students form attitudes, where students build foundations of their future identities, and begin to accept or deny what is considered as important knowledge (p. 567).

 **Place.**

 Attending to our places in which we are each situated Starblanket and Kiiwetinepinesiik Stark (2018) offer: “There is thus an important difference between understanding our place in the world as situated within relations of interdependence with all of creation and living in a ways that carries out our responsibilities within these relationships” (p. 177). Through Science education and the path in which our relationships are situated, I ask, are they connected to place? Movement across land develops relationships, as described by Starblanket and Kiiwetinepinesiik Stark (2018) and acknowledges how this mobility promotes actions of responsibility (p. 171). It is important to use treaty education understand our history and also as Kovach (2013) states “moves beyond teaching Treaty as a historical artifact to that of living protocol for how to exist in a world that is honorable, just, and caring for each other” (p. 116). In such “[t]he containment of Indigenous lands to reserves or even the more expansive Aboriginal Territory can risk our assuming that our movements through our own territories are not always regulated and conditioned by relationships and responsibilities” (Starblanket & Kiiwetinepinesiik Stark, 2018, p. 191).

 **Narrative.**

 Curriculum within Canada has a history of telling one story (Tupper & Cappello, 2008). Experiences continue to reinforce future generational ways of interacting within society as what Tupper (2014) referred to as a constructed the “truth” (p. 470). I pose the question for future researchers: if there is a correlation of achievement in science education connected to the constructed narrative in which it is taught? Many scholars work toward disrupting that narrative and attempt to move forward in building peaceful relations (Tupper & Cappello, 2008; Tupper, 2014). Kovach (2013) explores the dominant culture as being suppressive and the need to understand that treaty has meanings that run deep into historical understandings are connected to power, control and structures built on trust (p. 120). Interconnect with Tupper and Cappello’s (2008) work in which she describes how privilege of content with curricula documents are included or omitted (p. 566). The extensions of omission plays a role in the selection of what is acknowledged as “knowledge” is where Starblanket and Kiiwetinepinesiik Stark (2018) explicitly point out. What counts for knowledge results in asymmetrical power and the production of hierarchies (Starblanket & Kiiwetinepinesiik Stark, 2018, p. 180).

 Tupper (2014) speaks to the numerous social divisions which have created unequal opportunities of development for Indigenous peoples and the significance treaty education offers diverse approaches to address counter-narratives that can challenge epistemologies as a way to guide Reconciliation in a peaceful way (p. 474-475, 484). Starblanket and Kiiwetinepinesiik Stark (2018) state, “We must be attentive to how power structures and determine which narratives, modes of understanding our world, and the web of relationships in operation are given primacy. Furthermore, we must untangle how these narratives have ordered how we relate to one another and to creation” (p. 180). It is this dominant narrative that both Kovach and Tupper speak against as Tupper (2014) states, “treaty education contributes to democratic peacebuilding by challenging epistemologies of ignorance that deny Aboriginal peoples daily experience of colonial oppression” (p. 484).

**Incorporating, Including, Infusing a Salad into the meal**

 In the scope of this literature of where, when and what incorporating, including and infusing Indigenous knowledge into student learning found as key themes. In addressing these themes, we are now going to serve the first dish to begin our feast. Many scholars have entered relations within this field of research and there are many more that will follow in their footsteps. have all contributed to the field of research that addresses bringing Indigenous Knowledge into or within Educational settings and systems (Aikenhead, 2006; Aikenhead & Ogawa, 2007; Aikenhead & Elliot, 2010; Austin & Hickey, 2011; Barnhardt & Kawagley, 2005; Donald, 2019; Higgins & Tolbert, 2018; Starblanket & Kiiwetinepinesiik Stark, 2018; Tuck & Gaztambide-Fernández, 2013; Watson & Huntington, 2008). There are many more in this field however for the scope of this literature review, at this time these are the scholars able to make it to our table. In addressing entry points of Indigenous knowledge into settings not their own have demonstrated how desires play a role, containments are a factor, and also how responsibilities to knowledge are of importance.

 **Desires.**

 The reasoning behind bringing Indigenous knowledge into an educational setting has been to solicit a “desire for social justice in equitable representation” (p. 540), according to Aikenhead and Ogawa (2007). It is this incorporation of these proposals as Austin and Hickey (2011) have raised concerns and acknowledging the impacts of authoritative parties have on the “success of the innovation” (p. 144). This response of desires and the collaboration between what Aikenhead and Ogawa (2007) describes as a “political arena of resource management economic progress, and Indigenous sovereignty” (p. 581); interconnect with how Indigenous knowledge is incorporated, included and infused within curriculum, pedagogy, the classroom and within society. However, many scholars continue to work through the complexities in which they are “focusing on integrating local knowledge and pedagogical practices into all aspects of the educational system” in the efforts and hopes to “provide fertile, real world content in which to address the many issues associated with learning and Indigenous knowledge outlined above” (p. 14).

 **Containments.**

In understandings of epistemologies and the complexities, Aikenhead & Elliot (2010) address how knowledge and the containments of knowledge face ways in how relational knowledge are “more authentically capture an Indigenous worldview, such as Indigenous ways of knowing, living, or being" (p. 322). However, ways in which dominant society enters relations through inclusion results in what Tuck and Gaztambide-Fernández (2013) refers to as “absorb, and contain, consuming and erasing the other” (p. 82). The continuance of erasure is also supported in the work of Watson and Huntington (2008) whereby their description of integration is “accomplished a the expense of American Indian and Alaska Native intellectual traditions…” (p. 262). Bowers (2007) states, “[e]nclosure is a word that should be understood as inseparable from the word commons” could be extended to which containment of knowledge is also to inseparable from realities, experiences and epistemologies (p. 4). Bowers (2007) also goes on in the explanation of Enclosure as “approaches to education that promote a form of individualism that lacks the skills and knowledge that are part of the intergenerational knowledge that sustains cultural commons” (p. 4).

 **Responsibilities.**

 The simple recipes of traditional dishes requires attention to details of the ingredients, preparation, intention, love and are relational to the ways in which worldviews are rooted in unique epistemologies, ontologies, and axiologies. The fears explained and described by many Indigenous scholars and allies are ways in which Indigenous knowledge and how relations are entered into hold responsibilities. It is these responsibilities that are often overlooked which result in the appearance of being tokenistic (Aikenhead, 2006). Bringing knowledges together that are rooted in separate epistemologies, hold differing understandings and responsibilities. Sometimes bringing knowledges together causes problems to arise in the way knowledge is used demonstrates dichotomies and hierarchical assemblages (Watson & Huntington, 2008). Donald (2019) describes how attention to how understanding are explored have the potential of producing an null effect when intentness is not explicit and thoroughly thought through.

 This thorough thinking is evident in the way in which Watson and Huntington (2008) add to the importance of entering with Indigenous knowledge authentically, while remaining true to the integrity of the epistemological essence of meaning. They describe this through their conceptual understanding of “Cartesian rationality” (Watson & Huntington 2008, p, 276), a way in which Science’s descriptions tends to describe knowledge as factual which has potential of “mis-representing the assemblages” (Watson & Huntington 2008, p, 276). It is these assemblages, a concept developed from Deleuze and Guattari (1998) used by Watson and Huntington (2008) to identify these multiplicities (Watson & Huntington 2008, p, 276). It is these multiplicities that bring fear to innovation and desires which add to the complexities of incorporation of Cultural knowledge into dominant society’s education system.

**Asking Decolonization to Serve the Main Dish**

 In reviewing the literature in the area of decolonizing education the scholars invited to the conversational feast are Aikenhead, Aikenhead and Elliot, Battiste, Higgins and Tolbert, Madden, Smith, Styres, and Tuck and Gaztambide-Fernández (Aikenhead, 2006; Aikenhead & Elliot, 2010; Battiste,1998, 2017; Higgins & Tolbert,2018; Madden, 2019; Smith, 1999; Styres, 2019; and Tuck & Gaztambide-Fernández, 2013). Other scholars also hold important work within this field, however at this time these are the fields of work which I am including for this literature review. My intention here is not to make my own dish or definition for what decolonization is rather embrace the multiple ways in which their understandings have guided them in their discipline. The more recipes I add to the conversation within our feast the better I can help students within my classroom. Attending to the details of decolonizing education, the cumulative research guided this literature review to themes that demonstrated a need to attend to an overarching umbrella concept of decolonization and ways each scholar approaches decolonization. Themes of this scope of review also attend to they ways in which scholar’s intentions bring unique understandings, and also how Scholars are disrupting the dominant systems and structures within our daily lives.

 **Overarching Umbrella.**

 In guiding this overview of Decolonization, Linda Tuhiwai Smith (1999) addresses it through a multi-level process, where engagement is required to identify underlying assumptions and values (p. 21). Experiences of decolonization require what Battiste (2017) describes as “negative and positive practices” (p. 138); while Styres (2019) identifies decolonization as a way to open spaces and develop sense-making (p. 32). As learning environments within a classroom, curricula and within society frame and guide students, teachers, and communities, it is how students learn, share knowledge and teach values that have over time reinforced colonial ways (Styres, 2019). Decolonizing one’s self is challenging, as Battiste (1998) explicitly states, however she also explains that these interactions are required in recovering ways of knowing and living as being vital in “local ecologies and languages” (p. 24). As the importance and scope of this work in all respects extent, both Madden, Higgins and Tolbert have also contributed to this field of research. De/colonizing introduced as ways of disrupting the dominant narrative in utilizing “hybridity” to address colonial logics of the dominant narrative found within our education system (Madden, 2019, p. 4). Higgins and Tolbert (2018) state, “Like others, we utilize the term de/colonizing to consider the ways in which decolonizing and colonizing discourses cannot be wholly framed in opposition, particularly within spaces like education institutions” (p. 274).

 **Intentions.**

 Within decolonizing curriculum Aikenhead and Elliot (2010) addresses opportunities that “cross-cultural Science” (p. 324) can “improve scientific literacy” (p. 324), however this is contingent on the abilities and capabilities of the teachers and the “teacher education programs” (Aikenhead, 2006,p. 393). The intentions and importance of opening spaces through decolonizing pedagogies as explained by Styres (2019) allows students to “question their own positionalities, prior knowledge, biases, and taken-for-granted assumptions together with the ways they are implicated in and/or affected by colonial relations of power and privilege” (p. 33). As efforts to continue in the processes required to Decolonize, Tuck and Gaztambide-Fernández (2013) acknowledge the the work of “Maori scholar Linda Tuhiwai Smith” (p. 81) and how Smith (1999) addresses the implications of dominant societies attempts to use what she refers to as the “universal recipe” (p. 229) interconnects to “multicultural definitions” (Tuck & Gaztambide-Fernández, 2013, p. 81) and the ways that these “assumes that oppression has universal characteristics that are independent of history, context and agency” (Smith, 2000, p, 229). Intentions of bringing many Cultural understandings together are what St. Denis (2011) addresses where Multiculturalism counteracts Aboriginal sovereignty. St. Denis (2011) addresses how multiculturalism causes competition within minorities, resulting in negotiations or competition between “ethnic groups” (p. 310).

 **Disrupting.**

 It is this disruptive narrative in which de/colonizing as described by Higgins and Tolbert (2018) has the ability to “deconstructively” examine particular colonial logics. Through this approach to de/colonization Higgins and Tolbert (2018) describes, the construct of nature not being able to be separated from “(neo)-colonial forms of power” (p. 276), but Science has the potential to “refuse participation” (p. 276). Styres (2019) approaches Decolonizing praxis as ways for students to move toward “more critical consciousness” (p. 33). In suggesting a way to decolonize a curriculum, Korteweg and Fiddler (2018) identify beginning ways in which we interact and connect with land is a good starting point (p. 265). This is also addressed in what Styres (2019) connects to open opportunities that “understandings of Land and self-in-relationship” which she also addresses that using capital “L” for Land brings land into relation (p. 24-25).

**Reconciliation with Desert, Please Pass the Berries**

 In reviewing the literature of Reconciliation, I am aware of the manner Borrows, Madden, Tully, Wiseman and Borden, bring conversation to our table. (Borrows, 2018; Madden, 2019; Tully, 2018; Wiseman & Borden, 2017). Before I address that, I acknowledge just as Wiseman and Borden (2017) acknowledged that work required for Reconciliation holds many complexities (p. 182-183). This title of this sub-section within this literature review connects the importance of such work to the importance Indigenous peoples are interconnected to relationships with everything. Kimmerer (2013) states:

What I mean of course is that our human relationship with strawberries is transformed by our choice of perspective. It it human perception that makes the world a gift. When we view the world this way, strawberries and humans alike are transformed. The relationship of gratitude, and reciprocity thus can increase the evolutionary fitness of both plant and animal. (p. 30).

The Scholars mentioned above share their own understandings of reconciliation through their writings, which guide focus for our feast. The scope of this literature review will attend to aspects where Reconciliation holds the ability to heal relations to Earth, and also within Treaty relations. Reconciliation also extends to means that are transformative to students, schools, and society as a whole.

 **Heal Relations.**

 Reconciliation holds the possibilities to guide healing. The overlap of healing relations and Treaty relations are visible through the work of Borrows, which will be discussed in a later section. Scholarly work, shared by Borrows, Madden, and Wiseman and Borden all are in agreement that to reconcile we must include Reconciliation with Earth (Borrows, 2018; Madden, 2019; Wiseman & Borden, 2017). In addressing how both Science education and Reconciliation could be addressed through curriculum, Wiseman and Borden (2017) bring in Cajete’s (2006) work that addresses “hidden curriculum” that alters students’ personal perception within the natural world (Wiseman & Borden, 2017, p. 180). How we learn relations with Earth or land impacts the interactions we have with Earth or Land. Borrows (2018) speaks to the actions that Indigenous teachings guide through laws, and describe how “…love can be used to strengthen how we act towards one another in means that bind ourselves more tightly to respecting the earth” (p. 55). Foundational actions that address guiding practices through means of transversing and transgressing guide students in moving forward toward Reconciliation (Wiseman & Borden, 2017, p. 187-188).

 **Treaty Relations.**

 Relations addressed in this literature of Reconciliation also convey how Treaty relations are interconnected. As explained by Borrows (2018) Reconciliation requires a resurgence of Treaty relationships along with Indigenous laws and Ways of knowing and being to rebuild broken and forgotten relations (p. 69). In addressing the practices in which Treaty relations hold possibilities, Borrows (2018) states “Furthermore, if the Crown promised to provide education, health care or infrastructure to the Indians, this constrains the Crown’s discretion in these policy fields– it must forever act to implement these promises ‘as long as the grass grows and the river flows and the sun shines’” (p. 64). I acknowledge that Madden’s work is not situated solely within Treaty relations, it interconnects through the relations in which she explains, ways Reconciliation must be guided by the balance of relationships with our ancestors and also with Land. Ancestors were key in our historical past and such acknowledgments to their work within treaties are valuable.

 **Transformative.**

 Reconciliation as explained by Tully (2108) encompasses many features, variations and entry points within Reconciliation and others that require strong relations to be transformative (p. 85-94). Tully (2018) explains that the relationships we currently hold with Indigenous and non-Indigenous relations are straining, also othering, and are not living in sustainable ways (p. 91). To be transformative requires examining complexities of reconciliation and the work required to bring balance within our lives is connected to how students learn within the classroom, how teachers teach within a lesson, and also how curriculum developers construct curricula. Tully (2018) states, “[r]elating to the living earth as a storehouse of commodifiable resources dis-embeds them from these interdependent ecological relationships and re-embeds them in the abstract and competitive relations of the global market systems” (p. 105). These understandings are rooted in the strained relations with both the Earth and also with the people who share it. Madden (2019) makes an explicit connection that reconciliation requires resistance to systemic efforts of today’s society and that through changing, the effects can allow for healing to begin (p. 13). The implications of how reconciliation are interconnected with students participation with the education system, specifically learning through science classes, are invaluable in rebuilding relations. To heal each other, heal the earth, relationally transform society, scholars Wiseman and Borden (2017) demonstrate recovering land-based teachings and reconnecting wisdom are practices that reinforce reconciliation (p. 11). The calls to move beyond the binary relations and heal are where the possibilities can move us forward, when we listen and learn from each other the will move us toward reconciliation (Wiseman & Borden, 2017, p. 13).

**Implications**

 In holding conversations during our scholarly feast many insights, themes and commonalities arose. Nakata (2007) who described cultural interface as being multi-dimensional, and full of intersecting trajectories guide us in how we shape our discursive views and “how we come to understand one another” (p. 199). Identifying ways in Indigenous knowledge and science education can be brought together does not have a step-by-step guide. The implications of this is interconnected to our responsibility as educators to learn with each other. This scope of literature has identified areas of “intersecting trajectories” in which they demonstrate the connections tied to knowledge, relations and power. Each trajectory overlaps within treaty education, ways of incorporating, infusing and including indigenous knowledge, decolonizing education, and also reconciliation for education. The ways I am addressing these implications I am continuing to bring in “Wholistic theory” (Absolon, 2010).

 In attending to the ways in which Knowledge is addressed in both Indigenous knowledge and within science education, it is important to learn each within their own epistemology to remain authentic and nurture the learning that was intended. It is the importance to understand the reason, motive, desire and intention as to where Indigenous knowledge and science education meet. This is the responsibility of the educator to enter into learning opportunities that guide understandings with Indigenous knowledge as explained by many scholars. Identifying where and when to bring knowledge in is dependent on the work one is willing to do and the implication of this is also dependent on the circumstances of communities, place and also how the contexts are addressed.

 Relations with each other, with land and also with our more than human relatives is important to understand the complexities these hold within science education. This also extends to the multi-dimensions spoken by Nakata (2007). The extensions of relations are rooted in place and hold close meanings and cultural practices. How students are learning relations within science education impacts their relations with each other, the earth and also the more than human relatives. Spending time on the land develops more relationships. Currently science education within Alberta guide students learning through multiple units that consist of learning about the natural world. It is experiences with these relations that hold the implications and are interconnected with knowledge. Addressing these potential areas for ways science educators can bring in Indigenous knowledge open these implications that are connected across the scope of this literature. Identifying the areas of trajectories and opening opportunities to discuss possibilities may allow for understandings to develop and relations to grow.

 Power was demonstrated throughout this scope of literature through narrative, disrupting containments and desires. In finding ways to hold conversations that are grounded in sharing the land for all, science education has a potential for exploring the possibilities in moving forward in Reconciliation. To shift the trajectory from power and look for openings of sharing and learning with each other holds deep transformative implications for rebuilding relations and Reconciliation. Having the opportunity of conversing with each other and our learning journeys by sharing, guiding, and talking are foundational with transversing and transcending (Wiseman & Borden, 2017). The implications of such process hold the potential to find ways to live sustainably of this land we all share and call home.

**Conclusion**

 In my journey of this process of analyzing this literature through a theoretical lens of wholistic theory alongside cultural interface has guided my understandings of Indigenous knowledge and science education and the relations they hold. These potentials have allowed for more understandings of where, when, and how Indigenous knowledge and science education can enter relations. This capping project has helped me to identify the complexities needed to facilitate learnings for students, educators and also for administrators. This research has guided me to acknowledge my own responsibility for providing authentic and accurate information as well, to continue on my learning journey with Indigenous knowledge and science education. In the process of this review, I explored the possibilities of entry points with Indigenous knowledge and science education. The complexities of trajectories of knowledge, relations, and power were identified and the implications they are interconnected with have focused ways in which I will bring Indigenous knowledge and science education into relations. As I take time for reflection before I enter back into the classroom I will take this opportunity, to locate, and situate myself with my family, and the understandings I have come to know, not as an expert, but more as an educator in my learning journey.

References

Absolon, K. (2010). Indigenous Wholistic theory: A Knowledge Set for Practice. *First Peoples Child & Family Review*, 5 (2). 74-87.

Aikenhead, G. (2006). Towards Decolonizing the Pan-Canadian Science Framework. *Canadian* *Journal of Science Education, Mathematics and Technology Education*, 6(4). 387-399. https://doi.org/10.1080/14926150609556712

Aikenhead, G. & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Culture Studies of Science Education*, 2. 539-620.

Aikenhead, G. & Elliot, D. (2010). An Emerging decolonizing science education in Canada. *Canadian Journal of Science, Mathematics and Technology Education*, 10(4). 321-338.

Alberta Learning. (2003, Updated 2009, 2014). Science 7-9 [Program of Studies]. [Edmonton], Canada: Alberta Learning.

Alberta Education. (2018). Teaching Quality Standard (Professional Practice Standards). Edmonton,

Austin, J., Hickey, A. (2011). Incorporating indigenous knowledge into the curriculum” Responses of science teacher educators. *The International Journal of Science in Society*, 2(4). 139-152

Barnhardt, R. and Kawagley, O. (2005). Indigenous knowledge systems and Alaska native ways of knowing. *Anthropology & Education Quarterly*, 36(1). 8-23

Battiste, M, (1998). Enabling the Autumn Seed: Toward decolonized approach to aboriginal knowledge, Language, and Education. *Canadian Journal of Native Education*, 22(1). 16-2

Battiste, M. (2017). Decolonizing Education : Nourishing the Learning Spirit. Saskatoon, Sk: Purich Publishing.

Borrows, M. (2018). Earth-Bound: indigenous Resurgence and Environmental Reconciliation. In Asch, M. Borrows, J, & Tully, J. (Eds.), *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (49-81). Toronto, Ont: University of Toronto Press.

Bowers, C.A. (2007). Philosophy, Language, and the Titanic Mind-Set. *Language & Ecology*, 2(1). 1-16.

Cajete, G. (2000). *Native science: Natural laws of interdependence*. Santa Fe, New Mexico: Clear Light Publishers.

Cajete, G. A. (2006). Western science and the loss of natural creativity. In Four Winds (Ed.), *Unlearning the language of conquest: Scholars expose anti-Indianism in America* (pp. 247-256). Austin, TX: University of Texas Press.

Deleuze, G. and Guattari, F. (1998) A Thousand Plateaus: Capitalism and Schizophrenia. Minneapolis: University of Minnesota Press.

Donald, D. (2019). *Homo economicus and forgetful curriculum: Remembering other ways to be a human being*. In H. Tomlins-Jahnke, S. Styres, S. Lily & D. Zinga (Eds.). Indigenous Education: New directions in theory and practice. Edmonton: university of Alberta Press.

Higgins, M. & Tolbert, S. (2018). A Syllabus for Response-able Inheritance in Science Education, *Parallax*, 24 (3). 273-294. https://doi.org/ 10.1080/13534645.2018.1496579

Kimmerer, R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants*. Canada: Milkweed Editions.

Kovach, M. Treaties, Truths, and Transgressive Pedagogies: Re-Imaging Indigenous Presence in the Classroom. *Socialist Studies*, 9(1). 109-127.

Korteweg, L., & Fiddler, T. (2018). Unlearning colonial identities while engaging in relationality: Settler teachers' education-as-reconciliation. *McGill Journal of Education*, 53(2). 254-275.

Little Bear, L. (2000). Jagged Worldviews Colliding. In M. Battiste (Ed.), *Reclaiming Indigenous Voice and Vision* (77-85). Vancouver, BC: UBC Press.

Madden, B. (2019). A de/colonizing theory of truth and reconciliation education. *Curriculum Inquiry*, 49(3). 284-312. https://doi.org/ 10.1080/03626784.2019.1624478.

Moreton-Robinson, A. (2016). *Critical indigenous studies: Engagements in first world locations*. Tucson, Arizona: The University of Arizona Press.

Nakata, M. (2007). *The cultural interface. In Disciplining the Savages: Savaging the Disciplines*. Canberra, A.C.T.: Aboriginal Studies Press.

St. Denis, V. (2011). Silencing Aboriginal Curricular Content and Perspectives Through Multiculturalism: “There are other children here”, *Review of Education, and Cultural Studies*, 33(4). 306-317. https://doi.org/ 10.1080/10714413.2011.597638

Smith, L.T (1999). *Decolonizing methodologies: Research and indigenous peoples.* (2nd ed.). London, UK: Zed Books Ltd.

Styres, S. (2019). Literacies of Land: Decolonizing Narratives, Storying, and Literature. In (Eds.), Smith, L., Tuck, E. Yang, W. (2019). Indigenous and Decolonizing Studies in Education: Mapping the Long View. NY, Routledge.

Starblanket, G. & Kiiwetinepinesiik Stark, H. (2018). Towards a Relational Paradigm- Four Points for Consideration: Knowledge, Gender, Land, and Modernity. In Asch, M. Borrows, J, & Tully, J (Eds.), *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (175-207). Toronto, Ont. University of Toronto Press.

Tully, J. (2018). Reconciliation Here on Earth. In Asch, M. Borrows, J, & Tully, J. (Eds.), *Resurgence and Reconciliation: Indigenous-Settler Relations and Earth Teachings* (83-129). Toronto, Ont. University of Toronto Press.

Tupper, J. A., & Cappello, M. (2008). Teaching Treaties as (Un) Usual Narratives: Disrupting the Curricular Commonsense. *Curriculum Inquiry*, 38(5). 559-578.

Tupper, J. (2014). The Possibilities for Reconciliation Through Difficult Dialogues: Treaty Education as Peacebuilding. *Curriculum Inquiry*, 44(4). 469–488.

Tuck, E. & Gaztambide-Fernández, R. (2013). Curriculum, Replacement, and Settler Futurity. *Journal of Curriculum Theorizing*, 29(1). 72-89.

Watson, A., & Huntington, O. (2008). They're Here- I can feel them; The epistemic spaces of indigenous and western knowledges. *Social & Cultural Geography*, 9(3). 257-281.

Wiseman, D., Borden, L. (2017). Echoed Remembering : Considering Mathematics and Science as Reconciliation. In L. Jao, N. Radakovic (Eds.), *Trans disciplinary in Mathematics Education* (175-192*)*. Cham: Springer International Publishing