
**Place as an Aspect of Learning Indigenous Science**

In order for a science curriculum to be effectively adapted to suit Aboriginal perspectives, learning from Place must be an integral part of the experience. Understanding what *Place* means from an Indigenous perspective is a concept necessary to understanding and learning Indigenous scientific knowledge and processes. Aside from the more literal meaning of geography, house, town, residence, or other physical and tangible space, Place also includes less tangible characteristics. *Place* – or *sense of Place* – also suggests the concepts, memories, histories, ideas, emotions, relationships, identities (both individual and community) and objects associated with a particular physical space. Cajete explains that *Place* is integral to Indigenous cultures:

Indigenous people are a people of Place, and the nature of Place is embedded in their language. The physical, cognitive, and emotional orientation of a people is a kind of map they carry in their heads and transfer from generation to generation. This map is multi-dimensional and reflects the spiritual as well as the mythic geography of a people (Cajete, 2000b, p. 74).

*Place* can be aesthetic, ceremonial, economic, familial, historical, political, spiritual, or scientific. Edward S. Casey captures the complexity of *Place* in the following way:

Rather than being an indefinitely sort of thing – for example, physical, spiritual, cultural, social – a given place takes on the qualities of its occupants, reflecting these qualities in its own constitution and description and expressing them in its occurrence as an event: Places not only are, they happen. (Casey in Feld and Basso, 1996, p. 27)

This quote suggests that *Place* is a complex concept that is difficult to articulate. Part of this problem is a result of the ubiquity of *Place*. As Clifford Geertz tells us, “It is difficult to see what is always there. Whoever discovered water, it was not a fish” (Geertz in Feld and Basso, 1996, p. 259). *Place* is often assumed and rarely defined.

Although challenging, exploring the concept of place is crucial in understanding the Place of local knowledge in school science. Indigenous articulations, perspectives, and local concepts are important because there has been a shift from living in oral literate societies to living in a contemporary written literate society. The challenges in articulation are linked to a difference in knowledge systems. Indigenous knowledge systems are normally expressed orally, experientially and symbolically; consequently, relaying that knowledge through a western model has limitations (Battiste, 2002; Aikenhead and Ogawa, 2007).

An additional difficulty in articulating the concept of *Place* and its role in Indigenous knowledge systems is language. Articulation of the concept of *Place* in Indigenous languages is often viewed as fundamental to its accurate articulation (Basso, 1996; Battiste, 2002; Little Bear, 2000; Harris, 2002). According to Battiste (2002), the survival of Indigenous languages is by far the most significant factor in the survival of Indigenous knowledge. This is because Indigenous languages have symbolic, verbal, and unconscious elements that act to structure and order Indigenous knowledge and worldview. Thus, the understanding
of the concept of Place has lost meaning in a dual translation: from Indigenous languages to English, and from oral to written traditions. In addition, the contextuality of Place renders it inseparable from the land, culture, society, locality, worldview, philosophy, and spirituality. To extract it for the sake of defining it thus takes away its inherent interconnectedness to other aspects of life. As Aikenhead and Ogawa note,

Reading an article is not an adequate experience in coming to know how to live in nature. Ways of living in nature is action-oriented (verb-based); it cannot be given, accumulated, banked, and assessed by paper and pencil examinations. It must be experienced in the context of living in a particular place in nature, in the pursuit of wisdom, and in the context of multiple relationships. (Aikenhead and Ogawa, 2007, p. 21)

Michell (2005) makes a similar point about Woodlands Cree way of life, “which cannot be learned entirely from the written word; it must be lived and experienced” (p. 32). Place is understandably, then, a concept that is difficult to define within the space of this written report. Nonetheless, some attempts have been made to articulate Indigenous concepts of Place in English-language literature, and it helps build an understanding of the concept. According to the literature, there are five central dimensions of Place that are common among various Indigenous groups as follows.

**Dimensions of Place**

1) First, Place is **multidimensional**. It entails both physical and emotional characteristics and refers to more than just a geographic space. Thus, it encompasses all aspects of life. Place indicates a physical element or Place dependence (Stokols and Shumaker, 1981) and an emotional element or Place identity (Proshansky, 1978; Proshansky, Fabian, & Kaminoff, 1983; Korpela, 1989). Eric Riggs describes the all-encompassing character of Place:

Geography is not only a matter of location, distance, and elevation, but is additionally permeated with meaning and cultural significance. Indeed the worldview and cosmology of many indigenous cultures is indistinguishable and inseparable from the physical geography. (Riggs, 2004, p. 303)

Place is “created by the setting combined with what a person brings to it” (Steele, 1981, p. 9). In other words, Place is the interaction between location and resident (Cajete, 2000b). Edward S. Casey distinguishes between Space and Place: Space is the tangible, mappable, measurable while Place includes “locations where one chooses to stay or return” (Cruikshank, 2005, p. 67). The multidimensionality of Place, then, can be understood to have a dual characteristic: the spiritual and the physical. These two aspects encompass a wide range of perspectives that cannot be separated into parts (Cajete, 2000b).

2) Second, Place is a **relational** (or relationship-based). This notion of Place as a relationship is evident in many definitions and studies about Indigenous Peoples and their connection to the land, and thus might be considered a fundamental and shared aspect of sense of Place in an Indigenous context (Carlson, 2001; Cajete, 2000b). Indeed the principle of interrelatedness is central to Indigenous epistemologies (Colorado, 1988). Vine Deloria Jr. captures both the aspects of relationship and multidimensionality by *Indian metaphysics*, which he defines as “the realization that the world, and all its possible experiences, constituted a social reality, a fabric of life in which everything had the
possibility of intimate knowing relationships because, ultimately, everything was related” (Deloria and Wildcat, 2001, p. 2). This epistemological framework entails two fundamental and related concepts: power and Place. While power refers to spiritual power or life force, Place refers to a “familiarity with the personality of objects and entities of the natural world” (Deloria and Wildcat, 2001, p. 2). In other words, Place is a spiritual relationship with the tangible world that connects other aspects of life.

3) Third, Place is experiential (Aikenhead and Ogawa, 2007; Michell, 2005; Cajete, 2000b; Casey in Feld and Basso, 1996): it is the experiences that an individual has on their land – in their Place – that gives Place its meaning. Indeed, much Indigenous knowledge is created through experience (Scott in Nader, 1996). This includes both the remarkable and the unremarkable; it is life lived every day (Basso in Feld and Basso, 1996). To learn Indigenous science, learners must actively participate in the natural world (Michell, 2007), a process that can be transferred to formal, curriculum-based science learning (Kawagley, 1995; Kawagley and Barnhardt, 1999). Cajete cites the lack of practicality and its experiential approach as one of the major inhibitors of Aboriginal students’ success in the classroom (Cajete, 1988). In addition, Pauline Chinn notes, “that Science studies connecting science and society provide opportunities for personally meaningful, experiential, inquiry and Place-based learning fundamental to scientific and environmental literacy” (Chinn, 2007, p. 1248). Eric Riggs reiterates the impact of this approach, arguing that field-based methods to teaching science result in higher success rates (Riggs, 2004). Such a hands-on approach to learning provides a tactile and tangible connection between knowledge and life; it is what makes learning meaningful and practical. Thus, Indigenous knowledge and learning become contextual geographically, socially, culturally, spiritually, and physically (Battiste, 2002). Indeed, it is this contextuality and sense of Place that makes learning Indigenous knowledge experiential.

4) Fourth, Place is local. Place is site-specific and locality is central to its understanding. In Canada, Indigenous cultural diversity is captured in 53 different First Nation languages belonging to eleven different language families (MacIvor, 1995). As Cajete (2000b) states, “native people interacted with the places in which they lived for such a long time that their landscapes became reflections of their very souls” (p. 183). People, then, become inseparable from the land they inhabit, and Place becomes as integral to Indigenous identities as culture is. A few examples illustrate this concept. Adelson (2000), who has done research among Cree People in northern Quebec, asserts the “history of the people and the history of the land do not simply correspond to each other – they are one and the same” (p. 29). Similarly, Nîhîthewâk Ithiniwak like other Indigenous societies around the world consider themselves an intricate part of nature and have developed a way of life that reflects the boreal forest of northern Canada (Michell, 2005; Brightman, 1989, 2002; Siggens, 2005). Nîhîthewâk and the Places they occupy shape and form the worldview, culture, language, epistemology, ways of knowing, knowledge systems, values, and teacher practices in science education (Michell, 2005). While this project thus recognizes the commonality of certain concepts specific to Indigenous cultures, it also continues to respect and emphasize the centrality of locality to each of those groups. The concept of Place is as unique, individual, and local as the people who create it. According to Pomeroy (1994), localization of science curriculum is based on the argument that students will see science learning as relevant, if they can situate it in the context of their lives.

5) Fifth, and most essential, Place is land-based. Although First Nations and Métis Peoples come from diverse cultural contexts, there is a shared worldview in which humans are intricately connected to the land (Kawagley & Barnhardt, 1999; Knudtson & Suzuki, 1992; Michell, 2005). Leroy Little Bear elaborates:
In Plains Indian philosophy, certain events, patterns, cycles, and happenings take place in certain places. From a human point of view, patterns, cycles, and happenings are readily observable on land: animal migrations, cycles of plant life, seasons, and so on. The cosmos is also observable, and patterns are detected from a particular spatial location within the territory of a particular tribe. (Little Bear, 2000, p. 78)

Land is a central aspect of group identity among Indigenous cultures, and thus, so is the sense of Place that is tied to the land. It is the relationship between the land and the people who inhabit it, the connection people have to the land, and the role of Place in the history, culture, and community. Appreciating the connection to and relationship with the land that Indigenous Peoples have is essential to understanding the concept of Place and its role in Indigenous knowledge. As Marie Battiste states, Indigenous knowledge is also inherently tied to land, not to land in general but to particular landscapes, landforms, and biomes where ceremonies are properly held, stories properly recited, medicines properly gathered, and transfers of knowledge properly authenticated. Ensuring the complete and accurate transmission of knowledge and authority from generation to generation depends not only on maintaining ceremonies, which Canadian law treats as art rather than science, but also on maintaining the integrity of the land itself. (Battiste, 2002, p. 13)

RCAP reiterated this view:
Land touches every aspect of life: conceptual and spiritual views; securing food, shelter and clothing; cycles of economic activities including the division of labour; forms of social organization such as recreational and ceremonial events; and systems of governance and management. (RCAP, 1996, 2.2.4.3.2)

Hence, land or Place cannot be viewed in isolation of other cultural aspects. Knowledge, economy, society, and spirituality are all interconnected. In the context of Indigenous science, Place might be better and more simply understood or defined, then, as the product of the relationship with and connection to the land. Michell (2007), discusses science education among the Woodlands Cree and elaborates on this notion:
The fresh air, the sights and sounds of nature always leave me deeply connected and whole. For me, it wasn’t just the physical aesthetic beauty of it all nor the momentary awe experienced when one is walking through a forest. It is a deep sense of spiritual connectedness that is hard to describe in human words and most likely would be misunderstood and perhaps even discarded by a person who thinks from a secular and positivist Western science perspective. Being out on the land allowed me to become aware that I was connected to something much more greater than myself. For people of Nîhîthâwâk heritage, the concept of experience is culturally defined and goes beyond human interactions to embrace an essence of what I come to know as an interconnected spiritually imbued relatedness. (p. 7)

Place in Education

With this view of Place, then, its role in science education becomes evident. Learning from Place refers to “the learning of traditional knowledge, processes and practices from living in a particular place” (CCL, 2007a). An enhanced science curriculum recognizes Indigenous knowledge as a total knowledge system that describes and explains nature in culturally powerful ways. This knowledge resides in Aboriginal languages. Its validity is delimited by its geographic setting of those who hold it. Indigenous Knowledge systems are Place-based knowledge systems (Michell, 2005). Place-based education is a method that includes experiential learning in local natural and social settings. It is includes a trans-disciplinary and cross-cultural synthesis of Place-related knowledge and pedagogy, and service learning or other forms of community outreach (Gruenewald, 2003a, 2003b; Sobel, 2004). Place-based teaching is conscious of, and empowers the senses of Place of students and teachers; and it promotes local ecological and cultural sustainability (Sobel, 2004; MacIvor, 1995; Tuhiwai Smith, 2002).
6. RECOMMENDATIONS

6.1 A Holistic Paradigm
The traditional knowledge of Indigenous Peoples differs from region to region and is grounded in the particular environment and culture from which it has emerged. Traditional knowledge has emerged over time and changes over time. All time is part of Indigenous Peoples history and has contributed to Indigenous epistemologies. Battiste & Henderson (2000) provide insights in this regard,

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

Defining traditional knowledge for use in Eurocentric scientific paradigms is difficult. The oral nature, intangible aspects and holistic views of traditional knowledge are not easily understood, or accepted, within foreign scientific paradigms. That is, Eurocentric scientific paradigms search for finalities, for tangible evidence, for definitions and for non-contradictory qualities. Without these qualities, Eurocentric scientific paradigms cannot accept or process other kinds of information. This results in the hegemony of Eurocentric science paradigms being of little value in framing or understanding traditional knowledge. The challenge remains for Eurocentric scientists to expand their repertoire of a single exclusive model of scientific inquiry to include new paradigms that respect the intangible, intuitive and shifting nature of other kinds of knowledges, including Indigenous traditional knowledge.

Facing enormous global environmental crises in this millennium, governments and science communities are recognizing that irreversible environmental damage has placed continued human existence at risk. Yet, even Eurocentric science, embedded within Western ideology and hegemonic practices of capitalism and consumerism, has been powerless to avert pending disaster by providing sufficient solutions based on its own paradigms. In 2002, Simon Brascoupe, Director of the Aboriginal Affairs Directorate of Environment Canada, explained,

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

Cajete (1994, 1999) has written extensively about Indigenous science education. Perspectives on ecology, personal spiritual development, traditional philosophies, mythology, artistic visioning, relationships, and curricula are offered to help understand the complexities of Indigenous ecological education and formulate a framework for educators to work within. Cajete conveys methodologies for transformational education, drawing on Tewa teachings and similar philosophies from other Indigenous Nations. Cajete (1994) says, “This transformation is a dynamic creative process that brings anything but peace of mind, tranquility, and harmonious adaptation. The exploration of self, and relationships to
inner and outer entities, require a tearing apart to create a new order and higher level of consciousness” (p. 210).

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

Hampton (1995) describes a redefinition of Indian education in terms of a six-directional framework, incorporating traditional teachings of north, south, east, west, spirit and earth. Combined, the framework is intended to demonstrate a pattern for organizing thought about how we exist in the universe. Hampton believes it is important to recognize each direction’s set of complex meanings, feelings, relationships and movements are dynamic, as is Indian education. Examining past and current forms of Indian education is the beginning of a process to construct models and theories of education which will result in successful education for Indigenous students.

Klug & Whitfield (2003) detail concepts of culturally responsive pedagogy for American Indian Children. Pedagogy includes concepts of how we decide what will be taught, what is taught, when and how we teach. Ismat (1994) is cited in describing culturally responsive curriculum capitalizes on students’ cultural backgrounds rather than overriding or negating them; is good for all students; is integrated and interdisciplinary; is authentic and child centered, connected to children’s real lives; develops critical thinking skills; incorporates cooperative learning and whole language strategies; is supported by staff development; and is part of a coordinated, building-wide strategy (p. 151). Klug & Whitfield (2003) describe the need to incorporate traditional languages and knowledge within existing curriculum, and to draw on cognitive psychologist’s research on constructivist approaches to teaching and learning, which rely on students’ abilities to create knowledge based on their experiences (pp. 167-175).

Ultimately, in actualizing Indigenous educational processes and goals outlined by writers such as Cajete (1994, 1999), Hampton (1995), Ermine (1995), Klug & Whitfield (2003), and others, Canadian education systems will need to create new forms of educational institutions which are grounded in Indigenous traditional knowledge and values, but can facilitate the development of Western scientific academic disciplines as well. Indigenous science education must be seen to be more than a process of discovering remedies to deal with ecological damages and environmental crises worldwide. Indigenous science education must take its rightful place as the vehicle to produce ecologically aware citizens and a healthy global environment. Educators, researchers, policy-makers and community members can examine various forms of Indigenous education in an effort to ascertain common characteristics and philosophies, but the primary focus must be to integrate local knowledge systems into school science curricula.
6.2 Strategies to Enhance Indigenous Science in Curriculum

- Relationship-building (schools, post-secondary institutions, community, government, industry)
- Respecting protocols (discovering protocols of place & honouring them)
- Teacher skill-building (including school support for teacher release time)
- Community-based curriculum development (Frameworks: Ontology, epistemology, methodologies, and pedagogies)
- Adequate Funding Resources to support curriculum goals
- Teacher and student as learners
- Appropriate knowledge dissemination and storage
- Respecting wisdom of Elders and traditional land users
- Respecting ceremony as the domain of Aboriginal Peoples
- Respecting and supporting First Nations and Métis spiritual belief systems
- Seeking holistic understanding from First Nations and Métis perspectives (valuing diverse knowledge systems)
- Promoting intellectual understanding
- Encouraging affective learning
- Experiencing the natural world (inclusion of practical land-based experiences)
- Facilitating parental control and involvement in education (NIB, 1972)
- Encouraging self-development of individuals and systems
Recommendations for Further Research
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Based on
Herman Michell, Yvonne Vizina, Camie Augustus and Jason Sawyer. (2008). *Learning Indigenous Science from Place* (p. 134)
http://iportal.usask.ca/docs/Learningindigenousscience.pdf

Research is needed to:
1. learn from local Indigenous communities what they want their children to gain from studying school science.
2. document and explain the linkages between Place and urban Indigenous students.
3. document the extent to which science teachers understand both the culture of Euro-American science and the nature of Place, in terms of student learning.
4. determine a repertoire of best practices for initiating teacher candidates (pre-service) and practicing teachers into culturally responsive science teaching.
5. describe the complexities of developing a degree of culturally responsive science teaching; including teachers’ motivations as well as the systemic challenges and barriers that impede or inhibit the process.
6. describe the degree to which, and in what ways, do science teachers enhance their classes with Indigenous perspectives by using curriculum guides, Indigenous Elders and other Indigenous knowledge keepers, and other specific resources.
7. document the effects on non-Indigenous students in science classes where culturally responsive science teaching occurs.

Research and development (R&D) projects are needed to:
8. develop collaboration among science educators, Indigenous communities, educational jurisdictions, businesses and industries, and Departments/Ministries of Education, in order to:
   a. set priorities for students’ learning from Place,
   b. develop implementation plans,
   c. monitor the presence of culturally responsive science teaching, and
   d. produce teaching materials and create student inquiries, projects, and activities that support and sustain teachers’ culturally responsive science teaching.
9. take advantage of technologies that will support students’ learning from place, without discouraging the interpersonal relationships that make schools a culturally responsive human enterprise.