CANADIAN JOURNAL OF SCIENCE, MATHEMATICS
AND TECHNOLOGY EDUCATION, *9*(3), 141–153, 2009

ISSN: 1492-6156 print / 1942-4051 online
DOI: 10.1080/14926150903118342

Routledge
Taylor & Francis Group

Two-Eyed Seeing in the Classroom Environment: Concepts, Approaches, and Challenges

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Abstract: This article outlines concepts and approaches for teaching Integrative Science (in Mi'kmaq: *Toqwa'tu'kl Kjijitaqnn*) using the guiding principle of Two-Eyed Seeing, and it discusses challenges that need to be overcome. This discussion is based on the almost 10 years of experience delivering Integrative Science to students at Cape Breton University. Integrative Science is the interface between Indigenous Sciences (at Cape Breton University guided by eastern Canadian Mi'kmaq traditions) and Western Sciences where one does not have to relinquish either position but can come to understand elements of both. Western scientists seek to understand how the Universe works. The basic premise of Indigenous Sciences is participating within nature's relationships, not necessarily deciphering how they work. The Two-Eyed Seeing approach used in Integrative Science seeks to avoid knowledge domination and assimilation by recognizing the best from both worlds. Integrative Science in the classroom relies on a holistic transdisciplinary curriculum firmly based in place. Crucial elements include a colearning philosophy, connection with culture and community, a psychologically safe classroom, and Aboriginal pedagogy.

Résumé: Cet article présente brièvement les concepts et approches qui se fondent sur le principe de la « double regard » en enseignement des Sciences Intégrées (dans la langue micmaque: *Toqwa'tu'kl Kjijitaqnn)*, et analyse les défis à relever dans ce domaine. L'analyse se base sur l'expérience du programme de Sciences Intégrées de l'Université du Cap Breton, mis en place il y a près de dix ans. Les Sciences Intégrées sont une sorte d'interface entre les sciences autochtones (qui à l'Université du Cap Breton se rattachent aux traditions Micmaques de l'est du Canada) et les Sciences Occidentales, perspective selon laquelle il n'est pas nécessaire de renoncer à l'une ou l'autre position car il est possible d'embrasser des éléments des deux. Les scientifiques du monde occidental cherchent à comprendre comment fonctionne l'univers, tandis que le principe de base des sciences autochtones est la participation aux relations qui existent dans le monde naturel, sans qu'il soit nécessaire de déchiffrer son fonctionnement. La « double regard » qui est utilisée dans le programme de Sciences Intégrées cherche à éviter la domination et l'assimilation grâce à une reconnaissance du meilleur des deux mondes. Dans la salle de classe, ce programme se fonde sur un curriculum solide, holistique et transdisciplinaire, dont les éléments principaux sont entre autres une philosophie d'apprentissage

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réciproque, un lien indissoluble avec la culture et la communauté, une salle de classe rassurante sur le plan psychologique et une pédagogie autochtone.

INTRODUCTION

The authors of this article are on a colearning journey that began 10 years ago around a water fountain at Cape Breton University with a conversation between Cheryl Bartlett, Professor of Biology, and Murdena Marshall, Professor of Mi'kmaq studies. The conversation centered on the lack of Mi'kmaq students enrolled in the sciences at the university and Murdena's suggestion that the existing fragmented, disciplinary approach to science education may not be appealing to the Mi'kmaq students. Albert's (Murdena's husband) interest in traditional ways of knowing and his commitment to Mi'kmaq youth has made him a valuable traveler on this journey. Significant steps have often been made around the Marshalls' kitchen table in Eskasoni. Annamarie Hatcher joined the travelers 4 years ago as a Biology Professor teaching two of the core science courses in the Integrative Science (*Toqwa'tu'kl Kjijitaqnn*) degree, a 4-year bachelor of science (community studies) degree. The stories distributed throughout the text are based on her experiences teaching these MSŁT courses (MSŁT is a Mi'kmaq word meaning "everything"). There have been other travelers, both teachers and students, on the way, and all have contributed in some way. This program began with the advice of Gregory Cajete, who enthusiastically said, ". . . just do it . . .," and this article is an examination of that process of "just doing it" with some of the foundational concepts.

CONCEPTS

The Social Context of 'Science'

What is defined as science is deeply steeped in social and cultural tradition and reflects the worldview of the definer (Little Bear, 2000). Today's scientists embrace fundamental worldviews that are shaped by science's origins and evolution. The beginnings of science can be traced to the 17th century when Renaissance natural philosophers (i.e., Galileo, Descartes, Newton) developed and established a knowledge system that was largely based on the authority of empirical evidence as opposed to the authority of the church and royalty. With the birth of the BAAS (British Association for the Advancement of Science) in 1831, the term *science* became applied to the Eurocentric (Western) approach as commonly practiced today, replacing the term *natural philosophy*. This evolution of natural philosophy has resulted in a close connection between modern science and Western thinking. Western Science was seen to gain power over nature. The quantitative objective approach of Western Science involves a disconnection between the observer and the observation. Before this revolution, science (derived from the Latin *scientia*) simply meant knowledge (Aikenhead & Ogawa, 2007).

Western Science(s)

The scientists who contributed to the Western Science knowledge system in the 20th and 21st centuries were originally trained at university science departments and then employed by industry,

government, and universities. In the professional science communities they worked (and still work) within a subculture that framed (and still frames) their thinking and practice, leading to disciplinary fragmentation (research silos). Because the subcultures that dominate in modern professional science communities (i.e., science disciplines) center on paradigms and approaches that are discipline specific, the term *Western Sciences* is used here as a plural.

The following excerpt from a presentation of a fourth-year Mi'kmaq science student at St. Thomas University describing her experience to a gathering of university and college administrators in May 2009 provides an observation about the disciplinary fragmentation of Western Science: "I am studying nature in various bubbles. There is the Biology bubble, the Chemistry bubble and so on" (Canadian Council on Learning, 2009).

Many of the principles of Western Sciences rely on a type of logic that assumes hierarchical thinking. The basic premise is that nature is "knowable" (Aikenhead & Ogawa, 2007) and Western Sciences seek to know how the universe works. In Eurocentric or Western Sciences, eradication of mystery is a key goal (Aikenhead & Ogawa, 2007).

Indigenous Sciences

In the Indigenous Worldview, knowledge and the knowers or learners are intimately connected, in contrast to their separation in many Western Sciences. Because of this connection, Indigenous knowledge is more accurately described as Indigenous ways of living in nature (Aikenhead & Ogawa, 2007). Indigenous ways of living in nature are strongly place based and the goal of Indigenous Sciences is to become open to the natural world with all of one's senses, body and spirit (Cajete, 2000). Self-identities of Indigenous people are inextricably tied to their place in contrast to the common Eurocentric notion of land as a commodity. In the Indigenous Worldview, the Earth is so sacred that it is "Mother," the source of life (Little Bear, 2000). Indigenous Sciences represent a way of knowing which is relevant to all aspects of Indigenous tradition (Cajete, 2000). They are contextual and experiential, in direct contrast to many Western Sciences. In verb-based Indigenous languages, knowing is more about the journey than the destination. *Indigenous Sciences* is a plural term because of the diversity related to the strongly rooted place-based traditions that form their foundations.

Two Indigenous scholars, Battiste and Henderson (2005), summarize the structure of Indigenous ways of knowing: (a) knowledge of unseen powers in the ecosystem; (b) knowledge of the interconnectedness of all things; (c) knowledge of the perception of reality based on linguistic structure or ways of communicating; (d) knowledge that personal relationships bond people, communities, and ecosystems; (e) knowledge that traditions teach specialized knowledge related to morals and ethics; and (f) knowledge that extended kinship passes on social traditions and practices from one generation to the next.

Indigenous Sciences are a large range of coming to know processes that result from human experiences in the natural world (Cajete, 2000). Indigenous Sciences are underlain by the perception of multiple realities and that reality perceived by our five senses is but one of those (Cajete, 2000). In Indigenous Worldviews, animacy and spirit are everywhere (Little Bear, 2000). Indigenous Sciences are underlain by the understanding that all physical bodies and minds are connected and expressions of a deeper spiritual essence (Sheridan & Longboat, 2006). Human consciousness, which is part of the larger web, can thus be aware of the cosmic connection. With the whole of creation composed of a web of interrelationships (in Mi'kmaq: *Msɨt No'kmaq*, "all

my relations"; and in Lakota: *Mitakuye Oyasin*, "we are all related"; Cajete, 2000), knowledge gained through these relationships implies a responsibility of the knowledge-keeper. Knowledge is passed to another only when a relationship between the giver and receiver is formed and when the knowledge receiver is ready.

In Indigenous Sciences, the development of respectful relationships among participants must precede any effective learning, a concept that comes into play in the classroom. This basic understanding is demonstrated by the following story from an Integrative Science class. The class was first year *MSIT* called "Sense of Place, Emergence and Participation" at Cape Breton University. In the Mi'kmaq language, *MSIT* means "everything together" and this first-year class grounds the students in scientific understandings of their place, *Una'maki* (land of fog; i.e., Cape Breton).

Ready to Learn

The students crawled into their first-year university science lab, having been forewarned that we had a visitor today. They sat in a circle around our guest as he said a prayer and introduced himself in the Mi'kmaq language. The students are all Mi'kmaq and the majority of them speak the language. Our visitor asked them who their fathers and mothers were and established that he was distantly related to several of them. He had spent the last 10 years documenting traditionally used plants and thoroughly engaged the group with the depth of his knowledge and understanding. The visitor noticed that one of the students was quietly nodding off and addressed him directly:

Visitor: I have learned much about how our people use medicinal plants from your grandfather.
Student (shaking the sleep from his head in disbelief): Not my grandfather, he's just an old man.
Visitor: Your grandfather is a trusted herbalist with a broad knowledge of local plants.
Student: Why did I not know this about my grandfather?
Visitor: Because you never asked.

The spiritual connection with Mother Earth is traditionally developed because Mother Earth is the teacher and the learner is immersed in her sights and sounds. This story from an *MSIT* class demonstrates how this connection can be nurtured in other ways.

MSIT No'kmaq

In the *MSIT* 301 class (Cycles and Holism), I was showing a computer simulation of global ocean currents, concentrating on the trade winds and the Gulf Stream. This followed a video that showed the voyage of an intrepid catamaran sailor across the Atlantic Ocean and up the eastern coast of North America, pushed by the Gulf Stream, which was generated by the equatorial trade winds. One of the students in the class had spent time as a crab fisherman on the Grand Banks and was very familiar with the warm water current that ran north off the continental shelf in that area. Making the connection between his observations aboard the fishing vessels and the global ocean currents was startling to the student. He said that he had no idea what might lead to the warm water current but never thought that it may be generated from so far away. He immediately made the connection to an event that had occurred late in the previous summer in the Bras D'Or lakes near his community of Eskasoni. An eddy had budded off the Gulf Stream and entered the lakes carrying schools of unusual tropical fish species. As the eddy dissipated, the fish succumbed to the cold water and became a food source for hundreds of bald eagles (Kitpu), a notable and memorable feeding frenzy observation for the people around the Bras D'Or, including the student. This series of events demonstrated to the student the interconnectedness of many processes that surround him in his place on Mother Earth and how he and his place are connected to and influenced by other places and living things a great distance away. *MSIT No'kmaq*.

Ceremonial practices are fundamental to Indigenous ways of living in nature because they provide a focus for intended actions and strengthen the will (Vickers, 2007). These practices include smudging, sweat lodges, vision quests, the sacred pipe and Sundance ceremonies. Respect is born and matured through the sacred ceremonies in dialogue with the land (Vickers, 2007). Ceremonial practices are embedded in a culture that includes belonging to a clan and a family and knowing the language. "Spirituality is not simply worship of a higher being or holding certain ceremonies. The spirituality of a people is wrapped up in their language and their songs, their stories and their dances, in how they live and interact with each other, and who or what they honour" (Confederacy of Mainland Mi'kmaq [CMM], 2007, p. 49).

An intimate association with nature has led to a circular view of time in most Indigenous Worldviews. With a long history of observation, the cycles of nature become an important method of time-keeping. This is another aspect of the Indigenous Worldview that emphasizes that the journey is more important than the destination. "Time is part of the constant flux but goes nowhere. Time just is" (Little Bear, 2000; as cited by Aikenhead & Ogawa, 2007, p. 563). When you are not rushing to the future, you value the time available in the present (Keane, 2007).

The basic premise of Indigenous sciences is participating within nature's relationships. Though Indigenous cultures around the world differ, relationships with the natural world are similar and thus some generalizations can be made about Indigenous sciences (Cajete, 2000).

INTEGRATIVE SCIENCE (*TOQWA'TU'KL KJIJITAQNN*) AND TWO-EYED SEEING

> The survival of planet Earth may be dependent on Western Science's ability to acknowledge and utilize the principles of Indigenous Science. Cross-cultural exchange and collaboration through participatory research might ensure such utilization. (Colorado, 1988, as cited in Cajete, 2000). Indigenous Science, then, would be recognized as an equal but different source of knowledge, not measurable through a Western Worldview. (Cajete, 2000, p. 291)

Many different ways of knowing coexist on our planet and a postcolonial agenda requires that bridges be built among them (Kawagley, 1995). Cultural modes of perception and understanding are deeply embedded and self-perpetuating. Indigenous Sciences contain deep and subtle wisdom, which Mother Earth needs, but that is difficult for those with a Western culture to practice authentically because they generally do not have the underlying beliefs, values, and cultural connections to nature and each other. Many cultural concepts simply are not transferable to other cultures. Indigenous Sciences cannot be practiced within Western ontological assumptions and experiences. Even in this article we cannot avoid weighting our comparisons with Eurocentric meaning because we are writing it in English. The bridge-building that encompasses Integrative Science and Two-Eyed Seeing is one way to approach these challenges.

Albert Marshall, a respected Elder of the Mi'kmaq Nation and one of the authors of this article, suggests that Two-Eyed Seeing has emerged in Atlantic Canada (the traditional territory of the Mi'kmaq Nation) because Mi'kmaq people are the Aboriginal people of North America who have had the longest experience of living side by side with the newcomers from Europe. Albert was an inmate of the Indian Residential School in Shubenacadie, Nova Scotia, for much of his childhood and teenage years. He was profoundly affected by this experience and it has led him on a lifelong quest to connect with and understand both the culture he was removed from and the

culture he was forced into and to help these cultures find ways to live in mutual respect of each other's strengths and ways.

In the Mi'kmaq language, *Toqwa'tu'kl Kjijitaqnn* (Integrative Science) means bringing knowledges together using the guiding principles of Two-Eyed Seeing. Two-Eyed Seeing refers to learning to see from one eye with the strengths of Indigenous ways of knowing and from the other eye with the strengths of Western ways of knowing and to using both of these eyes together. This avoids a clash of knowledges (Canadian Council on Learning [CCL], 2007). Thus, Two-Eyed Seeing intentionally and respectfully brings together our different ways of knowing, to motivate people to use all our gifts so we leave the world a better place and do not compromise the opportunities for our youth (Bartlett, Marshall, & Marshall, 2007). The concentration on the common ground between Indigenous and Western ways of knowing means that one does not have to relinquish either position but can come to understand elements of both (Brandt, 2007). The guiding principle of Two-Eyed Seeing in Integrative Sciences allows the Indigenous Sciences sense of the whole "to dance with" the Western Science sense of the parts.

In English the Mi'kmaq word *netukulimk* roughly translates to "develop the skills and sense of responsibility required to become a protector of other species." Alternatively, another Mi'kmaq speaker may translate the word as "hunter and provider." Some of the meaning of this word is based on the understandings of the speaker. Elders know that being a protector of other species is in their culture. Nature clearly teaches us this lesson: seeds germinate when the environment is appropriate. Elders know that traditional knowledge will transform the learner, even though many years may be required to see this. The Western/Indigenous Science dichotomy is a construct that arises, in part, from the Western practice of viewing knowledge as singular, independent from the teacher. *Knowledge* is a noun, to be passed objectively from one person to another. In Indigenous languages, knowledge is a verb, and the teacher and learner both play a constructive part in it. Thus, the Western concept of knowledge is more aptly referred to as a coming to know process in an Indigenous context. The traditional language takes us into a lifelong journey. Knowledge is not a tool but rather it is a spirit. It transforms the holder. It also reminds us that we have responsibilities to the spirit of that knowledge. We must pass it on.

Two-Eyed Seeing teaches you to awaken the spirit within you. You become a student of life, observant of the natural world. Two-Eyed Seeing teaches that everything is physical and spiritual. The Indigenous Worldview, exemplified by the language, teaches us about interdependence. People must look at our natural world with two perspectives. Western Science sees objects, but Indigenous languages teach us to see subjects. Indigenous languages teach us that everything alive is both physical and spiritual. Humans are a very small part of the whole.

Using the Two-Eyed Seeing approach means that education within Integrative Science incorporates a more holistic mindset and is transcultural as well as multidisciplinary, multidirectional, and multisensory, with the total environment as the laboratory, as recommended by Kawagley (1995). The legitimization of knowledge passed down and available through the Elders motivates Indigenous learners to connect or reconnect with their past, present, and future. Knowledge is contextualized, of direct relevance to the learner. This is demonstrated by a story from an *MSIT* class.

The Birds in "My Place"

MSIT 101/103 (A Sense of Place, Emergence and Participation) was taught in a Mi'kmaq community (Indian Brook) for the first time in 2008. The students were largely adult learners working on a

bachelor of arts degree through Cape Breton University. In this new group of students was a single mother who was raising many children (hers and others) who said, "I have a lot of blackbirds around my house. I'm going to find out what the Mi'kmaq and the scientific names are and then count them." She found that the bird that she always thought was a blackbird was actually a European Starling. The common name caused her to start talking to the Elders to find out why these birds in her community were referred to as European. The Elders told her that the bird was not always here, not native. This was a real eye-opener for her. Now she and her children are observing and documenting all of their local birds to determine which are native and which are not. She and her children have started the connection with their local environment and with the knowledge of their Elders.

APPROACH TO INTEGRATIVE SCIENCE

To teach Integrative Science, the teacher has to introduce Indigenous sciences to the classroom. The challenge for the teacher introducing Indigenous Sciences is to help the student develop their inner ear to hear the many voices of nature (Cajete, 2000). In Indigenous cultures, the overarching trust in the natural growth of children leads to a trial-and-error approach to learning. Children are allowed to make mistakes in order to learn. The main ethical educational rule is not to give direct advice or criticism. Children learn by close observation and not by being verbally taught. They have to learn to be close observers of nature. Advice is given indirectly in the form of legends and stories because there is a trust in the human consciousness and the ability of students to draw the conclusions that are best for them.

One of the bridges between Western and Indigenous Sciences is the analysis of visual patterns, a strength of both Western and Indigenous Sciences, in the common ground (Stevens, 2000). Ross (1992) identified the ability to take in vast amounts of information from the natural world as pattern-thought. In Indigenous communities Elders have many stored spatio-temporal patterns, critical to a hunter-gatherer society. Pattern-thought depends on an open-minded sensitivity that Ross (1992) claims shuts down in city-dwellers due to an overwhelming and then numbing of the senses. Pattern-thought is a way of knowing that Ross (1992) refers to as a complex reasoning even though the person may feel that it is simply a hunch. This way of knowing is relational, focusing on motion and change rather than things that are static.

Integrative reflects four key elements within the overall framework for integrative science teaching and learning efforts:

1. The acknowledged role of you and me as creatively capable agents in our knowledges, and especially the importance of:
   (a) mindful reflectivity and evolution in our knowing, valuing, and doing
   (b) pattern recognition and expression in our scientific knowledges and ways of knowing (as above).
2. An understanding of our common ground as holders and/or practitioners of different scientific knowledges.

   It is difficult to live in two worlds without adequate bridges between them" (Kawagley, 1995)

3. An understanding of our differences and a respect for them.
4. A recognition of our need to walk and work together in our journeys on Mother Earth.

> The Creator made everything and so we must learn to work together and to hear what the other people has to say too. (Callaghan, 2000)

Cajete (2000) identifies modern eco-philosophy with the ecologically informed Indigenous Worldview. He advises that much can be learned from the Aboriginal collective heritage, which has always been ecologically sophisticated, and a solid underpinning of the sustainable future of humans. One of the challenges is the new technology of education and transmission of information:

> . . . The new knowledge the human race is acquiring does not compensate for the knowledge spread by direct oral transmission, which, once lost, cannot be regained or retransmitted: No book can teach what can be learned only in childhood if you lend an alert ear and eye to the song and flight of birds and if you can find someone who knows how to give them a specific name. (Calvino, 1983, as cited by Nabhan & St. Antoine, 1993, p. 229)

Holistic Curriculum

Ecology is the Western Science that is closest to Indigenous Sciences (Kawageley, 1995). The distinct difference is Spirituality, which is present in Indigenous Sciences but not yet in most mainstream ecology. It is the unification of physical and spiritual knowledge that makes Indigenous Sciences holistic. There is no separation of science, art, religion, philosophy, or aesthetics in Indigenous thought (Battiste & Henderson, 2005).

The word *holistic* comes from the Greek *holon*, which refers to a universe that is made up of integrated wholes that are more than the sum of their parts (Miller, 2007). Holistic curriculum is based on the principles of connection and it attempts to align Integrative Science education with the fundamental processes of nature. Balance is achieved through lessons that use several of the multiple intelligences (Armstrong, 2000). Linear thinking can be balanced with intuition, using metaphors, visualization techniques, and Indigenous pedagogy such as the Medicine Wheel (Lane, Bopp, Bopp, Brown, & Elders, 1984). The body and mind can be connected through movement and dance. Academic disciplines and traditional knowledge can be connected in many ways, such as through the visual arts. Self and community can be connected through a concentration of learning activities in communities outside the classroom. Self and Mother Earth can be connected by helping the learner reestablish himself as part of nature rather than separate from it (Mills, 1990). This often involves a readjustment of the senses and a fine-tuning of the powers of observation.

The appeal of contextual, holistic curriculum underlies the following story from a student in a third-year *MSIT* class:

> Holism and Reductionism
> An Integrative Science student was having trouble making decisions about other science electives that he wished to take to complete his degree requirements. He was going into his fourth year and had successfully completed *MSIT* 101/103 (Sense of Place, Emergence and Participation), *MSIT* 201/203 (Ways of Knowing), and *MSIT* 301/303 (Cycles and Holism). He needed to take a Biology course and this caused a bit of concern, even though many of the major Biology concepts had already been covered in the *MSIT* 301/303 course. I was the professor for this *MSIT* course, so he came to discuss his concerns with me at my home. As we were having tea at the kitchen table he picked up my pepper grinder. He said that I should visualize the pepper grinder as a science course. He said that he loved

pepper in most of his food and that he knew how to use the pepper grinder and what results he could get from different mixes of peppercorns. However, he had no desire to learn how the various gears, rods, and knobs worked and felt that that knowledge may detract him from his enjoyment of the final product. He then compared the pepper grinder to an *MSIT* course where he learned interesting things that honored his ancestors and his culture and that he could use in his intended career (Park Warden). He said that learning the structure of the DNA molecule in the first-year Biology course was like learning the mechanisms of the pepper grinder. He felt that he would suffer because he couldn't get excited about or engage with that subject at that level of detail.

Colearning

For students from Western cultures it is an easier transition into Western Sciences than it is for students from Indigenous cultures because students from Indigenous cultures experience cognitive conflicts between the tenets of the two worldviews (Aikenhead & Jegede, 1999). The principles of Two-Eyed Seeing are used for the process of collateral learning or colearning where Western scientific concepts are constructed side by side with minimal interference and interaction with Indigenous Scientific concepts (Jegede, 1995, 1997). Discrepant concepts are stored in long-term memory as cognitive scenarios (Aikenhead & Jegede, 1999). Ogawa (1995) proposed three types of science: personal (based on personal beliefs and experiences), Indigenous (communal beliefs and experiences of a culture), and Western modern science. He advocated multiscience teaching, emphasizing collateral learning. He pointed out the value of the students' recognition of their own conflicting schema. In Integrative Science, the personal and Indigenous Sciences merge as the Indigenous knowledge collective and Ogawa's three-way view is a two-way view, Two-Eyed Seeing.

Transformative Education in Integrative Science

In transformative learning, the learner and curriculum are seen as connected and the aim of this orientation is development of the whole person. In transformational learning, cooperative problem-solving and the arts are used to help the learner develop various connections that make the education personally meaningful to the student (Miller, 2007).

Transformative education acknowledges that the educational process is one of unequal power relationships and that learners should be active creators of knowledge rather than passive recipients (Royal Commission on Aboriginal Peoples, 1996). This is one of the steps in the healing journey, the path from the cultural loss catalyzed by the residential school experience in a whole generation of Indigenous people. The teacher is a facilitator who can guide the educational process without dominating. Transformative education is contextual. It ties the personal experiences of the student into a larger world of learning and understanding. This educational process is participatory and may take various forms such as experiential learning, research projects, and oral histories. Knowledge is shared among all participants and there is no competitive ranking of performance (Royal Commission on Aboriginal Peoples, 1996).

Creating the Psychologically Soothing Classroom Community

Integral to a holistic education model is creating a community within a classroom and between the class and the community outside the school. In Indigenous cultures, learning is lifelong and

the student's family and community is usually part of the learning process. A culturally safe environment is created within the school by a teacher who is present and mindful to the students (Miller, 2007) and/or to carefully engineered student-friendly surroundings. Communities within a classroom often develop through a cooperative learning strategy where students feel responsible for other students' learning as well as their own. The classroom should be a sanctuary where people feel affirmed (Secretan, 1996, as cited in Miller, 2007). The environment should be one of respect and caring where people feel validated as human beings (Miller, 2007). Creating an Integrative Science classroom that is a sanctuary can be accomplished in part by following these steps (Miller, 2007):

1. Recognize the importance of the nonverbal and the messages that contain so much information. For example, a smile to a child can make her feel welcome. Acceptance of a variety of learning styles creates a suitable learning environment for a diverse class.
2. Pay attention to the aesthetic environment of the school and classroom. Integrative science classrooms should be comfortable, have many healthy plants, and be decorated in warm colors with carefully chosen artwork. The Integrative Science classroom is decorated with various pieces of art from previous classes, which can provide a focus, which leads to a conversation, which leads to a lesson. Lessons reflect what the students see outside the classroom window, concentrating on seasonal changes. The school year starts with September, which is *Wikumewiku's* (mate calling time) in the Mi'kmaq calendar and ends with April, which is *Si'ko'ku's* (maple sugar time).
3. Tell stories about the school and weave stories about present and past students and teachers into the fabric of the present. This mythology generates a shared history or sense of meaning. Story-telling encourages students to engage with the material. In *MSIT* classes puppetry is used to enact traditional legends. Each puppet comes with its own story, which includes the story of how it was made and many stories about previous students who have given it their own voice. Integrative Science teachers embrace the colearning philosophy and each new *MSIT* topic comes with stories from the Elders and stories from other knowledge-holders from the community who have visited the classroom in past years.
4. Use celebrations and rituals to give students a sense of connection to their community and of the changing of the seasons. Community connections are extremely important to provide context for Integrative Science explorations and to provide support to help the students in their learning journey.
5. Value trust and authenticity and make sure that what we say is what we do (i.e., live by our own rules). Secretan (1996), as cited by Miller (2007), says that telling the truth is a significant part of cultivating soul in the classroom.
6. Encourage a nourishing voice where people can speak freely, without fear or embarassment. One way to do this is with the use of learning circles.

Learning Circles

Community can be created in any classroom by following the Indigenous practice of forming learning circles. Students may arrange seats in a circle and pass the feather or stick to indicate who has the floor. The circle can be used to share stories or as a mechanism of problem-solving.

It avoids the problems associated with shy or overly talkative students. The circle is a powerful symbol in Indigenous Science because:

> Everything the power of the world does is in a circle. The sky is round, and I have heard that the earth is round like a ball, and so are all the stars. The wind, in its greatest power, whirls. Birds make their nests in circles, for theirs is the same religion as ours . . . the life of a (person) is a circle from childhood to childhood, and it is in everything where power moves. (Black Elk as cited in Cajete, 2000, p. 281)

CHALLENGES IN TEACHING INTEGRATIVE SCIENCE

There are four key challenges in teaching Integrative Science in the standard classroom and they are largely related to the respectful presentation of the Indigenous Worldview.

The first challenge relates to spirituality. Indigenous Sciences have spirituality at their core, which may be difficult to treat sensitively in the conventional classroom. As a first step toward incorporating spirituality, students can be taught to respect their environment. In an Indigenous Worldview, spitituality is demonstrated by respect and by an acknowledgement of the place of humans in the cosmos. The elements of Mother Earth (i.e., the four-leggeds) have rights and humans (the two-leggeds) have responsibilities. For example, the four-leggeds have the right to live in an environment that has clean air to breathe and the two-leggeds have the responsibility to ensure that the air is not made unclean by any of our actions.

Native spiritually must have a place in the Integrative Science classroom. Regular participation in a smudging ceremony indicates respect and positive intent, the first step in effective learning. In *MSIT* classes the beginning of term is marked by a smudging ceremony and a talk by a Mi'kmaq spiritual leader outlining how we respect Mother Earth. Respect for Mother Earth is shown by carefully considered lab protocols. Every sample that is taken for study is either examined and then returned to the collection site or is damaged by the examination. If the damage is fatal, the student must thank Mother Earth by offering a gift of tobacco and ensure that the knowledge gained by the sacrifice is valued. Careful consideration must be given for every sample that is taken.

The second challenge relates to knowledge development. Indigenous Sciences are a living knowledge that requires less dependence on knowledge transfer from books and more on knowledge "gardening" with living knowledge-keepers. This transfer is expedient because the Elders are passing away without having the opportunities to pass along their knowledge. Knowledge-gardening in the classroom is accelerated by the inclusion of community members such as Elders and other resource people. Students will become more engaged when a teacher incorporates project-based learning using issues of interest to the students, their Elders, and their communities. Students and teachers will colearn as big-picture understandings develop.

The third challenge relates to the availability of classroom resources. There is an emphasis in Indigenous Sciences on "change, wholeness, and balance," whereas Western Sciences emphasize knowledge that is compartmentalized into disciplines. There is a dearth of curriculum materials related to wholeness, although that is slowly changing. Teachers who recognize disciplinary fragmentation in curriculum and textbooks must try to connect subjects on their own or let the pieces "fall where they may" (Wineburg & Grossman, 2001). Aboriginal learning concepts and

pedagogy (circle of learning, journey of life) are fundamental to growing understandings of change, wholeness, and balance.

The fourth challenge relates to the lack of connection between many students and their natural environment. This impoverished personal understanding of nature is something that can be stimulated, particularly in the earlier grades when natural curiosity remains unencumbered by peer pressure. To sharpen their interest and their powers of observation, teachers can provide many out-of-doors learning activities for students. The students need to be able to see the patterns in nature and recognize them as patterns. A rekindled interest in the natural world that surrounds them takes a different form with each student, as described in the following story from an *MSIT* class.

> *Tmgwatignej*: Now in Their "Field of View"
> Last year I had a very small class for *MSIT* 301 (Cycles and Holism). In the class were a pair of students who traveled to campus together and who had been best friends since elementary school. They loved the "Birds" theme in September, learning bird songs and adding a species to their lists almost daily with a lot of enthusiasm. Although they usually showed up on time for class, when mid-term time rolled around they were over an hour late. They arrived as I was packing up to leave, explaining that they had seen the "Stakedriver" with their own eyes as they drove from the reserve in Eskasoni along the shores of the Bras D'Or lakes to the campus. The Stakedriver is an English nickname used for the American bittern (in Mi'kmaq: *Tmgwatignej*) because of the noise that the male makes during mating season and it is a name that piqued their interest about the bird. They said that they were so excited to see the bird that they stopped their car in the middle of the road and crept down to the shoreline with their telescope, causing a line of cars to stop and watch. I was curious about the telescope, thinking that they carried it in their trunk to help them with their bird list assignment. "No miss, it was the telescope on our rifle." Horrified, I said, "You didn't shoot it, did you?" "Of course not, miss; we just looked at it." After the bird flew away, an impromptu discussion was held on the road about the significance of the sighting. Those students and all of the drivers who stopped behind now are engaging a bit more with their own natural surroundings and its seasonal visitors.

SUMMARY

Inherent in the Two-Eyed Seeing approach is a respect for different worldviews and a quest to outline a common ground while remaining cognizant and respectful of the differences. Two-Eyed Seeing, which has been successfully applied to Integrative Science education at Cape Breton University, is a powerful model for all human discourse.

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