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TITLE

Integrative Science: Enabling Concepts within a Journey Guided by Trees Holding Hands and Two-Eyed Seeing

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Abstract

This paper is an umbrella narrative for our decade long journey of bringing together Indigenous and Western sciences and ways of knowing, an on-going journey we call “Integrative Science” (IS) which is guided by the wisdom of “trees holding hands” and principle of “Two-Eyed Seeing”. We outline key emergent, enabling concepts for an IS post-secondary science program at Cape Breton University (CBU) and an Integrative Health and Healing (IHH) research project, including the view of science as “dynamic, pattern-based knowledge” (which allows explorations as to how different cultures shape and share knowledge stories). We hope these understandings can help others.

Trees Holding Hands: Introductory Wisdom

The award of the new Canadian Council on Learning (CCL) Aboriginal Learning Knowledge Centre was announced by Dr. Paul Cappon (President and CEO, CCL) at the national Aboriginal Policy Research Conference in Ottawa in late March 2006 and included wisdom from an unnamed Mi’kmaq Elder. Based on our own understandings (explained later), we recognized this wisdom as that of the late Mi’kmaq Spiritual Leader, Healer, and Chief Charles Labrador of Acadia First Nation, Nova Scotia. The wording we use (Dr. Cappon’s differed slightly) is: “Go into the forest, you see the birch, maple, pine. Look underground and all those trees are holding hands. We as people have to do the same.” (Kierans, 2003). This wisdom urges us towards knowledge inclusivity, something we (Aboriginal and non-Aboriginal) in Cape Breton, Nova Scotia, have been working towards such since the mid-1990’s. Our efforts have focused on bringing together Indigenous sciences and ways of knowing with Western sciences and ways of knowing, beginning in the post-secondary science education arena and then expanding to the science arenas of research, applications, and outreach to youth and community.

The umbrella narrative that we provide herein of this experiential journey of applied research and learning allows us to outline the emergent, key enabling concepts as we have come to understand them. They are stated simply with the intent of being easily understood, in hopes that they will be adopted elsewhere and thus, help facilitate a broad, new consciousness with

respect to science in diverse arenas relevant to Aboriginal peoples and all Canadians. We use two major achievements as markers of our journey, namely “Integrative Science” (IS) and “Integrative Health and Healing” (IHH). These have reciprocally informed each other through us, and thus our narrative entangles them somewhat. We intend to address, in other papers, various theoretical, pedagogical, or philosophical issues arising from these enabling concepts.

Our rationale for this approach lies in at least five indicators that point to a particularly compelling urgency for our understandings to be broadly shared, now. First, CCL has recently used headlines such as “The cultural divide in science education for Aboriginal learners” (CCL, 2007a) and words such as “a clash of cultures and viewpoints is discouraging young Aboriginal people from pursuing science and engineering education” (CCL, 2007b); we have favoured an approach of “working together while seeing the strengths in each”. Second, a key phase of our journey was funded by CIHR-IAPH (Canadian Institutes of Health Research – Institute of Aboriginal Peoples’ Health), an entity whose new and renewed “vision, mission and value statements reinforce the importance of the view that Aboriginal knowledge - both traditional and contemporary - can complement Western science in developing strategies to improve health” (IAPH, n.d.). Third, SSHRC (Social Sciences and Humanities Research Council) of Canada provided the first key funding for our journey and deserves credit as CCL enters the terrain. Fourth, NSERC (Natural Sciences and Engineering Research Council) of Canada is also now contemplating actions with respect to Aboriginal science education. And, fifth and significantly, we receive numerous requests for media copies of our understandings upon sharing them in local to international venues. People generally indicate that such would greatly facilitate their own efforts and these requests tend to reflect four broad categories of interest. These are: (1) natural resource planning and management initiatives with and by Aboriginal communities; (2) human health and ecosystem health research, especially those with and by Aboriginal peoples; (3) Aboriginal science education ventures; and (4) transformational learning and environmental education for sustainable ecosystem initiatives.

Connecting Trees Holding Hands to Two-Eyed Seeing

We are confident in making the above recognition with respect to Chief Labrador's wisdom as voiced by Dr. Cappon because we also chose his wisdom when initiating an important new phase within our own learning venture (Author Cheryl Bartlett was also in the audience at the time of Dr. Cappon's announcement). This phase was the aforementioned IHH; it involved Mi'kmaq Elders and university-based educators and researchers working together within an Aboriginal community-based, participatory action, health research project funded by CIHR-IAPH. IHH was launched at a workshop in Eskasoni First Nation in January 2004 (Paul 2004) and ended, some eight workshops and numerous sub-projects later, in October 2006. The full project title was "Integrative Health and Healing: co-learning our way to expanding wholeness through restoration of relationships with the land" and the overall project objective was to create a co-learning journey for different perspectives about health. The project's steering committee (six people, including the three authors) felt that Chief Labrador's wisdom was ideal and thus used it throughout the project's three years. Today, we continue to highlight it at conferences and workshops. Our wording comes via an interview (Kierans, 2003) with the Chief's son Todd in which he quotes his Father's wisdom and also says: "Everything I do, I do with respect. Father used to say, believe in all people. It's not we and them. It's us". In Fall 2004 within IHH, Author Albert Marshall proposed "Two-Eyed Seeing" as a guiding principle for thoughts, values, and actions that can manifest "it's us" consciousness. We further explain Two-Eyed Seeing later in this paper.

IS pre- and postdates IHH. It is our on-going initiative at Cape Breton University (CBU) in which university scientists and Mi'kmaq individuals are stewarding a new approach to post-secondary science education (Berkowitz 2001). From its origins in that educational arena in the mid 1990's, IS has expanded into other broad science arenas. Today, Two-Eyed Seeing and a view of science as "dynamic, pattern-based knowledge" are key to all IS activities. Our IS journey with its enabling concepts towards these forms the remainder of this paper.

Visioning and Beginning: Integrative Science (IS) Emerges and Succeeds

A vision that one day the educational mainstream would recognize Indigenous science alongside Western science has been nurtured by various members of the Mi'kmaq Nation for a long time, and it is a vision shared with many of the world's other Aboriginal and Indigenous peoples. For Author Murdena Marshall, this vision has been an important life aspiration and focus (Hunter, 2001). It is not surprising, therefore, that the "Integrative Science" (English) or "Toqwa'tu'kl Kjjijitaqnn" (Mi'kmaq) academic degree program came into existence at CBU, the university where Author Murdena Marshall was an Associate Professor of Mi'kmaq Studies and the institution that is home to more Mi'kmaq students than any other post-secondary institution in Canada. Two factors prompted us to create IS:

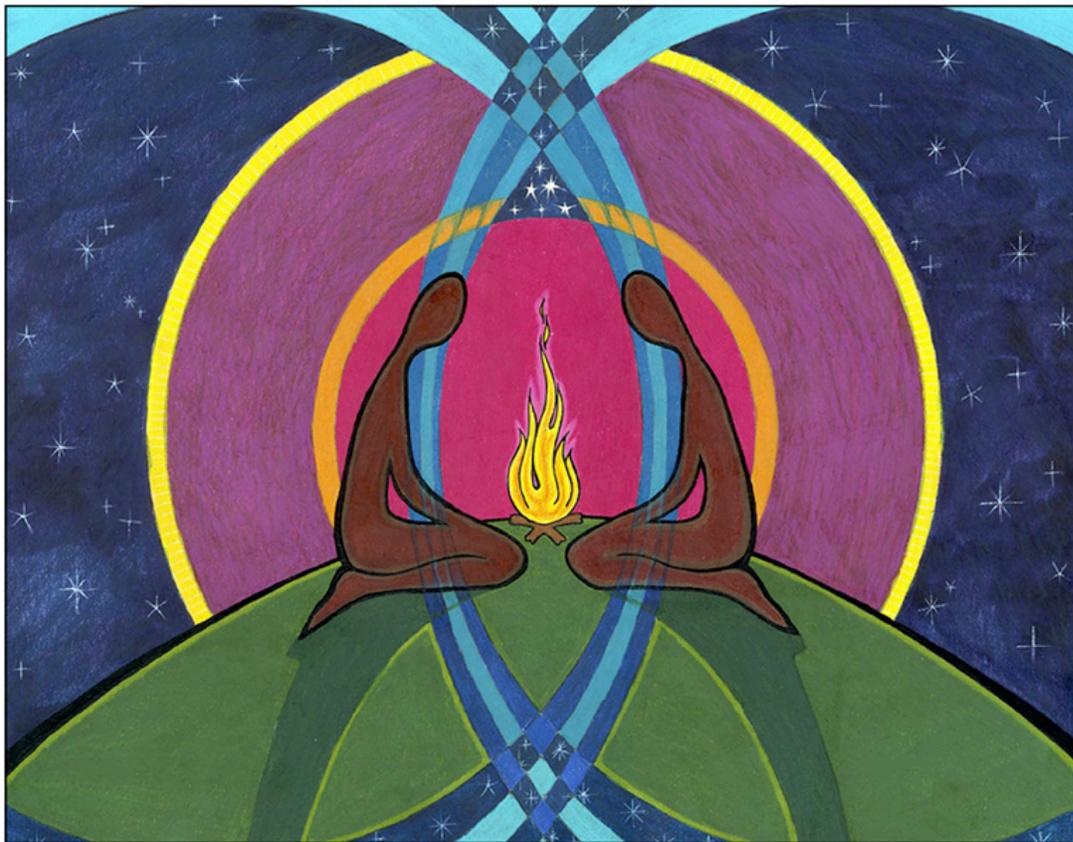
- 1) the almost total absence of Mi'kmaq students in science and science-related programs, including the failure or drop-out within a few months by those who did begin [note: dramatic under-representation of Aboriginal peoples is seen in science education and science careers across Canada (CASTS n.d.; CCL, 2007a), and
- 2) the failure within the science community to acknowledge Indigenous knowledge in science or science-related curricula.

Mi'kmaq community members felt that action towards reversing the second of the above could serve as an essential, concurrent step to address the first. In other words, it was felt that culturally inclusive curricula would help attract and retain Aboriginal students into and within science, as CCL is now suggesting for consideration (CCL, 2007a). Thus, in late 1996, a few key people (especially the three authors) from community and university came together to work on a proposal for IS as a concentration within CBU's Bachelor of Science Community Studies (BScCS) degree. On 19 June 1997, the proposal was submitted to CBU administrators with its cover letter signed by Author Murdena Marshall. Two years later, on 25 June 1999, CBU's Board of Governors approved the IS proposal and it was immediately submitted by the university to the Maritime Provinces Higher Education Commission (MPHEC), an agency of the Council of Maritime Premiers that "assists institutions and governments in enhancing a post-secondary learning environment that reflects the values of quality, accessibility, mobility, relevance,

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accountability, scholarship, and research” (MPHEC, n.d.). On 5 February 2001, MPHEC approved the IS program. At this point, IS became the third concentration within the degree, after “Biodiversity” and “Psychology, Health, and Environment”. The BScCS, a new four year and 120 credit degree, had been approved in concert with the Biodiversity concentration in December 1997; in other words, at the time that IS first came before MPHEC, the new degree structure that was to house it had already been approved.

Figure 1: Integrative Science visual, from original painting by artist Basma Kavanagh



At the time of its inception and inquisition, IS was a globally unique academic program; it still is and, furthermore, has now expanded to include science research, applications, and outreach to youth and community. We frequently explain our vision with the aid of a visual (Figure 1) by artist Basma Kavanagh that shows two people facing each other while kneeling

before a sacred fire of mutual trust and shared learning. Through these actions, the two spheres of their respective world views are brought together to generate an expanding ground of common understanding and a deepening respect for differences. In the painting, the whole of this effort may be seen as held in the talons of Eagle, a spiritual guide of great traditional significance for many Aboriginal peoples. The observation of Eagle was brought forward by Elder Jane Meader (Mi'kmaq Nation, Membertou Band) and the artist herself was delighted to learn of this. We have stylized Figure 1 as the logo (Figure 2) for our recently established Institute of Integrative Science & Health (IISH) at CBU, which stewards Integrative Science principles, approaches, and practices via Two-Eyed Seeing for Aboriginal and non-Aboriginal peoples alike (IISH, n.d.).

Figure 2. Logo for Institute for Integrative Science & Health at Cape Breton University, based on original painting in Figure 1 by Basma Kavanagh.



The four foundational, conceptual ideas for IS as post-secondary science were:

1. bring Indigenous and Western scientific knowledges and ways of knowing together in the science curriculum,
2. teach in an integrated way the knowledges from various disciplines within the Western natural sciences (especially cosmology, physics, chemistry, geology, and biology),
3. include consciousness as a central curricular topic, and
4. employ a holistic pedagogy that emphasizes all aspects of being human, namely the physical, emotional, cognitive, and spiritual.

We recognized at the outset that new, customized science courses would be needed as vehicles to implement these ideas; this was achieved by creating new courses given the label “MSIT”, a Mi’kmaq word meaning “everything together”¹. IS sees students take eight compulsory MSIT science courses over their four years: four in first year, two in third year, and two in fourth year. All MSIT courses are 3 credits (or ½ yr courses) and, as science courses, they have both lecture and lab components. MSIT courses are open to all qualified students, regardless of ethnicity or degree program and the IS program itself is similarly open.

In addition to MSIT courses, students in IS also take regular courses (for a total of 120 credits) in chemistry, mathematics, environmental studies, Problem Centred Studies, Mi’kmaq Studies, philosophy, effective writing, statistics, communication, and business, plus electives of their choice according to their career interests. Furthermore, students must also complete two science work placements (each 120 hours, voluntary or paid). Additional information about the BScCS degree structure and requirements for the IS program are available at IISH (n.d.).

As institutional approval for IS was slowly progressing (1997-2001), the program’s first students, from Mi’kmaq communities in Cape Breton, quietly started their studies (as a pilot offering) in September 1999. Between 1999-2007 and as a result of IS in conjunction with MSAP as a companion recruitment initiative², the numbers of Aboriginal students in science at CBU have changed dramatically, going from near zero to about 115 Mi’kmaq students who have experienced a first year of post-secondary science. About half of these 115 have continued at CBU beyond first year, some choosing to remain within the IS program, some transferring into

other science and science-related programs, and some transferring into arts or business programs. An informal internal survey at CBU in January 2007 revealed 48 Mi'kmaq individuals who could be considered "graduated, enrolled, and/or paused with intent to return" within science and science-related programs at the institution; 44 of these have had some formal affiliation with IS. As of Spring 2006, we have seven graduates from BScCS Integrative Science and we anticipate an additional four in Spring 2007 or 2008. Also, there are two graduates from other science (BSc Biology) and two from science-related (BSc Nursing) programs who started via IS-MSAP. Some graduates are working in community; others are in BEd or BScN programs and some are seeking entry to professional health sciences such as medical school or pharmacy. Moreover, between 2000 and 2005, NSERC approved 13 Aboriginal USRAs (undergraduate student research awards) for Mi'kmaq students in CBU's IS program (representing 13-33% of the national total of such awards at various times).

Overcoming Challenges in Teaching IS: Early Emergent Concepts

Dr. Gregory Cajete (native American scientist and educator, University of New Mexico) made the following statement "The teaching of science from only one cultural perspective and in the partialistic manner that dominates science education continues to be the central dilemma of science education today" (1986, p. 221). Thus, "how" was the first major challenge immediately encountered in creating and teaching the new MSFT science courses within the IS program. In this regard, the conceptual parents of IS had no programs elsewhere that could be looked to as models given the unique nature of IS as a four year post-secondary science degree program. Strength and inspiration were found in the "Spirit of the East" (Wjipenuk Etek Lnuimlkikno'ti) whereby "the East is, through its association with the sunrise, a place of beginnings and enlightenment, and a place where new knowledge can be created or received to bring about harmony or right relations" (Calliou, 1995). The conceptual parents found further strength in knowing that science as a way of knowing (regardless of the culture or world view) is dependent upon transformational consciousness towards thinking in new ways (Doyle, 2001). In Fall 1999, with the presence of the first students in the program's MSFT courses, we simply followed the

personal advice of Dr. Cajete to “just start, have the courage to learn by doing, and emphasize creativity”; in retrospect, it was perfect.

Beyond the challenge of being the first to implement such a post-secondary science program, we acknowledge four other key challenges in teaching IS, namely, that:

- 1) Indigenous science has spirituality at its core or heart, whereas spirituality is said to be absent in Western science;
- 2) Indigenous science is a living knowledge, whereas Western science education is heavily book-based;
- 3) emphasis in Indigenous science is “change, wholeness, and balance”, whereas Western science focuses on parts and emphasizes practitioner specialization;
- 4) today’s students are very familiar with computer-mediated entertainment and communication but tend to have impoverished personal understandings of nature, in other words, the subject of scientific knowledges, regardless of world view.

We have met these challenges by way of a multi-piece approach which we summarize below (those marked “*” are elaborated somewhat, later):

- 1) create numerous and diverse out-of-doors learning experiences;
- 2) involve community Elders, resource people, organizations, and workshops or other events, as appropriate, and as much as possible;
- 3) employ project-based learning using issues of interest to students either personally or to their communities;
- 4) use the ever-growing literature on traditional ecological knowledge and other published or multi-media information on the Indigenous sciences;
- 5) use Aboriginal learning concepts and pedagogy, as appropriate (e.g., Circle of Learning and Journey of Life);
- 6) teach in an integrated manner the major disciplines of Western natural science, namely cosmology, physics, chemistry, geology, and biology plus, as possible and appropriate, understandings from neuroscience and consciousness studies;
- * 7) employ an overall “integrative framework”;

- * 8) be prepared to co-learn with students, Elders, and others in community, and elsewhere;
- * 9) employ “Two-Eyed Seeing” as a guiding principle; and
- * 10) view “science” as “dynamic, pattern-based knowledge” and employ a conceptual framework involving pattern which embeds teaching and learning using the multiple human intelligences.

Doing Integrative Science: An “Integrative Framework” for Applied Research and Learning

We use the word “integrative” in IS and also below in outlining an “integrative framework”. This captures our intent that Indigenous science and Western science each be considered distinct and whole, plus the fact that our efforts in bringing them together, as we work together, are ongoing and ever evolving. In this sense our efforts are animate. We do not use “integrated” as it might suggest a finished job (in other words, one that is now inanimate) and, furthermore, it might also suggest that the two systems are being merged into one; we do not intend either of these possibilities. Our integrative framework, guided by Two-Eyed Seeing, contains four key elements for IS applied research and learning efforts, as below:

- 1) the acknowledged role of you and me as creatively capable agents in our knowledges, and especially the importance of:
 - mindful reflectivity and evolution in our knowing, valuing, and doing, and
 - pattern recognition, transformation, and expression in our scientific knowledges and ways of knowing;
- 2) an understanding of our common ground as holders and/or practitioners of different scientific knowledges;
- 3) an understanding of our differences and a respect for them; and
- 4) a recognition of our need to walk and work together in our journeys on Mother Earth.

Stephens (2000, p.11) at the University of Alaska at Fairbanks has developed a concept map that we find particularly helpful for IS purposes in that it uses an easily understood format to portray the common ground and differences, as per points 2 and 3 in our integrative

framework. We are also heartened by Stephen's Venn diagram format which resonates with that in our IS visual (Figure 1). We frequently point interested others towards this map, realizing it would have greatly facilitated our efforts had it been available in the mid 1990's when we conceptualized IS. Other key resources we frequently recommend are and Bopp et al. (1984), Cajete (1995, 1999a, 1999b, 2000a, 2000b), and Underwood Spencer (1990).

Enriching Integrative Science: “Eleven Lessons Learned for Co-Learning” as Protocols for IS Applied Research and Learning

In October 2002, the Canada Research Chairs (CRC) program awarded Author Cheryl Bartlett the Tier 1 Canada Research Chair in Integrative Science. The first research project we then pursued was the aforementioned IHH co-learning initiative involving university researchers and Cape Breton's Mi'kmaq Elders. This three year project had two main goals, namely: (1) to find ways to bring the vigour language and understandings of the Indigenous sciences together with the rigour language and understandings of the Western sciences within the context of (2) seeking ways to revitalize traditional Mi'kmaq understandings about inter-connectiveness in the cosmos, towards relevancy in the lives of today's children. The project focused on fostering root level growth for healthy living and healthy communities by emphasizing nature, creative relationship, and creative choice as elements in the life paths of children. Thus, activities were created to help foster a child's sense of place, emergence and participation within nature and thus, to contribute to their expanding sense of wholeness within environment (family, community, and ecosystem). Known collectively as “Toqikutimk” (growing together), these activities included, for example, puppetry using puppets made of bark, twigs, moss and other forest materials for characters in Mi'kmaq legends; sunflower growing projects to enable learning about reciprocities within relationships; and ecosystem moon cycle posters (Bartlett et al., 2004; Christie, 2006; IISH, n.d.). As mentioned, the project's guiding wisdom was that of the late Mi'kmaq Chief Charlie Labrador which encourages a deep working together of different peoples and their knowledges. In this regard, the project identified “eleven lessons learned for

co-learning” that we propose herein as protocols for IS guided by Two-Eyed Seeing. In brief, these are:

- 1) Acknowledge we need each other.
- 2) Acknowledge we are on a learning journey ... and more: a co-learning journey.
- 3) Learn to co-learn: employ a simple integrative framework.
- 4) Help institutions of higher learning to help community make Indigenous Traditional Knowledge real *in the minds of youth* (and many others), realizing that universities convey an intellectual authority with which Elders and other Traditional Knowledge Holders may not be able to compete, given today’s complex, multi-media world.
- 5) Work with agendas that can respond to the group’s emergent relational consciousness, expanding understandings, and ever changing circumstances.
- 6) Use organic language (e.g. community capacity growing), as possible, while also acknowledging the pervasiveness and utility of mechanistic and/or architectural language (e.g. community capacity building).
- 7) Do ... in a creative, grow forward manner.
- 8) Think “knowledge gardening” more than knowledge translation, transfer, or exchange.
- 9) Navigate the co-learning journey by weaving back and forth between our knowledges.
- 10) Navigate our weaving via awareness of “big patterns” (knowledge orientations or maps) while recognizing that there is much beyond the poignancy of their simplicity. We describe four such big patterns later.
- 11) Make visual our words, our knowledges, our understandings, our stories, and our guiding principles: use metaphors and pictures. “Trees Holding Hands”, “Two-Eyed Seeing”, and “big patterns” are examples.

Sustaining the Integrative Science Journey: “Two-Eyed Seeing” as a Guiding Principle

Two-Eyed Seeing is the descriptive label for an important guiding principle for one’s journey while here on Mother Earth. Author Albert Marshall offered this principle to IS in 2004, six years after the IS academic program took in the first students, two years after the award of the CRC, and one year into our IHH project. He gives voice to the gift in explaining that it refers to

learning to see from one eye with the strengths of (the best in) Indigenous knowledges and ways of knowing, and from the other eye with the strengths of (the best in) Western knowledges and ways of knowing, and to using both these eyes together, for the benefit of all. Thus, Two-Eyed Seeing intentionally and respectfully brings together our different knowledges and ways of knowing, to motivate people, Aboriginal and non-Aboriginal alike, to use all our gifts so we leave the world a better place and not comprise the opportunities for our youth (in the sense of Seven Generations) through our own inaction. Two-Eyed Seeing emerges from within and then reflexively guides the IS protocols outlined above.

To add to our previous explanation with respect to use of the word “integrative” and within the context of Two-Eyed Seeing: we recognize the distinct and whole nature of the Indigenous eye and of the Western eye while asking that they work together. Two-Eyed Seeing recognizes that in a particular set of circumstances we may choose to call upon the strengths within Indigenous sciences, and in another set of circumstances we may choose to call upon those within Western sciences. Thus, it will often require the aforementioned “weaving back and forth” between knowledges. To facilitate this, we propose four important “big pattern” landmarks (explained later). Two-Eyed Seeing intentionally seeks to avoid portraying the situation as either “a clash of knowledges” or “knowledge domination and assimilation”. We recognize that Indigenous Science draws upon Tribal Consciousness, while we also recognize that the latter tends to be negated by too much formal education and that our times place an overwhelming emphasis on formal education. We must, therefore, be diligent in taking the best from our two worlds: Indigenous and Western. We recognize that Western Science privileges objectivity and de-emphasizes the human element, yet we depend heavily upon it and its technologies in our modern lives. Nevertheless, for the benefit of all humans, our times need to learn to factor the human element into science and to rediscover our humility as but one species on the planet (A. Marshall, 2005; M Marshall, 2005). The Indigenous knowledges and ways of knowing have deep strengths and numerous insights in this regard and, through our Two-Eyed Seeing approach, these can be recognized and applied. Two-Eyed Seeing emphasizes that it is very important for all Aboriginal children and youth to be nourished with their culture’s knowledge, while also having opportunities to learn those of the non-Aboriginal mainstream.

Indeed, all Canadian children, Aboriginal and non-Aboriginal alike, should have such opportunities to learn Aboriginal and non-Aboriginal perspectives and stories.

Two-Eyed Seeing has substantial utility beyond the classroom. With respect to community workshops and other common aspects in a PAR (participatory action research) process, for example, Two-Eyed Seeing encourages acknowledgement of the necessity of formal structure permeable to and receptive of new understandings and opportunities, in other words understandings associated with “Spirit of the East” which brings the “gift of newness, of transformation”. Thus, we need to be able to shift our views of a printed agenda or other document such that it is “living”, in other words capable of responding to the energies in the present moment (with its encompassed past and future) rather than being seen as a rigidly enforced document incapable of “being and becoming”. Our efforts must be able to respond to emergent relational consciousness and collectiveness within an understanding of, for example, health and wisdom as expanding senses of wholeness within Creation.

The power and utility of Two-Eyed Seeing as a guiding principle is evidenced by the fact it has been and is being adopted by others, e.g. as one theme within the Mi’kmaqey Debert project of the Confederacy of Mainland Mi’kmaq (CMM, n.d.), as the theme for the 7th national conference of the Canadian Aboriginal Science and Technology Society (CASTS, 2005) as well as the 2007 ManOMin watershed conference of the Rainy River First Nations and Rainy River Watershed Program (ManOMin, 2007), as the structuring motif for a Master of Landscape Architecture by Pendl (2006) at the University of British Columbia, and as the approach for various collaborations involving Mi’kmaq communities in Nova Scotia, the Mi’kmaq College Institute (MCI) and IISH at CBU; Lindsay Marshall, Associate Dean, MCI (personal communication, March 28, 2007) verified this.

Understanding Science as “Dynamic, Pattern-based Knowledge” and Using a “Pattern Conceptual Framework”

Based on the numerous applied learning and research aspects within our experiential journey of IS, we use an innovative view of science as “dynamic, pattern-based knowledge shared through stories about our interactions with and within nature”. This view acknowledges that different cultures may shape and share their stories in different ways by using few or many of the multiple intelligences (“pattern smarts”) of humans. For example, of the nine intelligences recognized by Gardner (1983, 1993, 1998, 1999), Western science tends to privilege logical-mathematical and linguistic intelligences. Holistic sciences, such as those of many Aboriginal and other Indigenous peoples, tend to further draw upon the interpersonal, intrapersonal, musical, body-kinesthetic, spatial, naturalistic, and existential intelligences, as well as the spiritual; the latter was considered but not definitively proposed by Gardner (1998).

In considering science as “dynamic, pattern-based knowledge” we have also developed a “pattern conceptual framework” that explicitly seeks to empower IS learners, practitioners, and others by enabling exploration of how we shape and share our science stories, and to enable transit of pedagogy and praxis across the boundaries of methodologies, disciplines, and world views. We use this framework in conjunction with our broadened view of science to also assist diverse others to see the essential first light of new understanding. It is a simple, three-piece, iterative approach emphasizing “pattern recognition, pattern transformation, and pattern expression” that draws upon our multiple human intelligences. The three pieces are:

- 1) Recognition: Observation of “external natural pattern” is sensory, drawing upon sanctioned or privileged perspectives from methodologies, disciplines, or world views contextualized by mimesis (subject-subject participatory reciprocities) or alterity (subject-object causal relationships).
- 2) Transformation: Interpretation is poietic, drawing upon sanctioned or privileged intelligences to yield “internal ideal pattern”.
- 3) Expression: Communication is kinetic, pulling the internal ideal out as “external abstract pattern,” again drawing upon sanctioned or privileged intelligences.

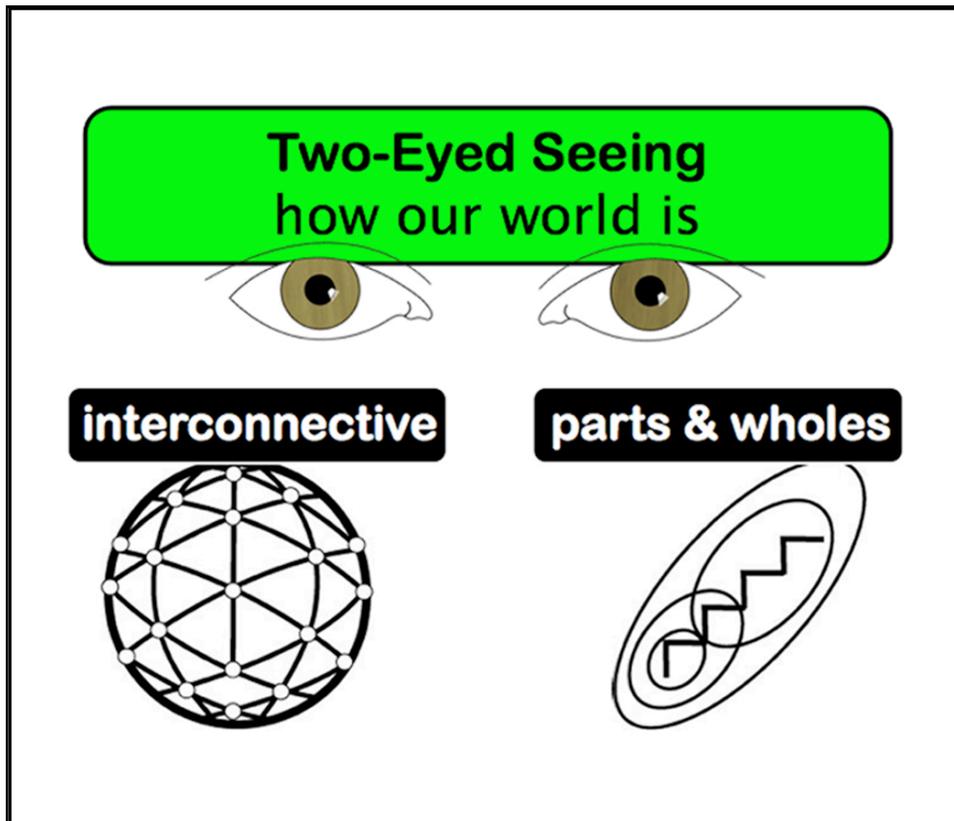
This is SSHRC-funded research by Author Cheryl Bartlett working with a larger group of

students, a post-doc, and Mi'kmaq Elders (especially Author Albert Marshall and Author Murdena Marshall). Two examples of our research were presented at the 4th International Conference on Imagination and Education: “relationships among Grandfather Sun, Mother Earth, and the human knowledge participant” (Lefort et al., 2006) and “relationships among plants and the human knowledge participant” (Kavanagh et al., 2006). The on-line papers for these presentations illustrate our pattern conceptual framework and its use. In addition, the lab exercise in the first year MSFT course in CBU’s IS program that draws upon the ideas in Lefort et al. (2006) is available on our website (IISH, n.d.); Kavanagh et al. (2004) presents different content for the relationships idea in Lefort et al. (2006).

Navigating Our World Views: “Big Pattern” Knowledge Landmarks

We have developed synopses and visuals of four “big patterns” to facilitate knowledge recognition, inclusion, and navigation, as per the “weaving back and forth” between Indigenous and Western perspectives that is required in applying IS in accord with Two-Eyed Seeing. In articulating these, we use the broad categories of “Western” and “Indigenous” pragmatically, invoking simple extremes in an intentional effort to encourage cognitive fluidity. Our four big patterns are identified and described below. Each has an accompanying figure which we commonly use during workshop or conference presentations, in accordance with our intent to “make visual” our efforts (point #11 in our protocols).

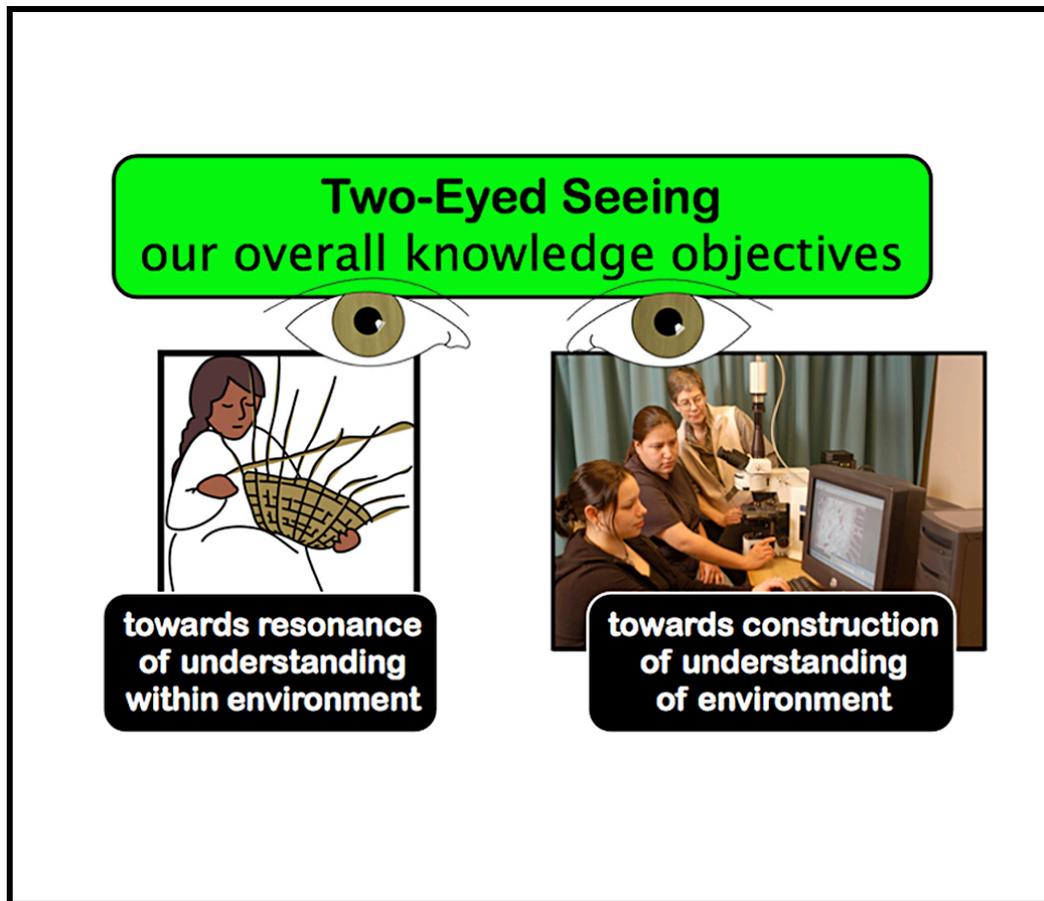
Figure 3. “Our World” big pattern for Two-Eyed Seeing navigation for Integrative Science purposes



1) Our World (Figure 3): We share a desire for our knowledges to have an overarching understanding of “how our world is”, albeit with differences as to the version seen: Indigenous as “interconnective”, and Western as “parts and wholes, systems and emergences”.

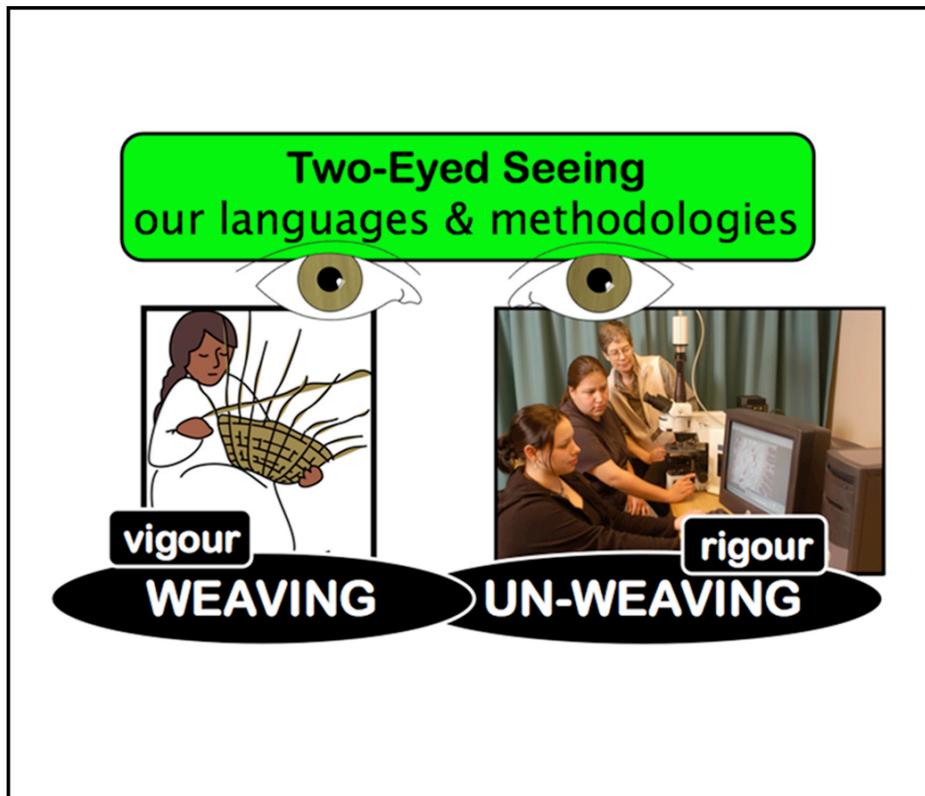
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Figure 4. “Our Overall Knowledge Objectives” big pattern for Two-Eyed Seeing navigation for Integrative Science purposes



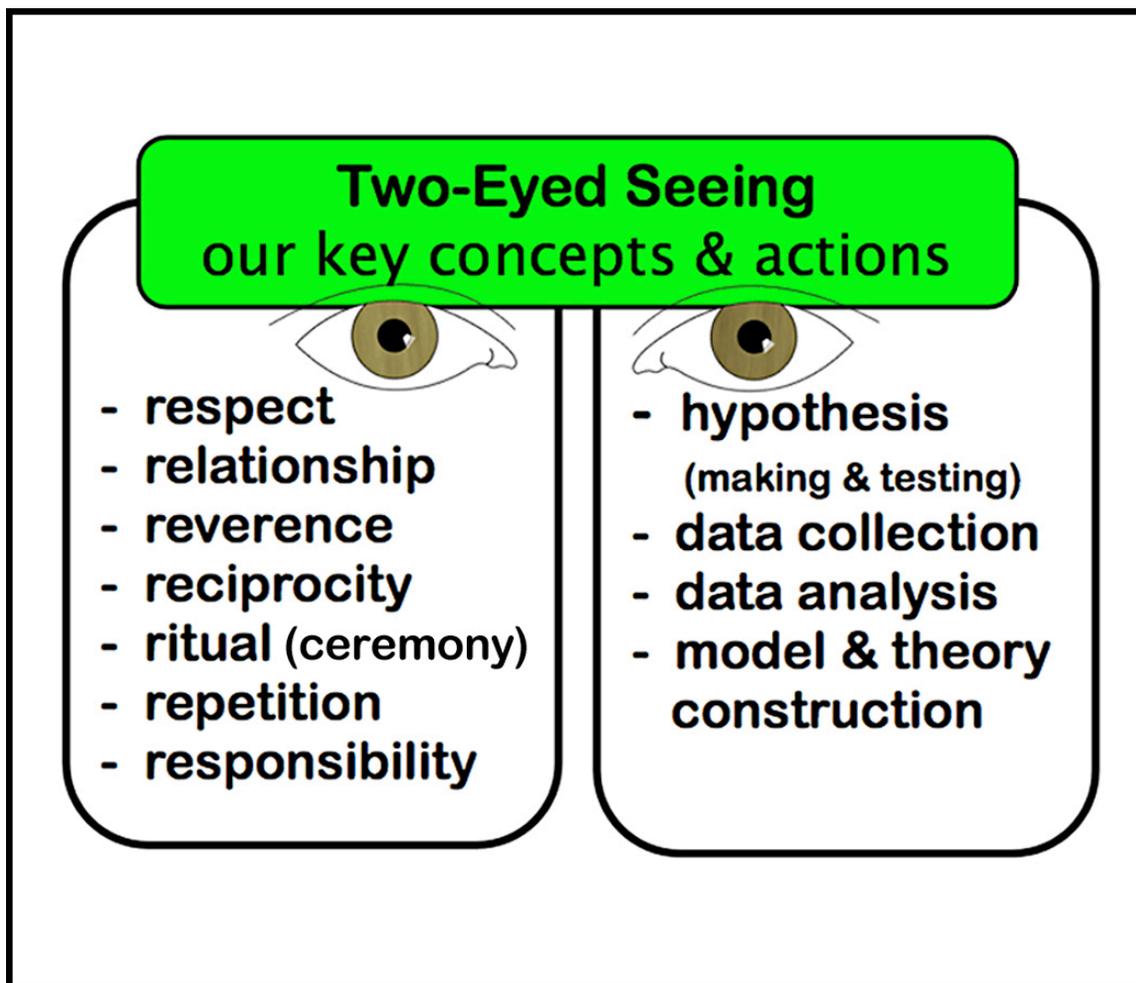
2) Our Overall Knowledge Objectives (Figure 4): We share a desire for our knowledges to have “overall objectives” albeit with differences as to what: Indigenous as “towards resonance of understanding with and within environment” and Western as “towards construction of understanding of environment”.

Figure 5: “Our Languages and Methodologies” big pattern for Two-Eyed Seeing navigation for Integrative Science purposes



3) Our Languages and Methodologies (Figure 5): We both identify key words for “our language and methodology” albeit with differences as to what: Indigenous as “vigour and weaving” of patterns within nature’s patterns (via creative relationships and reciprocities among life, love, and the land) and Western as “rigour and un-weaving” of nature’s patterns to cognitively reconstruct them (via analytic logic and mathematical language).

Figure 6: “Our Key Concepts and Actions” big pattern for Two-Eyed Seeing navigation for Integrative Science purposes



4) Our Key Concepts and Actions (Figure 6): We both identify “key concepts and actions” for our language and methodology albeit with differences as to what: Indigenous as “respect, relationship, reverence, reciprocity, ritual (ceremony), repetition, and responsibility” (Archibald, 2001) and Western as “hypothesis making and testing, data collection and analysis, and model and theory construction”.

We find that examples of “patterns within nature’s patterns” help first time listeners grasp this within concept #3 above. One such is the Mi’kmaq story of the changing night sky and earth’s landscape over a full year in which specific stars are birds who hunt and kill a bear and bear’s blood drips on one of them who shakes such that shaken blood is everywhere and reddens the trees (Dudding, 2003). These observational relationships are relevant to particular ecosystems at particular latitudes; they would not hold, for example, in either southern Alberta or the high Arctic. This illustrates how Indigenous science is grounded in “sense of place, emergence, and participation” (as long emphasized by Author Murdena Marshall), a contextualized connectivity of natural patterns and pattern seer that is not emphasized by Western science although it is capable of the same observations. Also, “sense of place, emergence, and participation” is richer than “sense of place” found in much contemporary environmental education literature. We suggest that creative connectivity is essential in reawakening our understandings of our human position within the web of life, as per our globally acknowledged need to see transformations in our values and practices towards environmental sustainability.

Conclusion

We hope the information and enabling concepts shared herein can help nourish the new consciousness required across numerous societal sectors for the full inclusion of and participation by Aboriginal peoples and their knowledges in various science arenas. A short video about Two-Eyed Seeing and science as pattern-based knowledge is available on the website for CBU’s Institute of Integrative Science & Health (IISH, n.d.).

IS was profiled by Berkowitz (2001) and mentioned by Mullens (2001), Battiste (2002, footnote 32), and Ezeife (2003). Indeed, Mullens (2001) featured our IS visual of Figure 1. In addition, we have publicized various IS efforts (Bartlett, 2004, 2005; Bartlett and Bernard, 2000; Bartlett, et al., 2004; Kavanagh et al., 2006; Lefort et al., 2006), maintained and updated a website (IISH, n.d.) since 2003, participated in numerous local to international conferences and workshops (including CCL’s Ottawa consultation meeting for the CCL Aboriginal Learning Knowledge Centre in November 2005), co-hosted CASTS 2005 national conference with its

theme of Two-Eyed Seeing (Bartlett and Marshall, 2005; CASTS, 2005), and are, as mentioned, beginning to see Two-Eyed Seeing adopted by others. Given the unique nature of the IS academic program and evidence of its success for Mi'kmaq First Nations' students pursuing post-secondary science, it is unfortunate that IS was not mentioned in a report (R.A. Malatest & Associates, 2004) that looked at “various strategies and initiatives that have been used to make post-secondary education more accessible, relevant and responsive to Aboriginal peoples” drawing upon examples in Canada, Australia, New Zealand, and the United States. It is also unfortunate IS was not mentioned in CCL (2007a) which points to innovative initiatives with respect to Aboriginal science education. We hope the shared understandings in this article will serve to broaden awareness of our efforts, as gained through ten years plus of applied research and learning in bringing together Indigenous and Western sciences and ways of knowing, for post-secondary science education and more.

Notes

1. The “ƒ” in MSƒT is the letter schwa, introduced to written Mi'kmaq by the Smith-Francis orthography. This letter it is not found in the Roman alphabet although in pronunciation guides for English words the schwa sound is often phonetically represented as “ə”.
2. Ann Denny, Shelly Denny and Jennifer Martin of CBU's Mi'kmaq College Institute worked within an initiative called MSAP (Mi'kmaq Science Advantage Program) to recruit students for the first three and some later entry level cohorts for Integrative Science.

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