

Integrative Science academic program

**DRAFT DOCUMENT #4 (of 5):
reinvigoration – relationships within asking
“what is Integrative Science ... what is science?”**

FIVE DRAFT DOCUMENTS

1. work required – overview
2. new courses required – “Science in Community” (SciC)
3. relationships – looking to AFN’s document on supporting students transitioning to PSE, CCL-AbLKC’s *First Nations Holistic Lifelong Learning Model*, and APCFNC/AAEDIRP Elders Project’s Recommendations on *Honouring Traditional Knowledge*
4. relationships – what is Integrative Science ... what is science?
5. relationships – transdisciplinarity

Integrative Science academic program

**DRAFT DOCUMENT #4 (of 5):
reinvigoration – relationships within asking
“what is Integrative Science ... what is science?”**

a brief exploration of the
Integrative Science view of science
followed by that of the
Native Science Academy

www.integrativescience.ca

NOTE about this document:

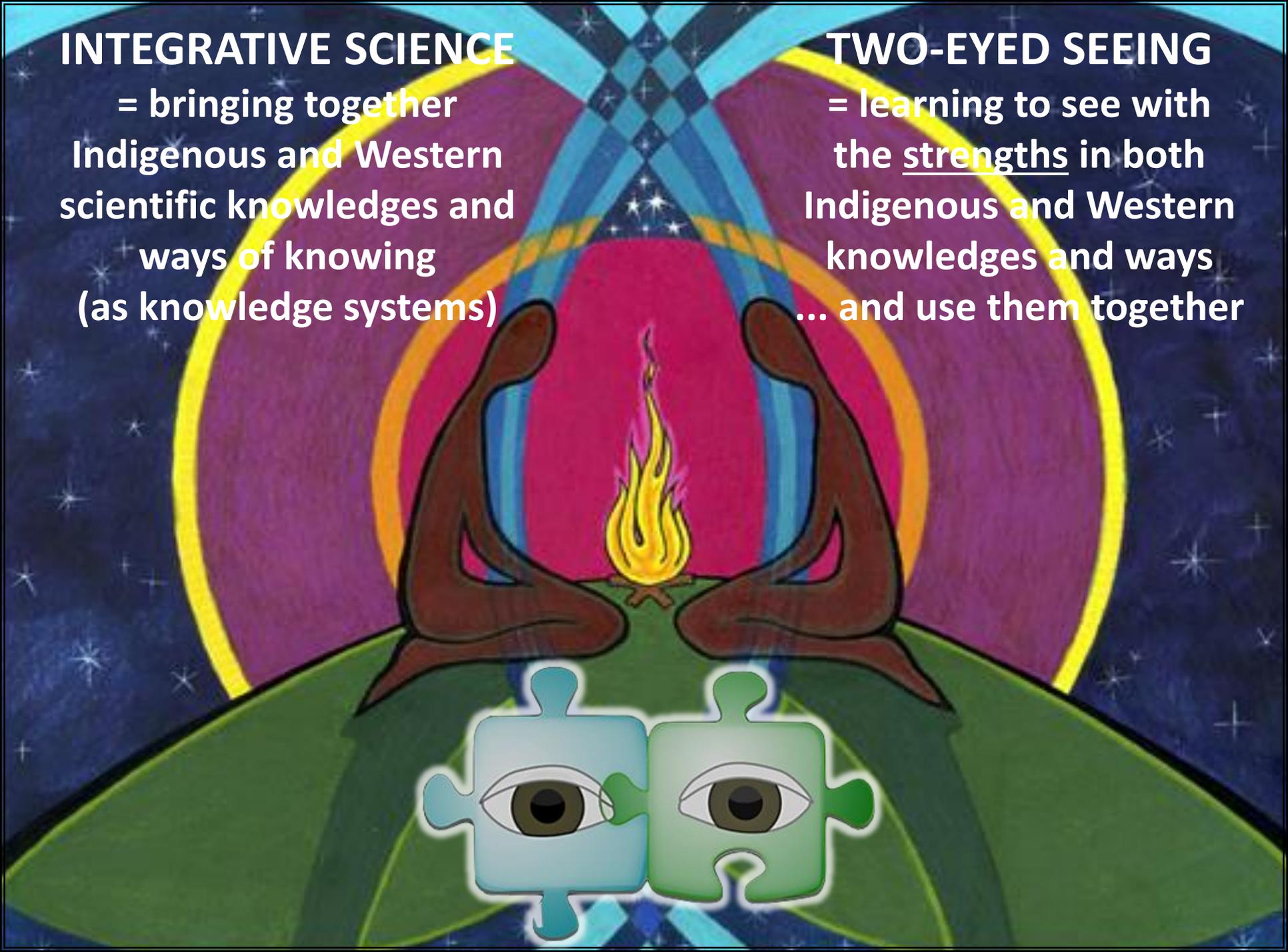
- Prepared in Winter 2014, this document along with others sought to convey understandings pertaining to *Integrative Science as a concentration with innovative MS&T science courses* within the *Bachelor of Science Community Studies (BScCS) four year degree* at Cape Breton University. They were prepared by Cheryl Bartlett to aid anticipated group discussions about potentially reinvigorating the Integrative Science concentration and the BScCS degree, given that both had become non-functional around 2010. The documents were not used and reinvigoration of Integrative Science and the BScCS did not occur.
- Collectively, the documents provide an overview of: (1) the work and resources that would have been required in order to proceed towards an envisioned reinvigoration of Integrative Science, and (2) the overall nature and evolving relationships for Integrative Science from its original vision and configuration as an academic program in the late 1990s guided by Two-Eyed Seeing through to its relationships with national developments in the 2000s and early 2010s. The period 1999 to the mid-2000s saw remarkable success for Integrative Science, including numerous students enrolled in the MS&T courses created for Integrative Science; several students graduate with a BScCS – Integrative Science degree; eleven students earn NSERC-USRAs and some students receive other scholarships; many students engaged in community workshops, summer research projects, and elementary school science outreach; and the Integrative Science program itself receive a national award of recognition from the Canadian Council on Learning.

INTEGRATIVE SCIENCE

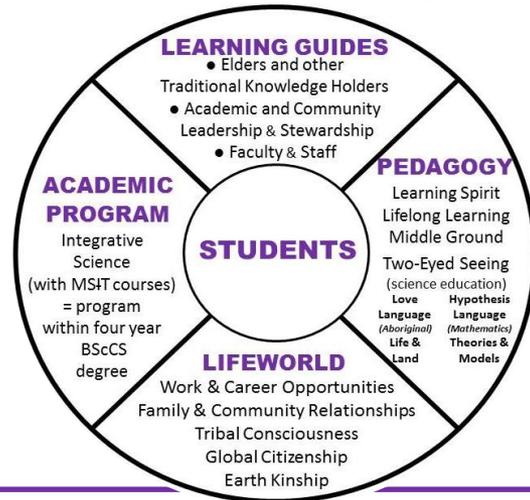
= bringing together
Indigenous and Western
scientific knowledges and
ways of knowing
(as knowledge systems)

TWO-EYED SEEING

= learning to see with
the strengths in both
Indigenous and Western
knowledges and ways
... and use them together

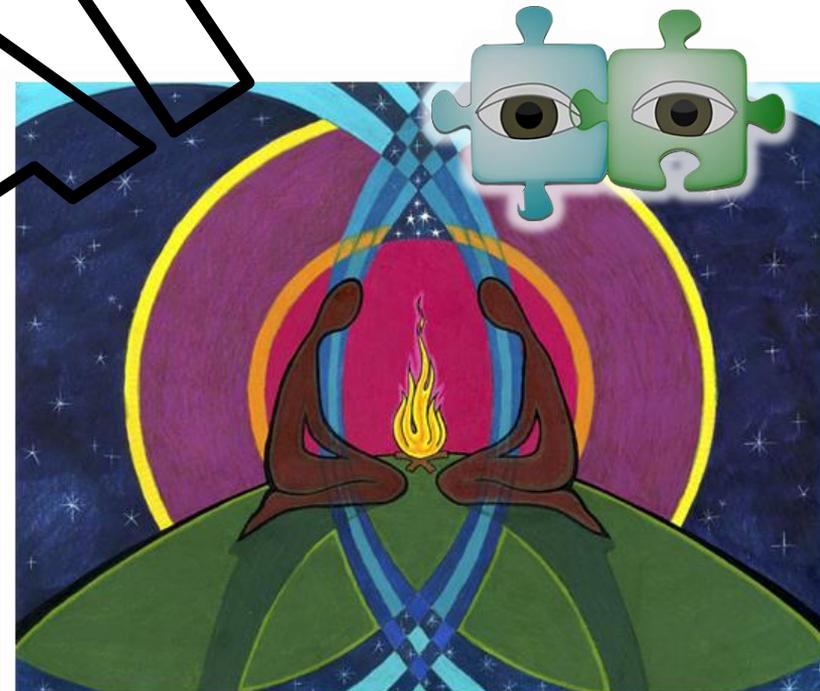


a document to share
 “information, resources, positioning, and congruencies”
 towards better and broader understandings of
Integrative Science and Two-Eyed Seeing



A series of documents has been created to help justify and contextualize efforts and approaches towards revitalizing the Integrative Science academic program, including CBU’s Bachelor of Science Community Studies (BScCS) degree which houses Integrative Science.

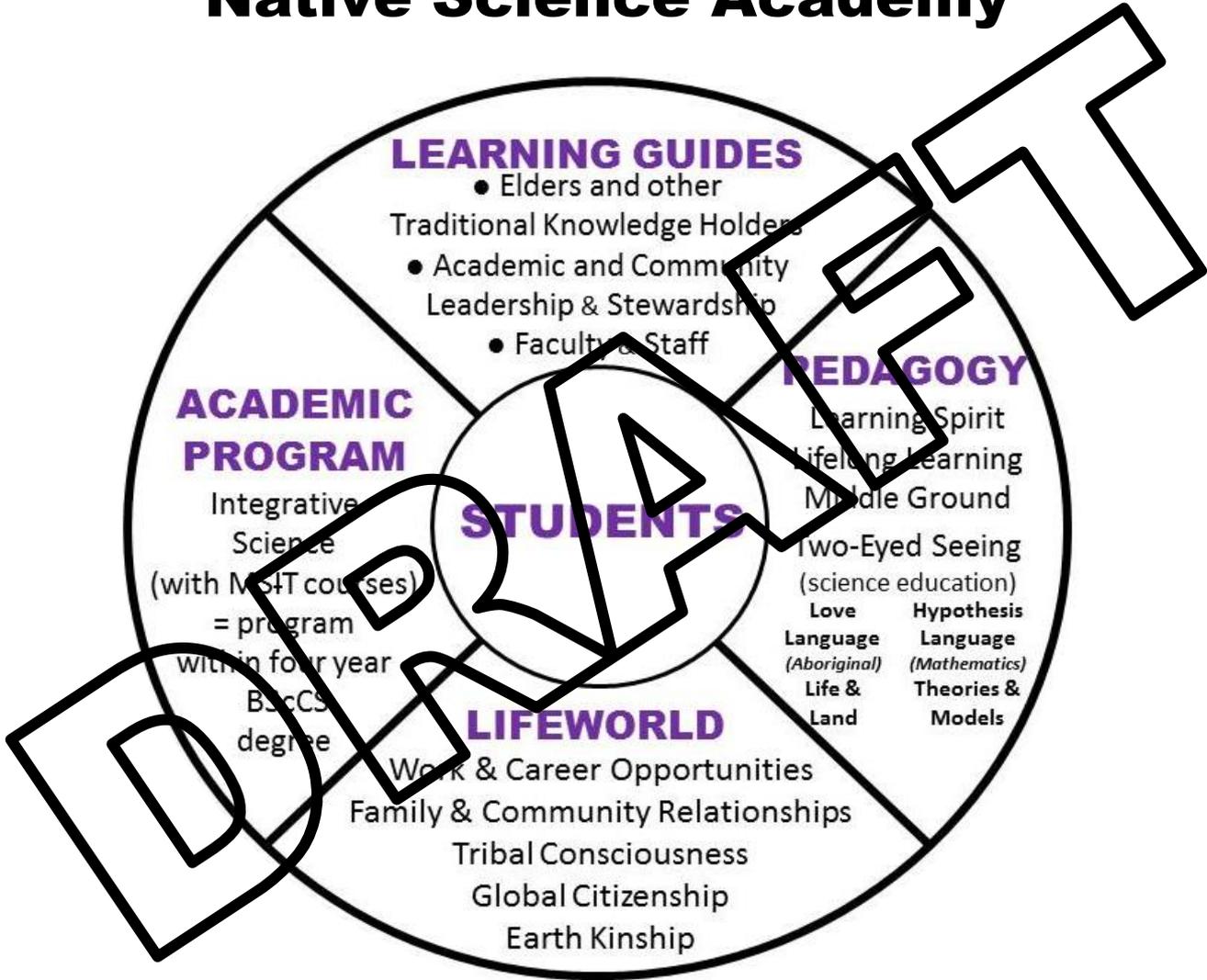
The documents in the series rely heavily on the use of images, congruent with the request that Integrative Science encourage learning in a visual way, a request made by Inukman community members when the academic program was conceived in the mid-1990s. The ability to read images and ponder a visual landscape – i.e. to sense patterns, changes, and resonances, and begin to interpret them – is both an Aboriginal traditional skill and a modern science skill ... i.e., an Integrative Science skill. Oral communication – a second skill and one particularly emphasized in Aboriginal traditional ways – can then facilitate the creation of shared meaning. As such, it becomes a desirable, although not absolutely essential, travelling companion for visual learning and visual thinking.



SUMMARY: This document entitled *“relationships within asking ‘what is Integrative Science ... what is science?’”* is an introduction to pondering the challenging issue (for mainstream science education but also, especially, for cross- and inter-cultural cultural science education) of “what is science”. Towards this ponder, four questions are posed: What is Integrative Science? What is Science? What is Indigenous or Native Science? What is Western Science? Synoptic responses are provided from the perspective of both Integrative Science and the Native American Science Academy. The Integrative Science response emphasizes “pattern recognition” and Howard Gardner’s multiple intelligences theory along with the diverse domains and sources of knowledge and learning guides identified in the CCL FN Holistic Lifelong Learning Model. How these lead, overall, to the pedagogy for Integrative Science is depicted. A wealth of additional explanation for the Integrative Science perspective is available on the website for the Institute for Integrative Science and Health (www.integrativescience.ca). Some new Integrative Science explanatory images not on that website are included in this UC document. They were created within APCFNC-funded work (2012-2013) to help encourage the Government of Canada (via its Department of Fisheries and Oceans) to incorporate ATK (Aboriginal Traditional Knowledge) in its fisheries management processes for the commercial fisheries in Atlantic Canada – processes currently informed only by western science approaches (albeit with final decisions based in domains such as the political). Additional Native Science Academy information is available at <http://www.silverbuffalo.org/NativeScienceAcademy.html>. Dr. Rose von Thater-Braan , Founding Director, was Director of Education, Centre for Particle Astrophysics at University of California – Berkeley. Dr. Marie Battiste and Dr. Saker Henderson (University of Saskatchewan) and Dr. Leroy Little Bear and Amethyst First Rider (University of Lethbridge) were also founding members. Stephen Augustine (now with Unama’ki College at CBU) additionally helped envision the Native Science Academy. The latter five individuals plus Dr. Gregory Cajete (University of New Mexico) were consulted during development of Integrative Science in 1997.

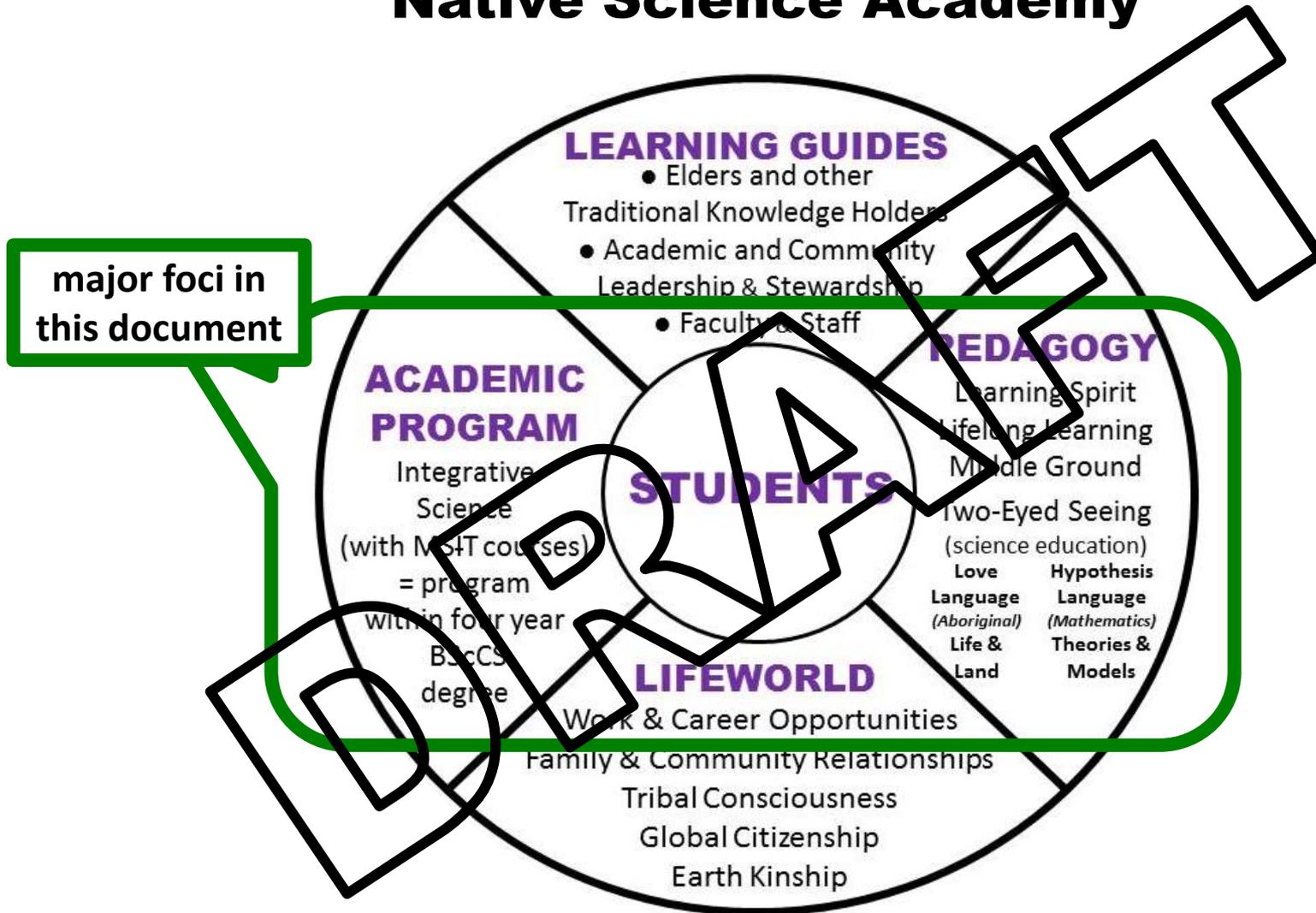
Integrative Science view on “science”

followed by that of the Native Science Academy



Integrative Science view on “science”

followed by that of the
Native Science Academy



What is Integrative Science?

What is Science?

What is Indigenous or Native Science?

What is Western Science?



DRAFT

Integrative Science

view of science

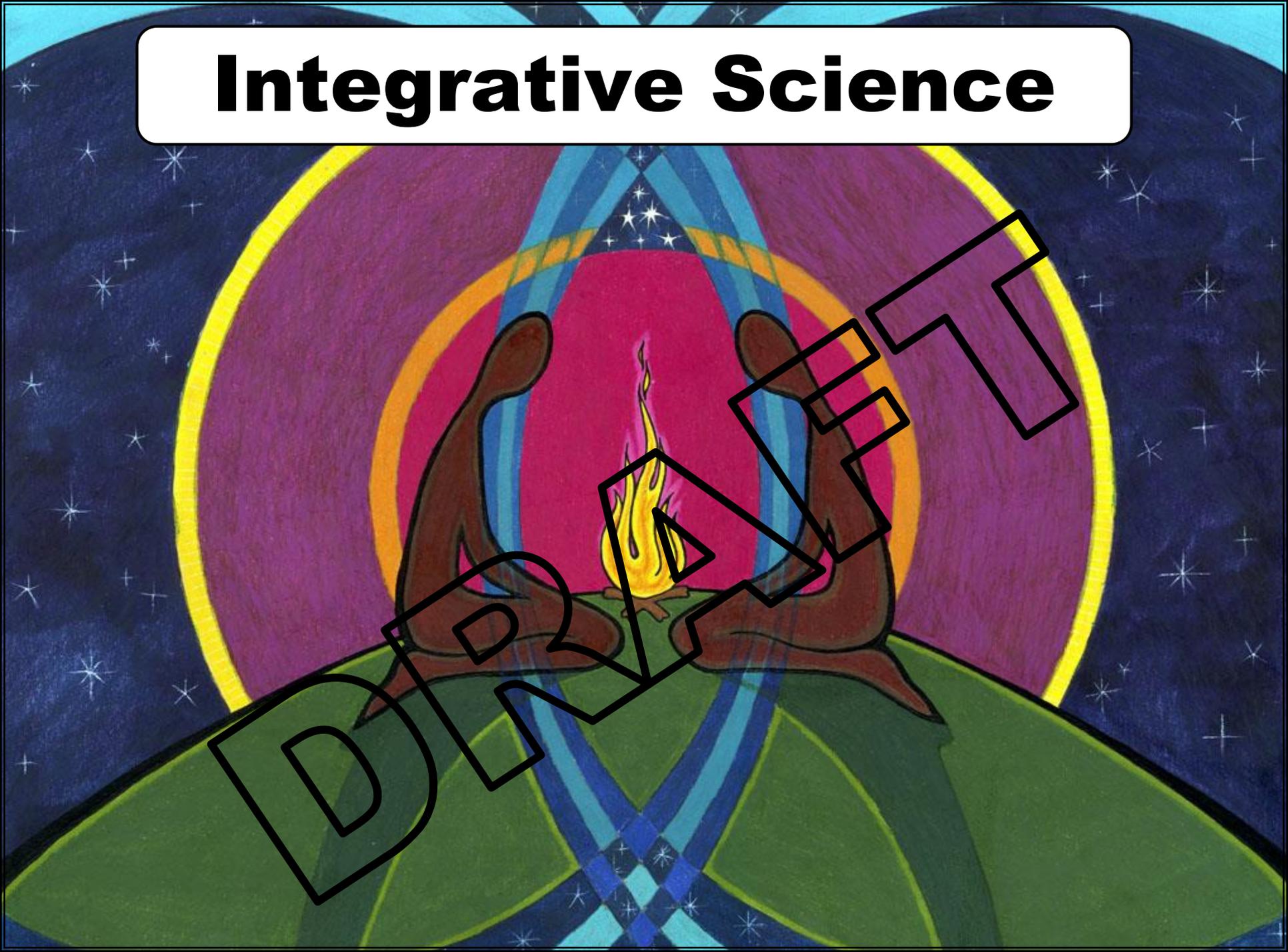
PREMISE:

- Acquisition of scientific knowledge is essential to human survival.
- It is a practical engagement with the real world and ...
- the scientific pursuit of knowledge must, therefore, be as old as the consciousness of our human species.

INTEGRATIVE SCIENCE emphasizes:

- the natural world and our human participation within it,
- cultural inclusivity, and
- our roles, including our responsibilities, as agents ... indeed, as storytellers ... in our knowledge systems

Integrative Science



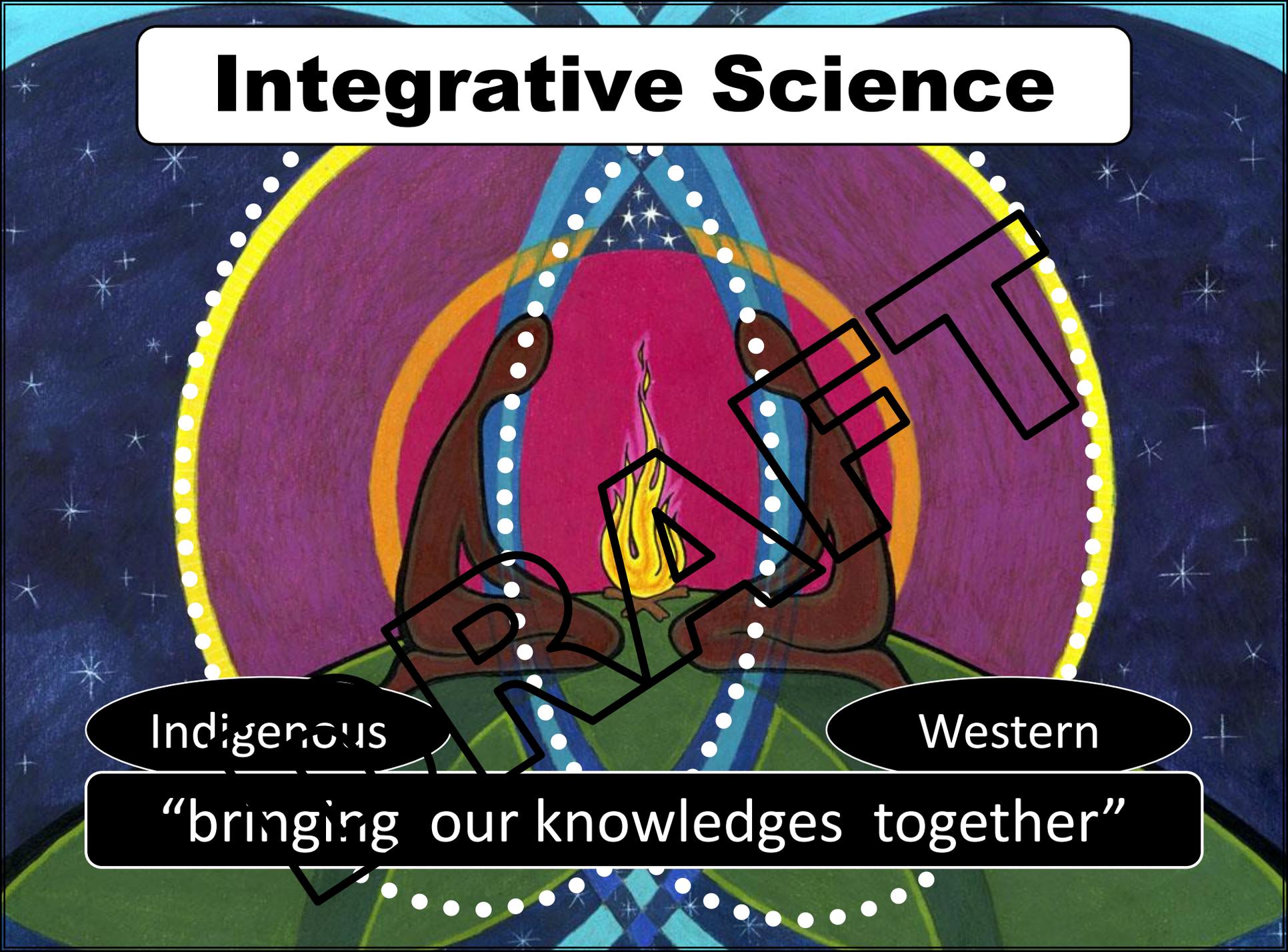
Integrative Science

Indigenous

Western

“bringing our knowledges together”

BRIDGE



Integrative Science

The “ive” in integrative indicates our work is forever active and ongoing

not merged, rather:
COMMON GROUND recognized
DIFFERENCES respected
... for our **KNOWLEDGE**
SYSTEMS

Indigenous

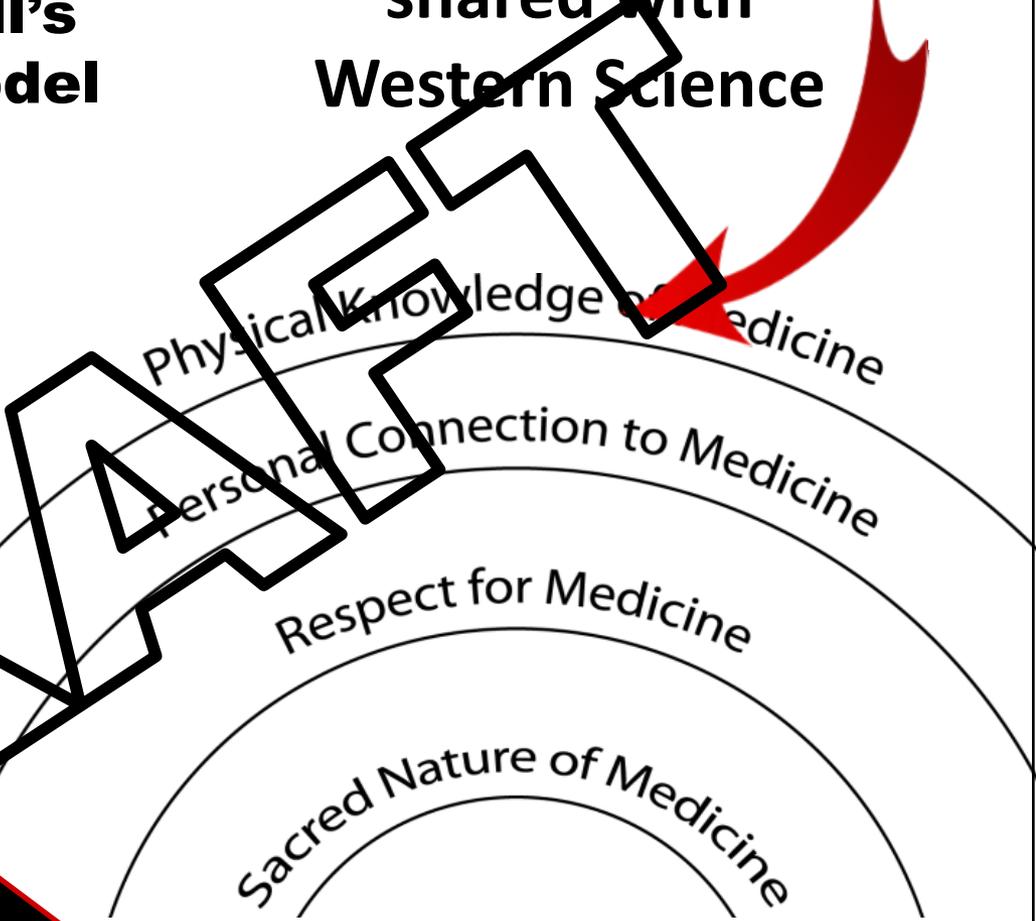
Western

“bringing our knowledges together”

Integrative Science

**Elder Murdena Marshall's
Mi'kmaq Knowledge Model**

shared with
Western Science

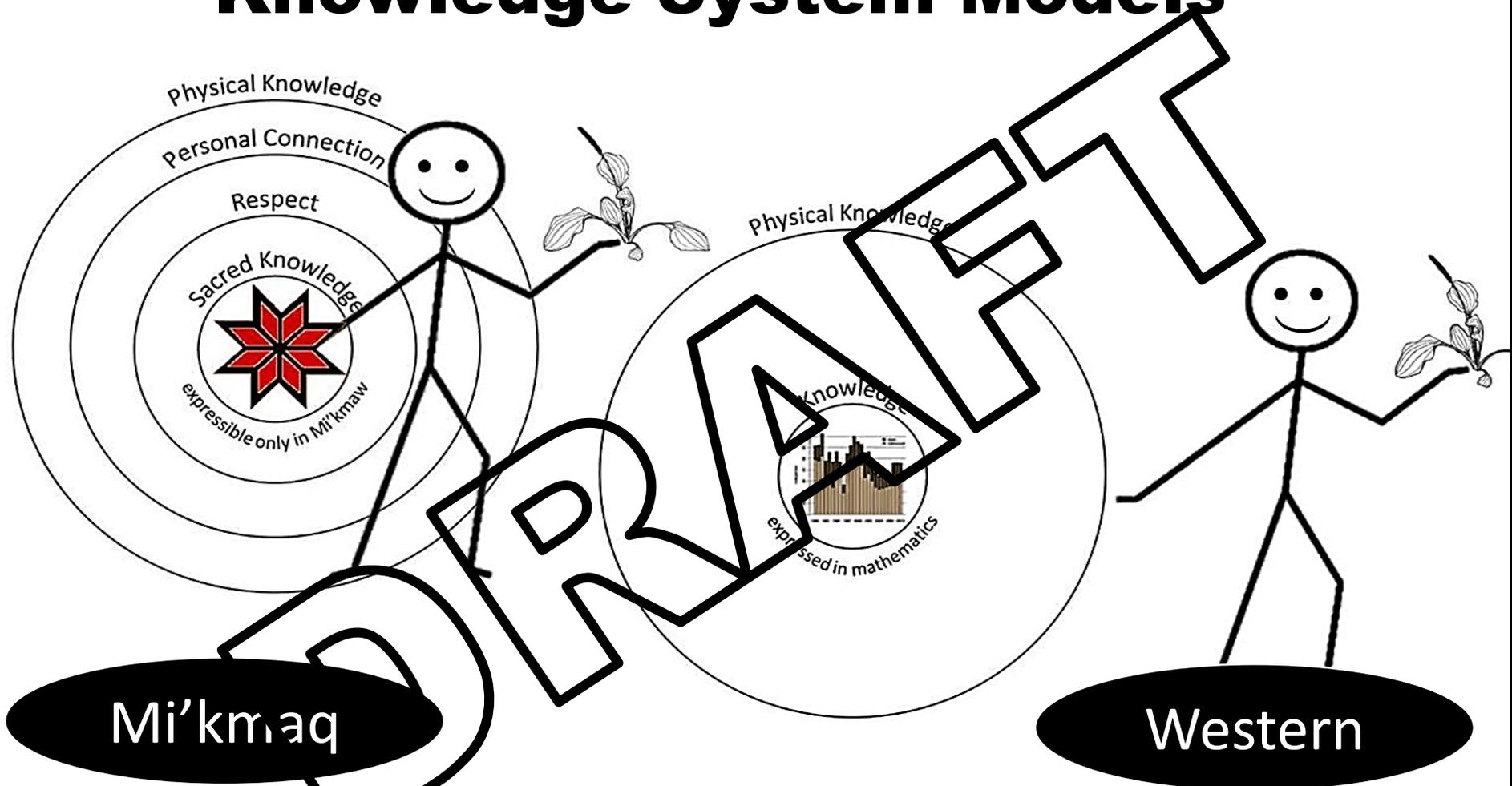


DRAFT

4 concentric circles

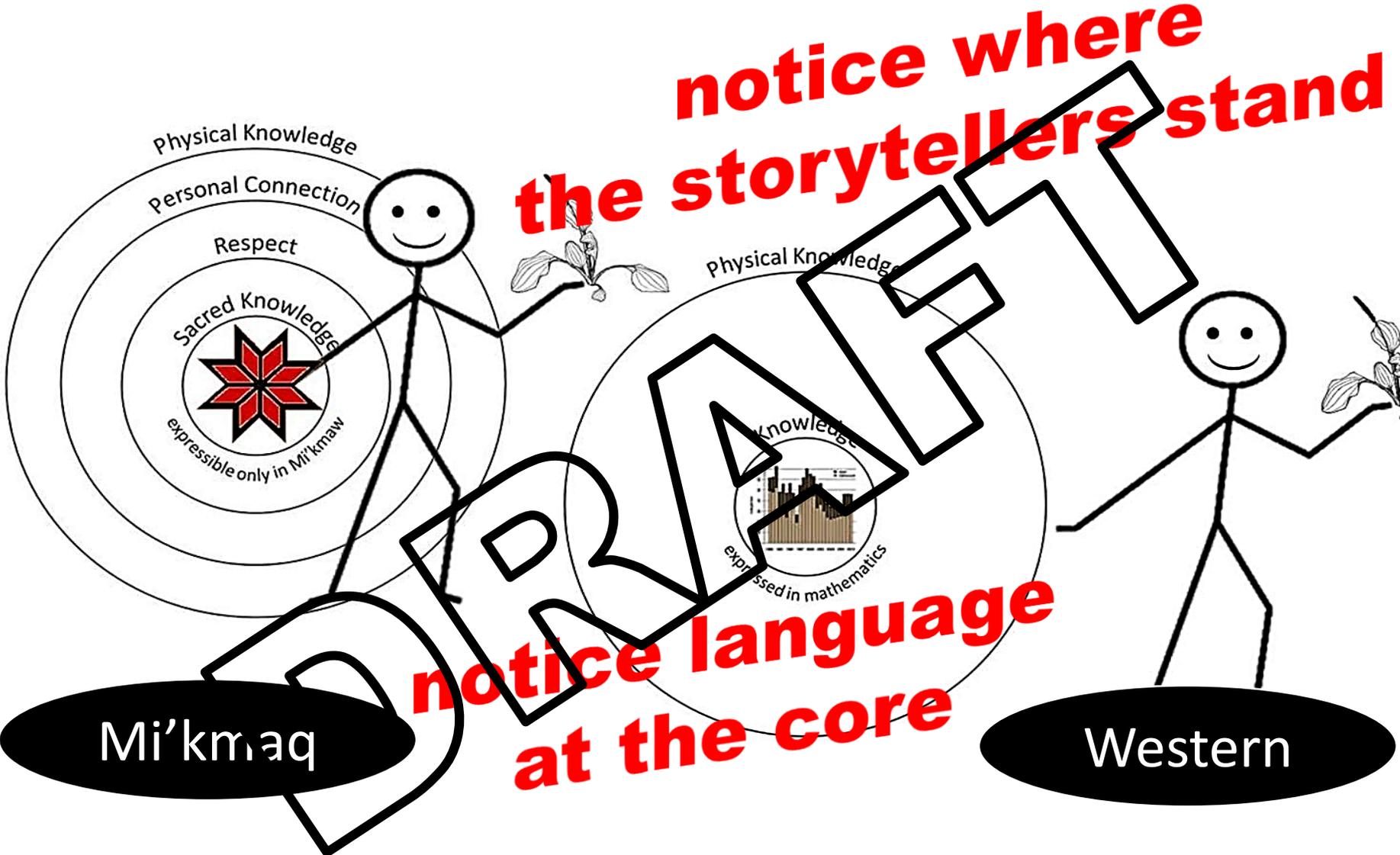
Integrative Science

Knowledge System Models



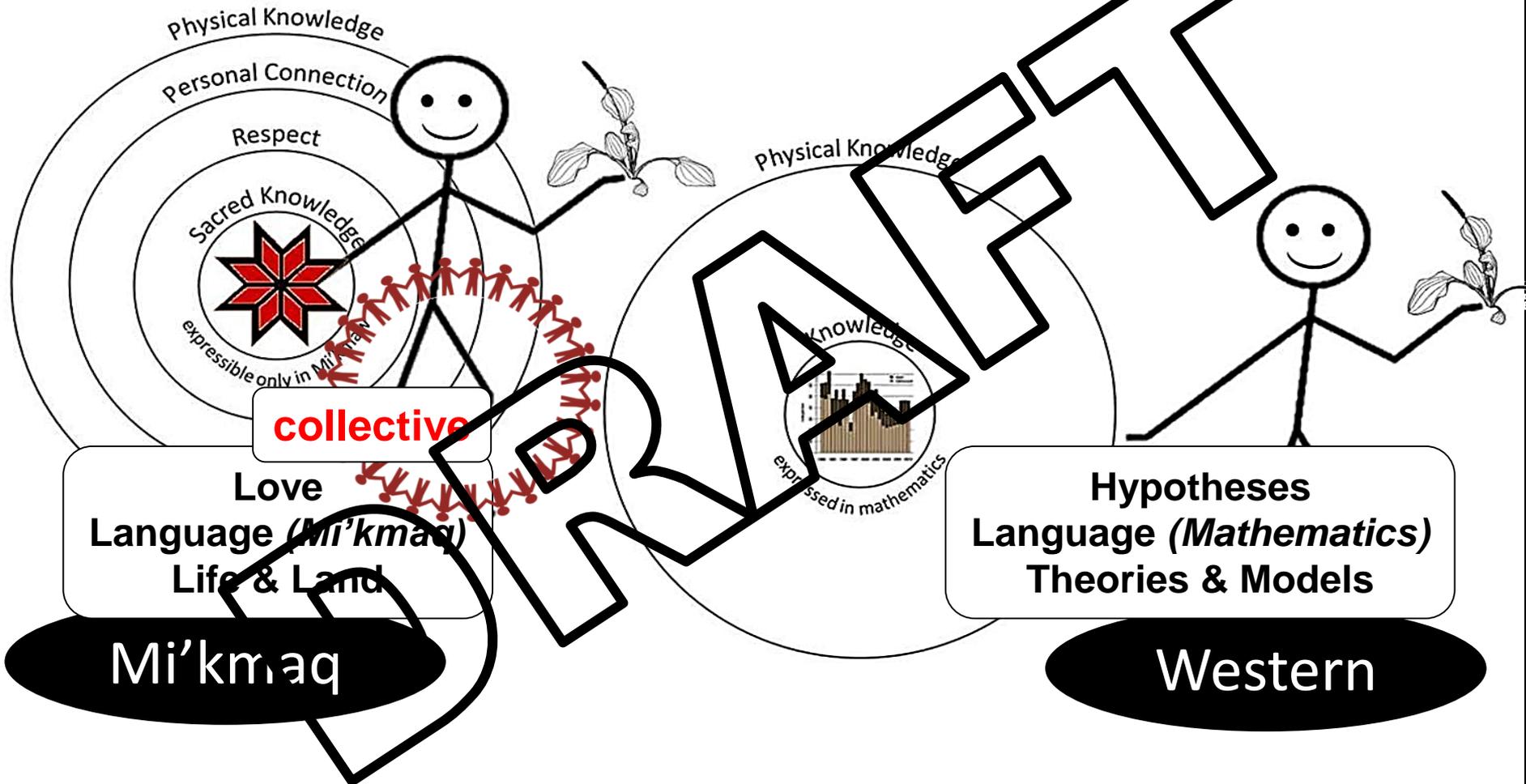
adapted from Elder Murdena Marshall

Integrative Science



Integrative Science

**as storytellers, as knowledge agents ...
we have responsibilities to our knowledges**



My Western

^ Science stories are

stories of

parts & wholes

... stories of:

MATTER & ENERGY

Spirit does not exist.

Consciousness is "problematic".

... and I am not in this story

My world is many "its" (objects).

... and energy fields!

... thus systems exhibiting emergence

but I am in the story for quantum physics!

DETAILED



Western

- [■ Un
- [■ super
- [■ clusters
- [■ galaxies (M
- [■ star systems
- [■ planet Earth
- [■ ecosystems
- [■ communities
- [■ populations
- [■ organisms
- [■ organ systems
- [■ organs
- [■ tissues
- [■ cells
- [■ organelles
- [■ molecules & minerals
- [■ atoms (natural elements #1-92; artificial elements)
- [■ baryons (neutrons & protons)
- [■ fundamental particles (quarks & leptons)

My Mi'kmaq

^ Science stories are

stories of

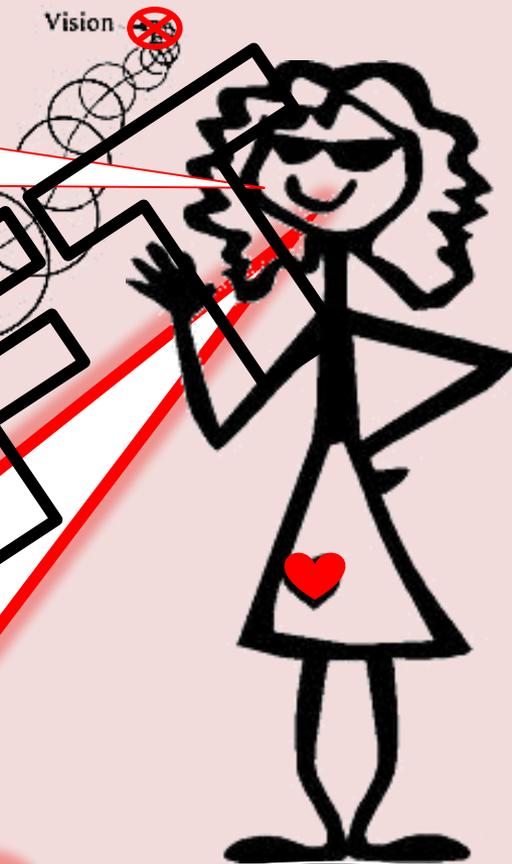
interconnectiveness

Our stories are alive.

**Place
Emergence
Participation**

... and I am
in the story

Vision ~~is~~



**Spirit
everywhere**

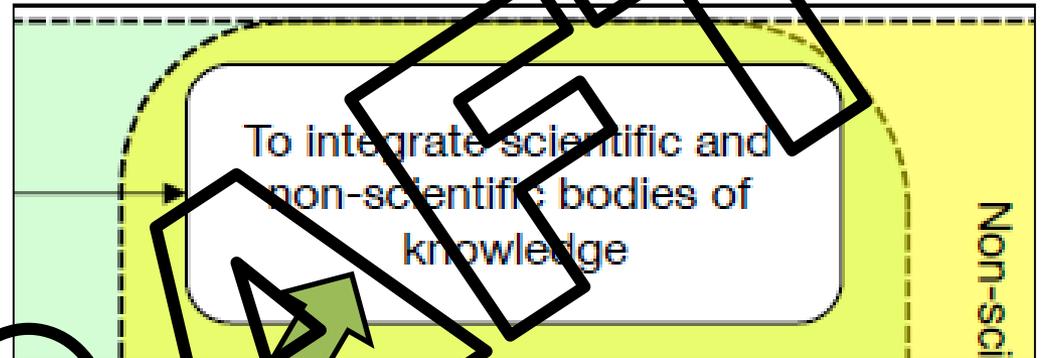
DRAFT

My world, our world, is
"All My Relations" (kin / subjects).

Mi'kmaq

a definition of
Integrative Science

= bringing together Indigenous and Western scientific knowledges and ways of knowing



*

When you encounter this type of a statement*, where fits Indigenous Knowledge, Aboriginal Traditional Knowledge? Is it "scientific" or "non-scientific"?

Or, are these types of questions something you would only ask from the perspective of Western knowledge?

a question that can be asked of

INTEGRATIVE SCIENCE:

What is “science”?



... from a “Western only” perspective, “non-scientific bodies of knowledge” include indigenous / Aboriginal knowledges

Is “science” found only within mainstream (Western) knowledges? Is it found only in Western cultures?

Integrative Science response:

No!

INTEGRATIVE SCIENCE: What is "science"?



DRAMA

Can we view "science" in a broad, multi-culturally inclusive way?

Integrative Science response:

YES!!

INTEGRATIVE SCIENCE: What is “science”?



PREMISE for INTEGRATIVE SCIENCE:

The acquisition of scientific knowledge is essential to human survival – it is a practical engagement with the real world – and the scientific pursuit of knowledge must, therefore, be as old as the consciousness of our human species.

DEBATE

INTEGRATIVE SCIENCE: What is “science”?



BROAD, MULTI-CULTURALLY INCLUSIVE VIEW OF SCIENCE
for the purposes of INTEGRATIVE SCIENCE:

**science = dynamic, pattern-based knowledge
shared through stories
about our interactions with and within nature**

INTEGRATIVE SCIENCE:

What kinds of “patterns”?



patterns essential to
human survival that
also reflect practical
engagement with
the real world

BROAD, MULTI-CULTURALLY INCLUSIVE VIEW OF SCIENCE

for the purposes of **INTEGRATIVE SCIENCE:**

**science = dynamic, pattern-based knowledge
shared through stories**

about our interactions with and within nature

INTEGRATIVE SCIENCE:



DRAFT

**Science stories are
pattern knowledge!**

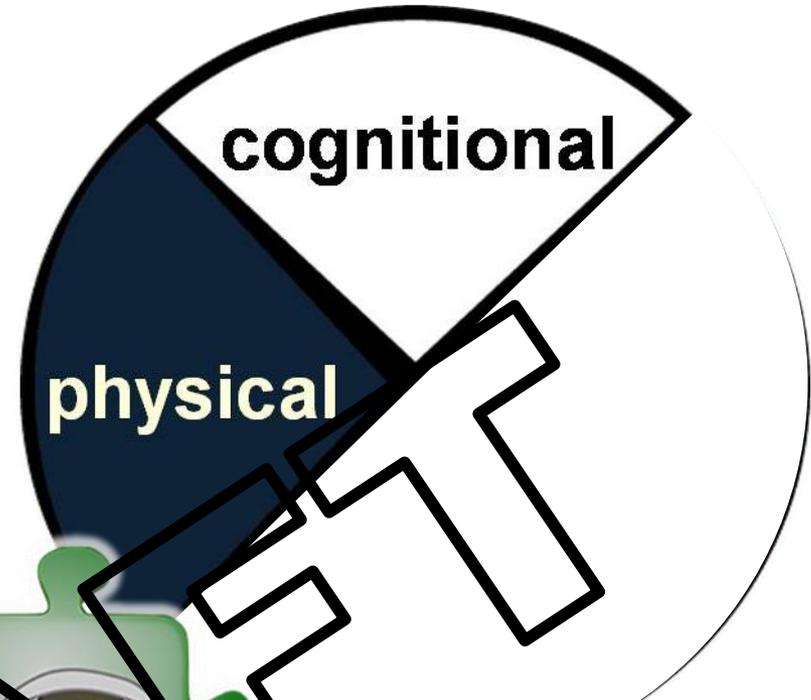
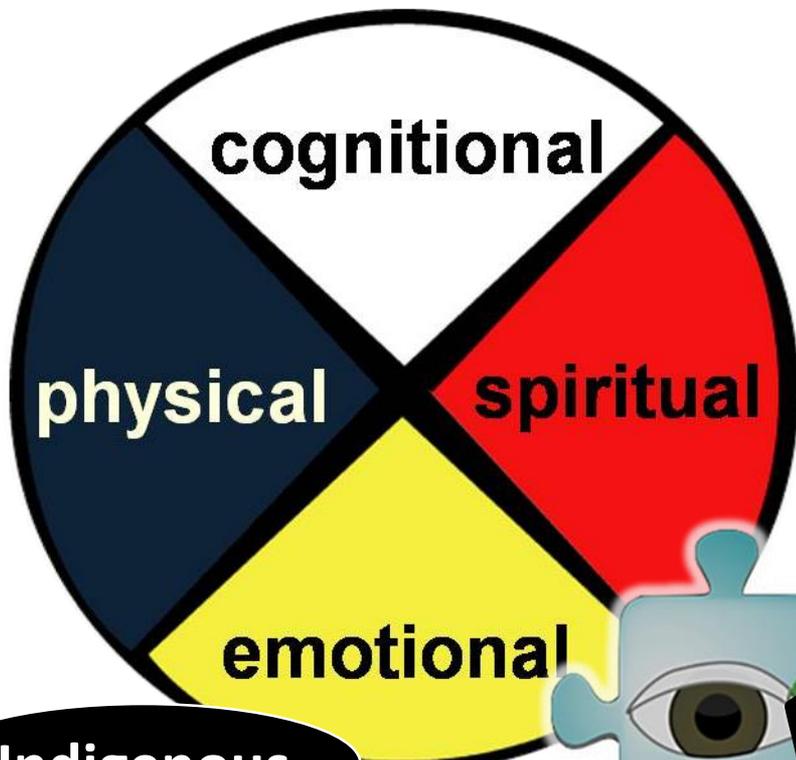
INTEGRATIVE SCIENCE:

How do we learn “patterns”?



What different “ways of knowing” can we use to learn patterns?

**Science stories are
pattern knowledge!**



Indigenous

Love
Language (*Aboriginal*)
Life & Land

Western

Hypotheses
Language (*Mathematics*)
Theories & Models

What different “ways of knowing” can we use to learn patterns?

**Science stories are
pattern knowledge!**



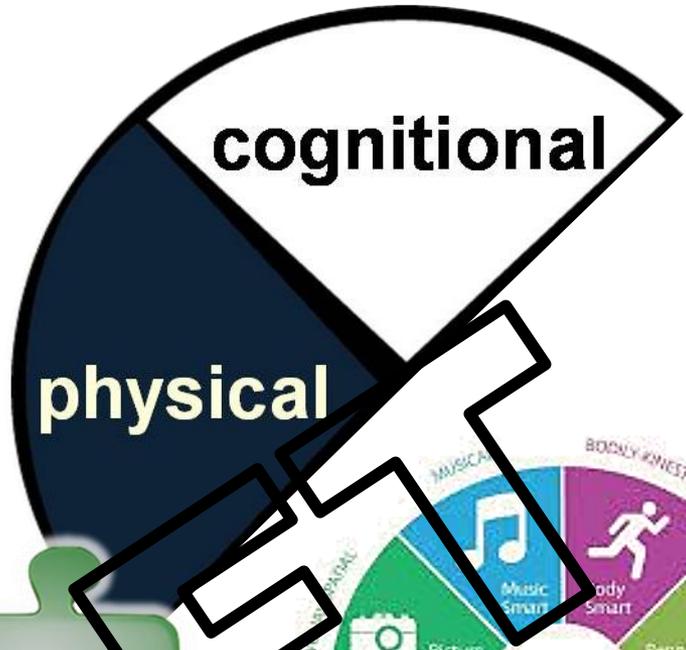
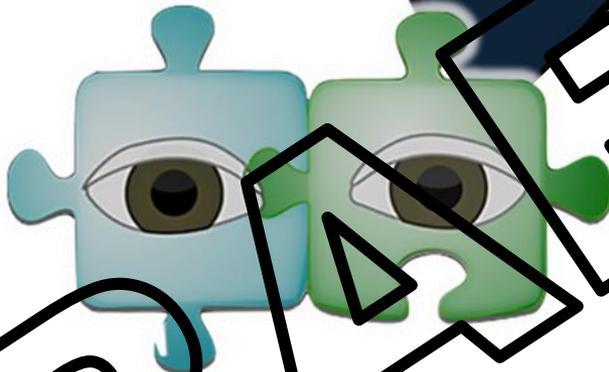
How do we learn “patterns”?

Howard Gardener’s Multiple Intelligences Theory

= a brain-based theory

... with different “pattern smarts”

for recognizing different kinds of patterns



What different “ways of knowing” can we use to learn patterns?

Science stories are pattern knowledge!

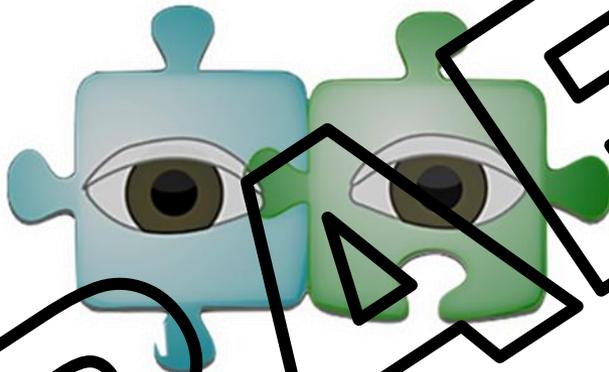


How do we learn “patterns”?

Howard Gardener’s Multiple Intelligences Theory

= a brain-based theory

... with different “pattern smarts” for recognizing different kinds of patterns



body smarts

nature smarts

self smarts



BRIDGE

music smarts

people smarts

picture smarts

spirit smarts*

word smarts

math smarts

* mentioned only tentatively by Gardner for “multiple intelligences theory”



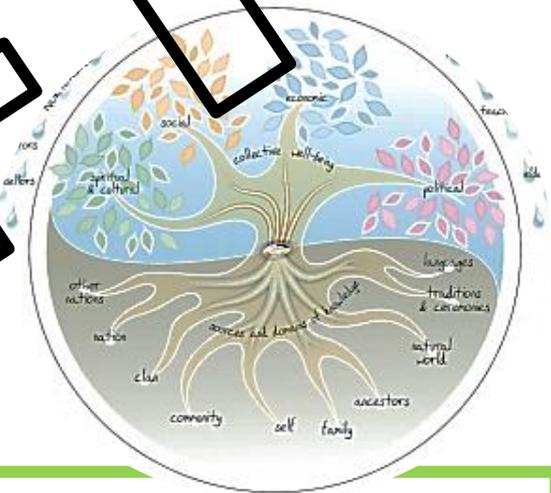
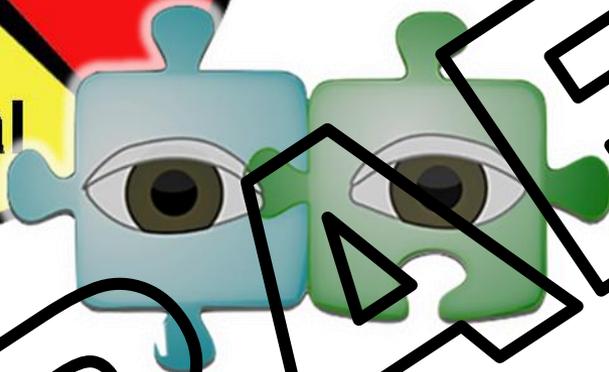
How do we learn “patterns”?

First Nations

Holistic Lifelong Learning Model

= a model with

many and diverse knowledge and learning sources, domains, and guides (e.g. CCL FN Holistic Lifelong Learning Model)



BRAND

What different “ways of knowing” can we use to learn patterns?

Science stories are pattern knowledge!

First Nations Holistic Lifelong Learning Model

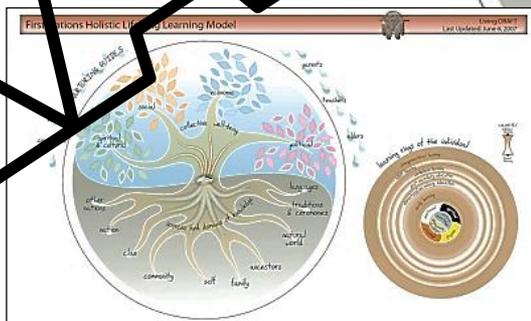
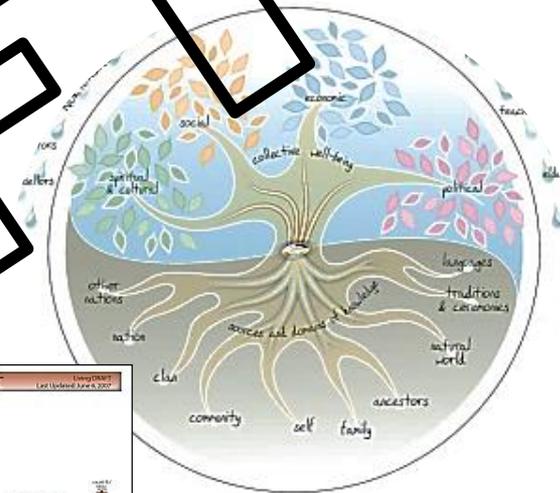
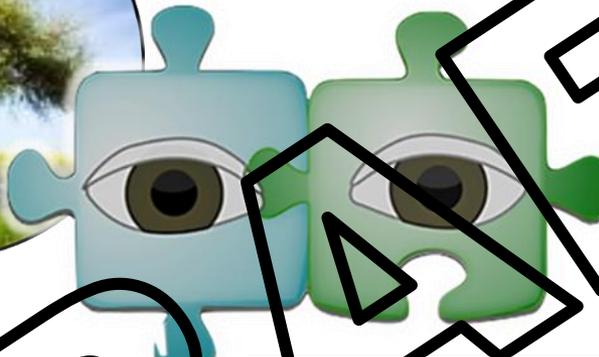
ABOUT THE FIRST NATIONS HOLISTIC LIFELONG LEARNING MODEL

The *First Nations Holistic Lifelong Learning Model* represents the link between First Nations lifelong learning and community well-being, and can be used as a framework for measuring success in lifelong learning.

THE MODEL patterned as a living tree

For First Nations people, the purpose of learning is to honour and protect the earth and ensure the long-term sustainability of life. To illustrate the organic and self-regenerative nature of First Nations learning, the *Holistic Lifelong Learning Model* uses a stylistic graphic of a living tree. The tree depicts the cycles of learning for an individual and identifies the influences that affect individual learning and collective well-being.

How do we learn “patterns”?
**First Nations
Holistic Lifelong Learning Model**
= a model with
many and diverse knowledge and
learning sources, domains, and guides
(e.g. CCL FN Holistic Lifelong Learning Model)



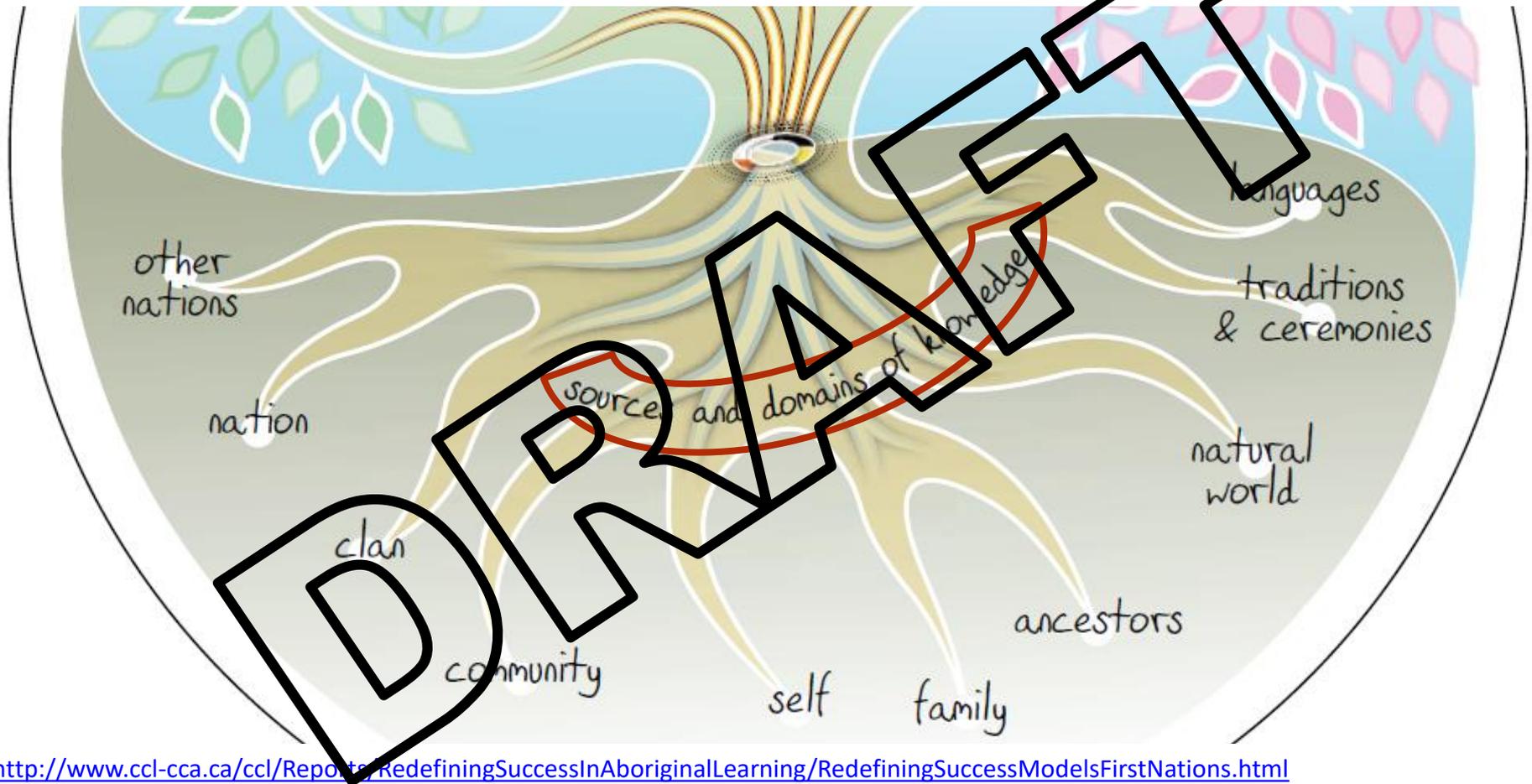
from: Aboriginal Learning Knowledge Centre – Canadian Council on Learning

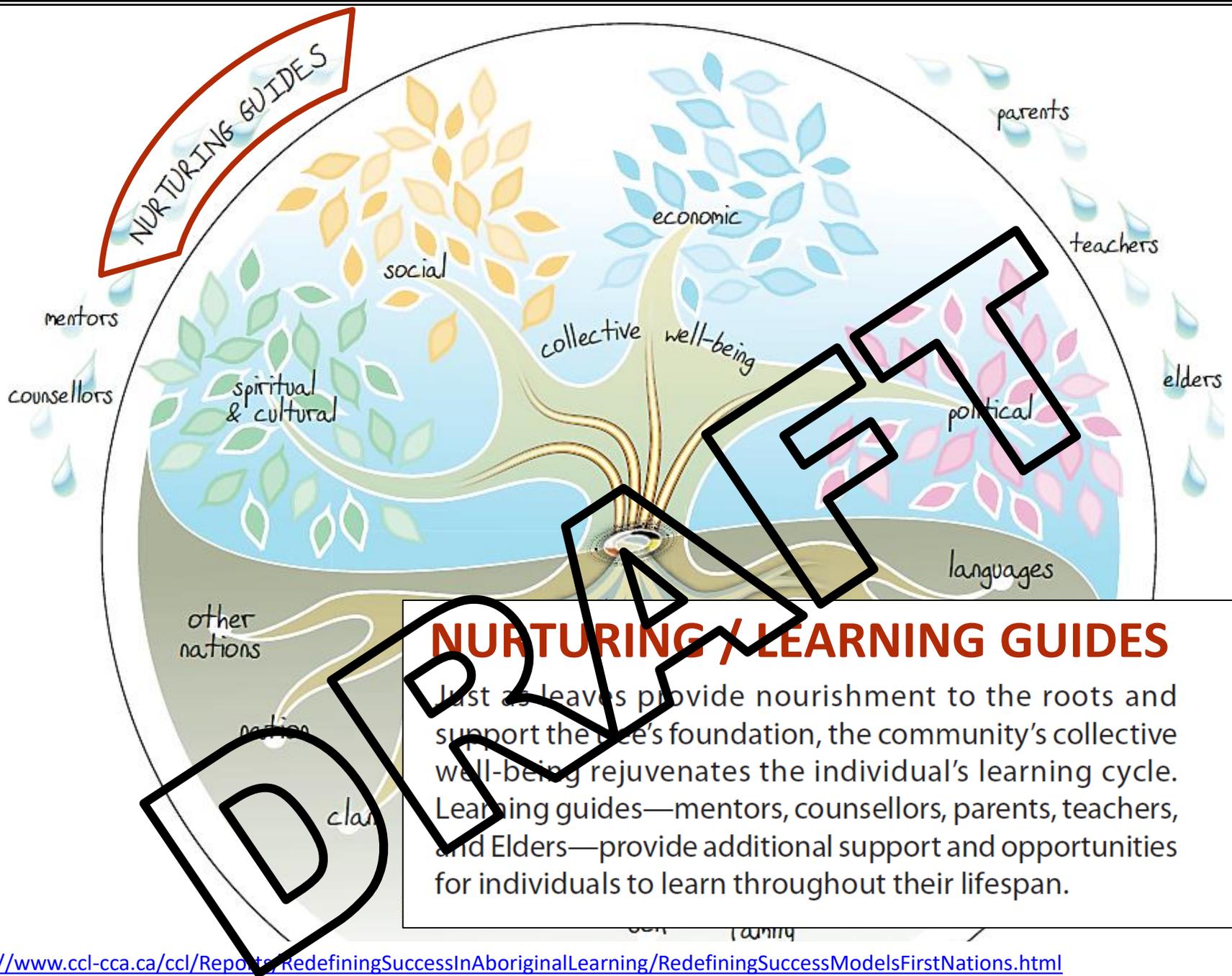
<http://www.ccl-cca.ca/ccl/Reports/RedefiningSuccessInAboriginalLearning/RedefiningSuccessModelsFirstNations.html>

ROOTS

Lifelong learning for First Nations peoples is grounded in experiences that embrace both indigenous and Western knowledge traditions, as depicted in the tree's root system, "Sources and Domains of Knowledge". Just as the tree draws nourishment through its roots, the First Nations person learns from and through the natural

world, language, traditions and ceremonies, and the world of people (self, family, ancestors, clan, community, nation and other nations). Any uneven root growth can de-stabilize the learning system. The root system also depicts the intertwining presence of indigenous and Western knowledge, which forms the tree trunk's core, where learning develops.





Connect dots ... see patterns
... tell stories.

Various ways to connect the dots.
Diversity in our science stories.

CULTURE prevailing*.

** for example, see: Joe Sheridan and Roronhiakwen "He Clears the Sky" Dan Longboat, 2006, The Haudenosaunee Imagination and the Ecology of the Sacred, *Space and Culture*, 9: 365-381.*

Science stories are
pattern knowledge!

our science stories ... draw upon our "pattern smarts"

word smarts

math smarts

music smarts

nature smarts

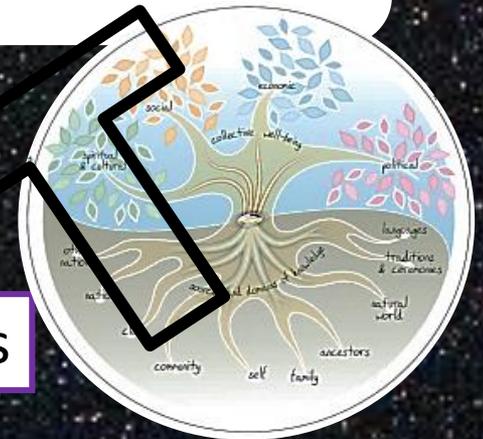
picture smarts

body smarts

spirit smarts*

people smarts

self smarts



**WHAT STORIES ... depends upon:
SANCTIONED PERSPECTIVES & INTELLIGENCES**

who we are; where we are; where we were;
what we know, do and value ... i.e., our **CULTURE**

* mentioned only tentatively
by Gardner for "multiple
intelligences theory"

IF: I acknowledge few pattern smarts ...

word smarts
math smarts

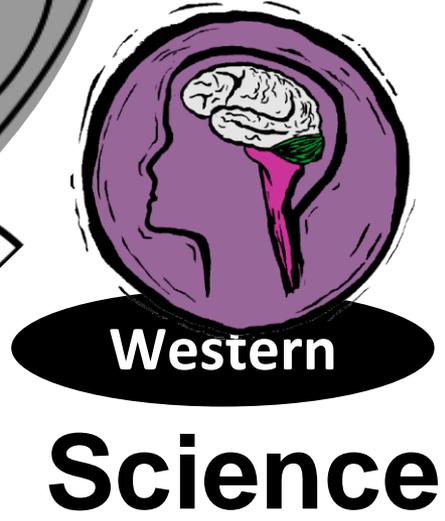
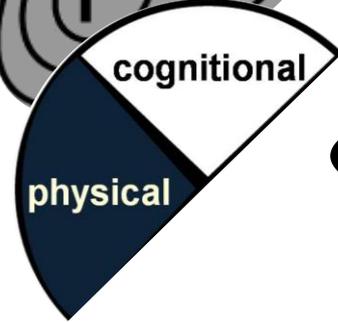
nature smarts

Howard Gardner's
"multiple
intelligences
theory"

[Western] Science is distinguished from other pursuits by the precise and limited intellectual means that it employs and the integrity with which it uses its limited means.

The [Western] scientific pursuit of truth uses no end of tools, ranging from sensitive scales to register the weight of a hair to observatories of the heavens.

Jane Jacobs, p. 65, 2004.
Dark Age Ahead. Vintage Canada.



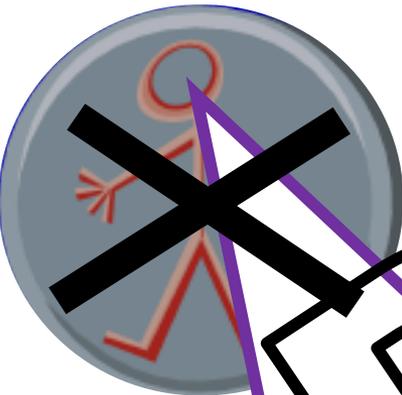
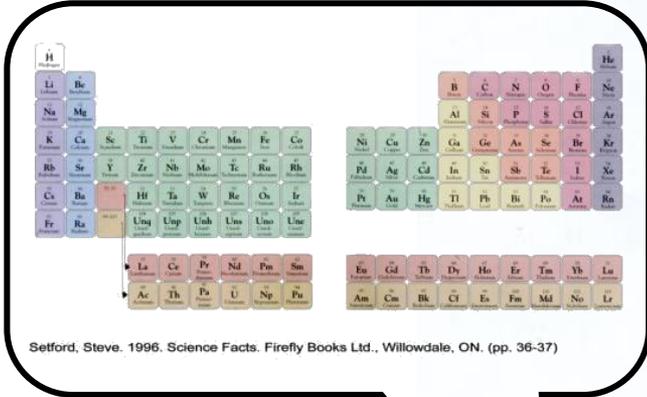
My ^

Science stories are

stories of

parts & wholes

Universe: Visible Matter (levels of organization - biology)



- Universe
- super clusters (Local)
- clusters (Local Group)
- galaxies (Milky Way)
- star system (Sun)
- planet Earth
- ecosystems
- communities
- populations
- organisms
- organ systems
- organs
- tissues
- cells
- organelles
- molecules & minerals
- atoms (natural elements #1-92; artificial elements #93 & higher)
- baryons (neutrons & protons)
- fundamental particles (quarks & leptons)

Consciousness is "problematic"; spirit does not exist.

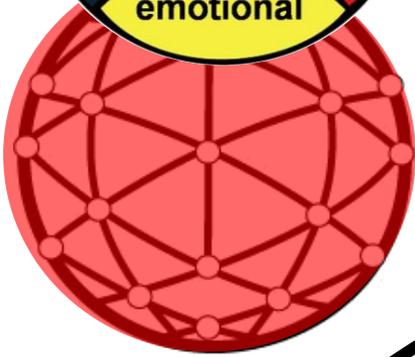
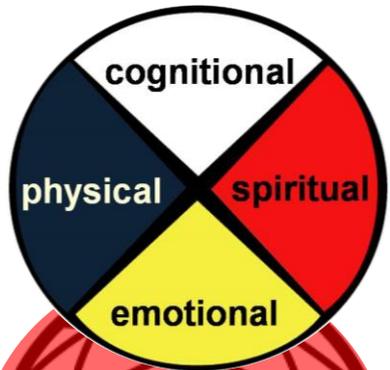
Western

Science

My world is many "its" (objects).

Science stories are pattern knowledge!

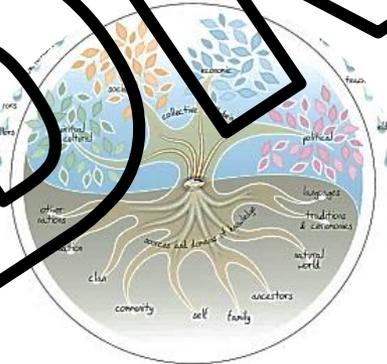
IF: I draw upon many **pattern smarts ...**



Indigenous Science

- word smarts
- math smarts
- music smarts
- picture smarts
- body smarts
- people smarts
- self smarts
- nature smarts
- spirit smarts

Howard Gardner's "multiple intelligences theory"



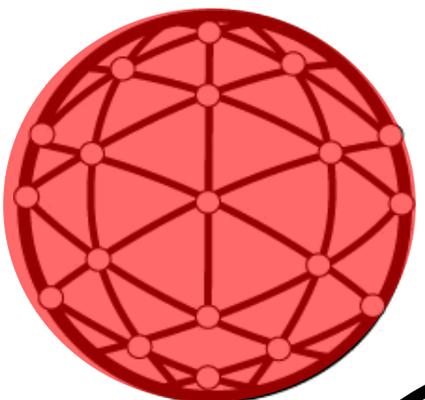
... and I also acknowledge many and diverse knowledge sources and domains, as well as learning guides ...

My
^

Science stories are

stories
of

interconnectiveness



Physical

Mental

Volitional

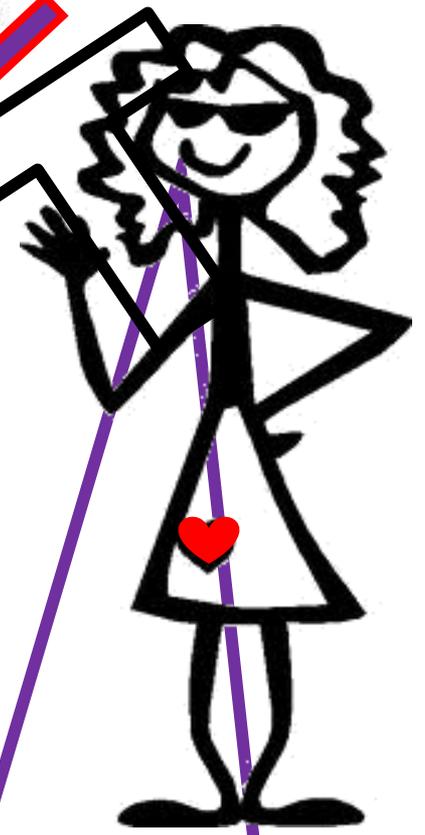
Vision



Spiritual

Emotional

Spirit is present.

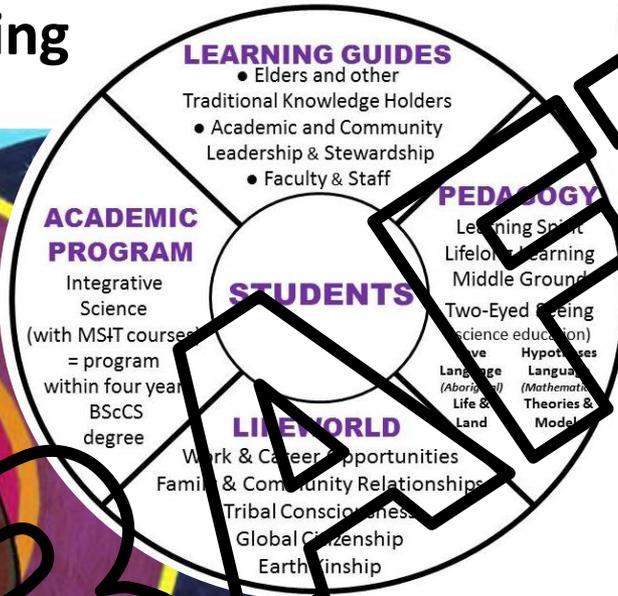
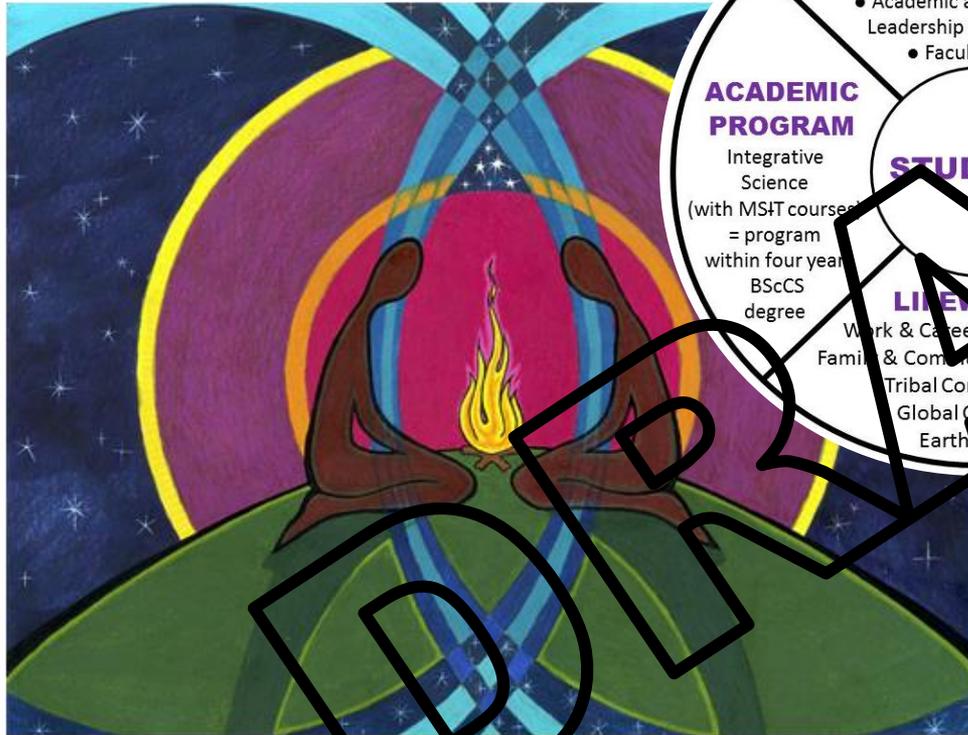


Indigenous
Science

My world, our world, is
"All My Relations" (subjects).

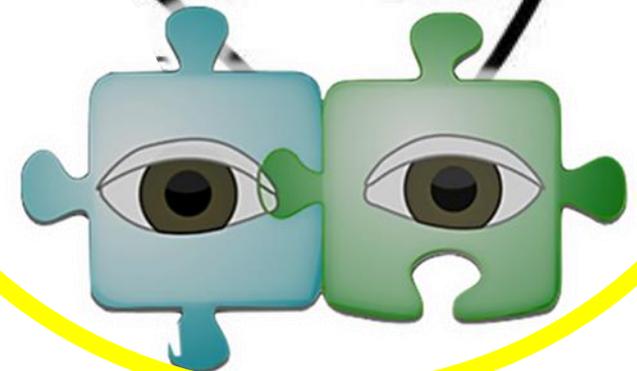
INTEGRATIVE SCIENCE

= bringing together
 Indigenous and Western
 scientific knowledges and
 ways of knowing



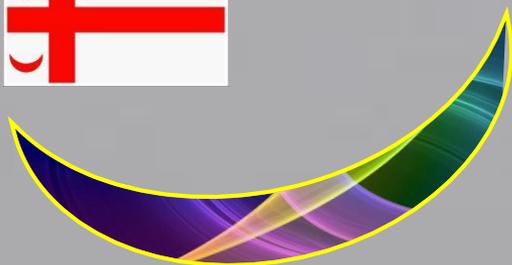
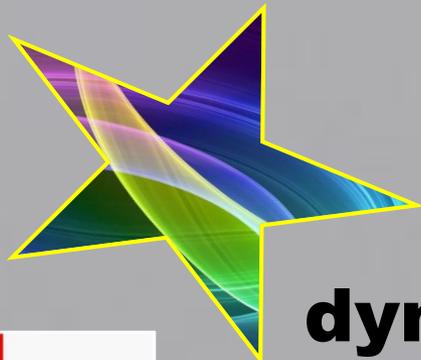
PEDAGOGY

Learning Spirit
 Lifelong Learning
 Middle Ground
 Two-Eyed Seeing
 (science education)
 Love Hypotheses
 Language (Aboriginal) Life & Land
 Language (Mathematics) Theories & Models



Integrative Science:

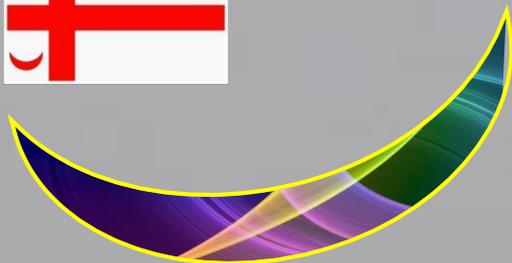
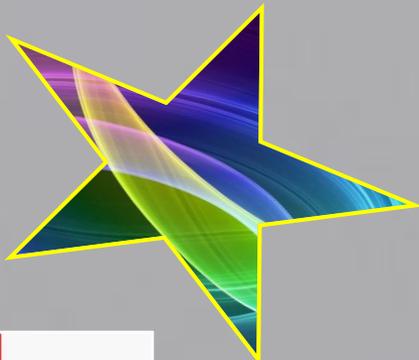
**science =
dynamic, pattern-based knowledge
shared through stories
about our interactions
with and within nature**



DRAFT

Integrative Science:

mobilized within APCFNC-funded work in 2012-2014



Roadmap for
Incorporating Aboriginal Traditional Knowledge (ATK) into
DFO's "Integrated Fisheries Management Plan" planning process
for the Commercial Snow Crab Fishery
in the Southern Gulf of St. Lawrence (Area 12)



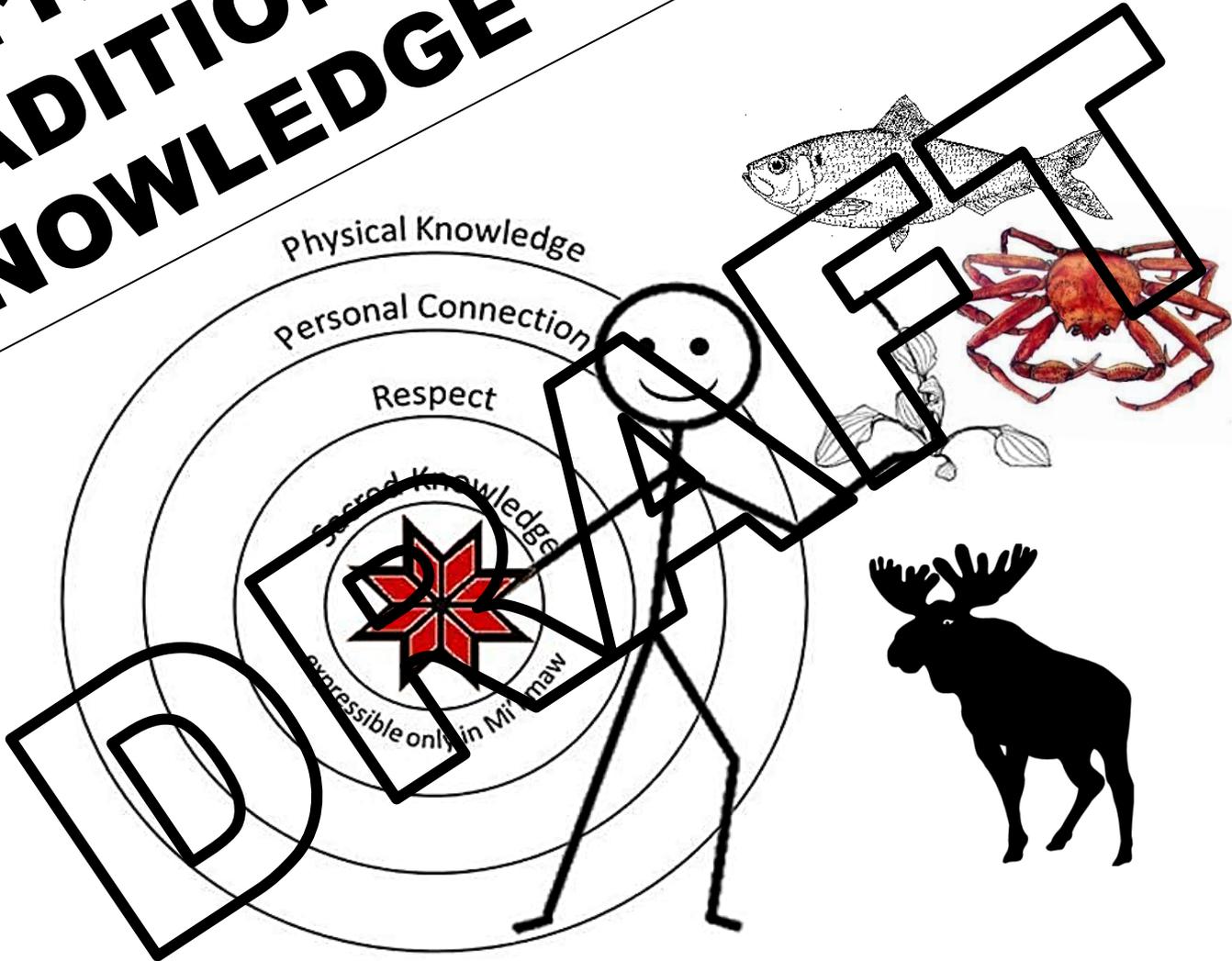
FINAL REPORT (APC Contract #2013-008 and Project #4125)
submitted to the Atlantic Policy Congress of First Nations Chiefs
Penultimate Draft - 20 MARCH 2013

Project Team / Report Authors

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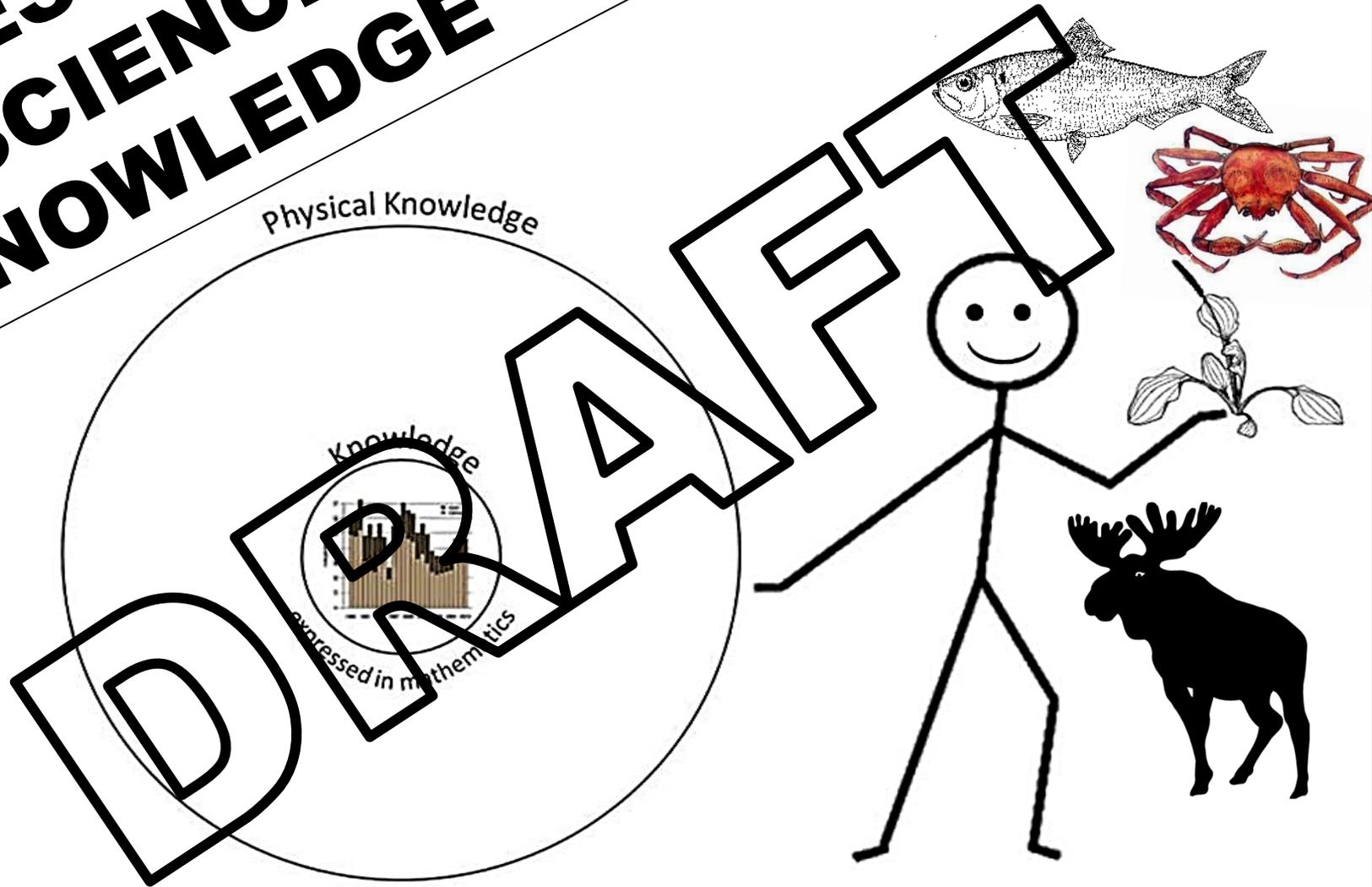
Concentric Circles Model for ATK / MTK
adapted from Elder Murdena Marshall

MI'KMAQ TRADITIONAL KNOWLEDGE

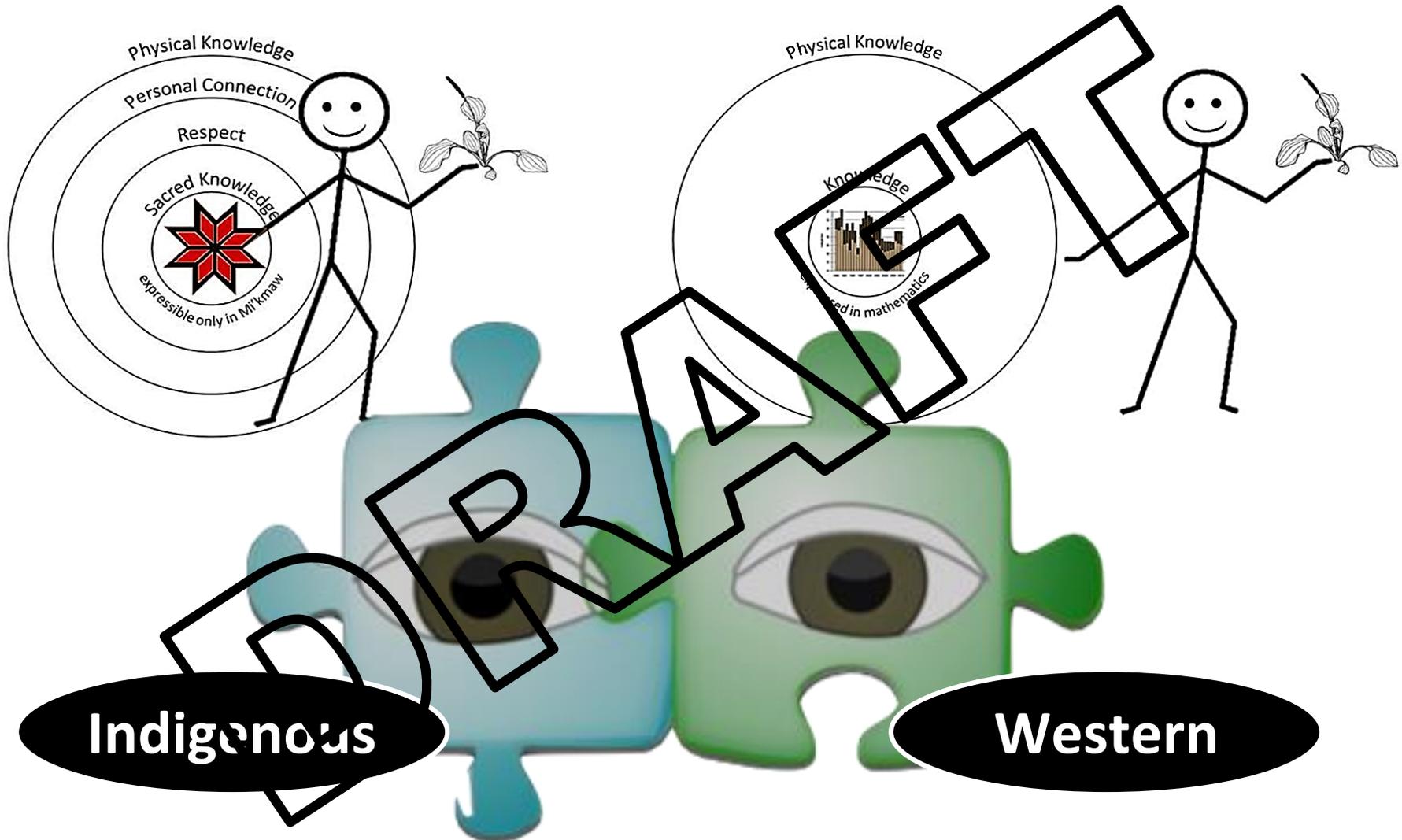


Model for Western Science patterned after
“Concentric Circles Model for ATK / MTK”
by Elder Murdena Marshall

**WESTERN
SCIENCE
KNOWLEDGE**



**The challenge is to bring together
the strengths from both so as
not to compromise the integrity of Mother Earth.**



Day-by-Day Fishing Experiences



Personal Observations & Stories

Fishing Trawls

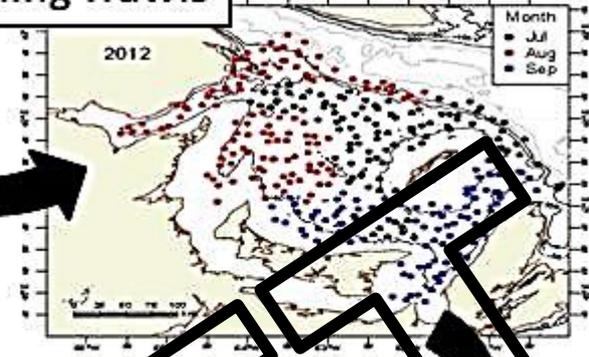
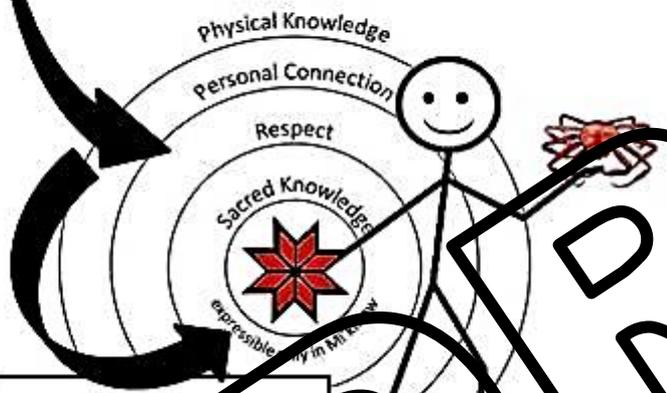


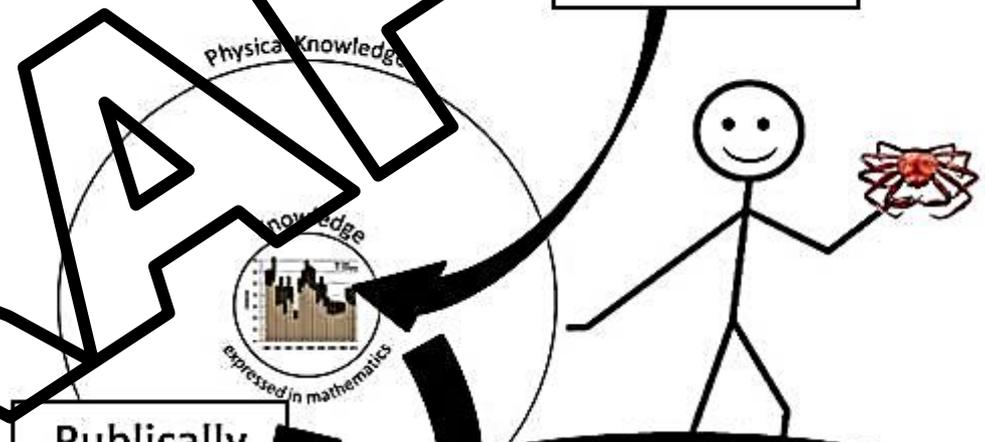
Figure 8. Monthly geographic distribution of trawls hauled during the 2012 survey

Trawl Results



Collective Oral Knowledge
ATK / MTK

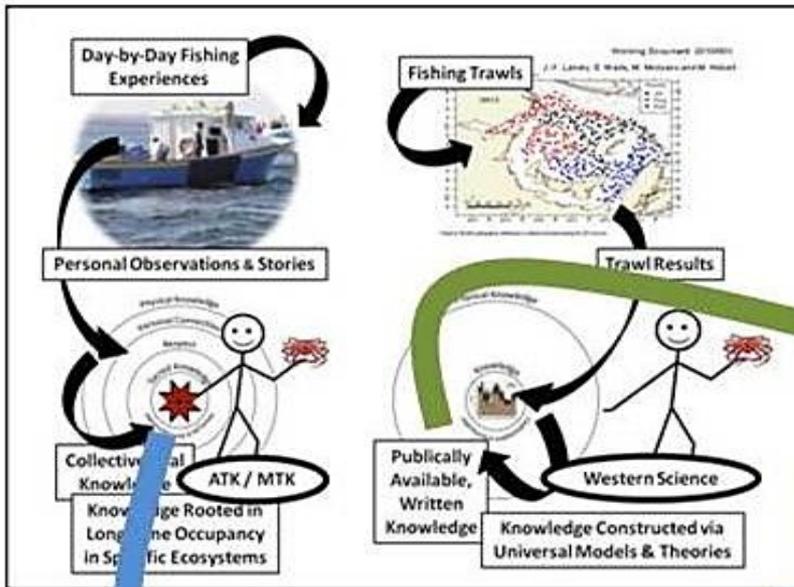
Knowledge Rooted in Long Time Occupancy in Specific Ecosystems



Publically Available, Written Knowledge

Western Science
Knowledge Constructed via Universal Models & Theories

DRAFT



2014 APCFNC-funded Two-Eyed Seeing work:

What community engagement methodology or process can we design to begin to bring ATK into the DFO process?



words of Mi'kmaq Elder Albert Marshall, LLD, Eskasoni First Nation

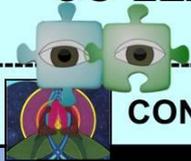
Ntua'q kinuk me'ki kina'masultinew aq wli nstmnew eptuaptasimkewey. Nuta'q wla etuapmkewey ankite'tm nej kulaman wen pipanikkesij kisi apoqnuatisnu nsitmnew. Ta'nik teto'qi msitmu'k miamuj kekinamu'kik ta'n koqoewey. Etuaptimkewey, miamuj weji kmitu'tij mimajik, ta'n telukwek aq kepmite'tasin. Kejitu tetpaqi ewekasi'k wsitqamu ajiknatew kinuk keji'tuk mu wen newtite'lsin ta'n tijiw weji ka'qa'tun aq pasik nekm wtapesin. Nuta'q iknaq, pitui knajan aq wsitkamuk siawasinm nutaq elt kinamuan wulo'tmnew wsitqamu wjit na nemowk.

We need to embark on a co-learning journey of Two-Eyed Seeing in which our two paradigms will be put on the table to be scrutinized. We need to honestly be able to say that the essence, the spirit of our two ways, has been respected as we work to balance the energies of those ways. We need to put the two together, such that we have something so profound that we can sustain ourselves and at same time be very cognizant that our actions of today do not jeopardize the ecological integrity of area. Our actions have to be seen to be beneficial for people of the next generations.

to get there ... we need to do this together, we need to **CO-LEARN**

CO-LEARNING for Two-Eyed Seeing

learning our strengths and learning together



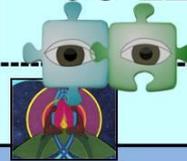
CONCEPTS and ACTIONS (epistemologies)

- respect
 - relationship
 - reverence
 - reciprocity
 - ritual (ceremony)
 - repetition
 - responsibility
- the question
 - hypothesis (making & testing)
 - data collection
 - data analysis
 - model & theory construction

J. Archibald, 2001, Can. J. Native Ed. 25(1):1-5

CO-LEARNING for Two-Eyed Seeing

learning our strengths and learning together



KNOWLEDGE OBJECTIVES

collective, living knowledge to enable nourishment of one's journey within expanding sense of "place, emergence and participation" for collective consciousness and interconnectiveness

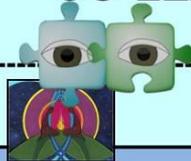
dynamic, testable, published knowledge independent of personal experience that can enable prediction and control (and "progress")

Towards resonance of understanding within environment

Towards construction of understanding of environment

CO-LEARNING for Two-Eyed Seeing

learning our strengths and learning together



METHODOLOGIES

weaving of patterns within nature's patterns via creative relationships and reciprocities among *love, land, and life (vigour)* that are constantly reinforced and nourished by **Aboriginal languages**

unweaving of nature's patterns (especially via analytic logic and the use of instruments) to cognitively reconstruct them, especially using **mathematical language (rigour)** and **computer models**

CO-LEARNING for Two-Eyed Seeing

learning our strengths and learning together



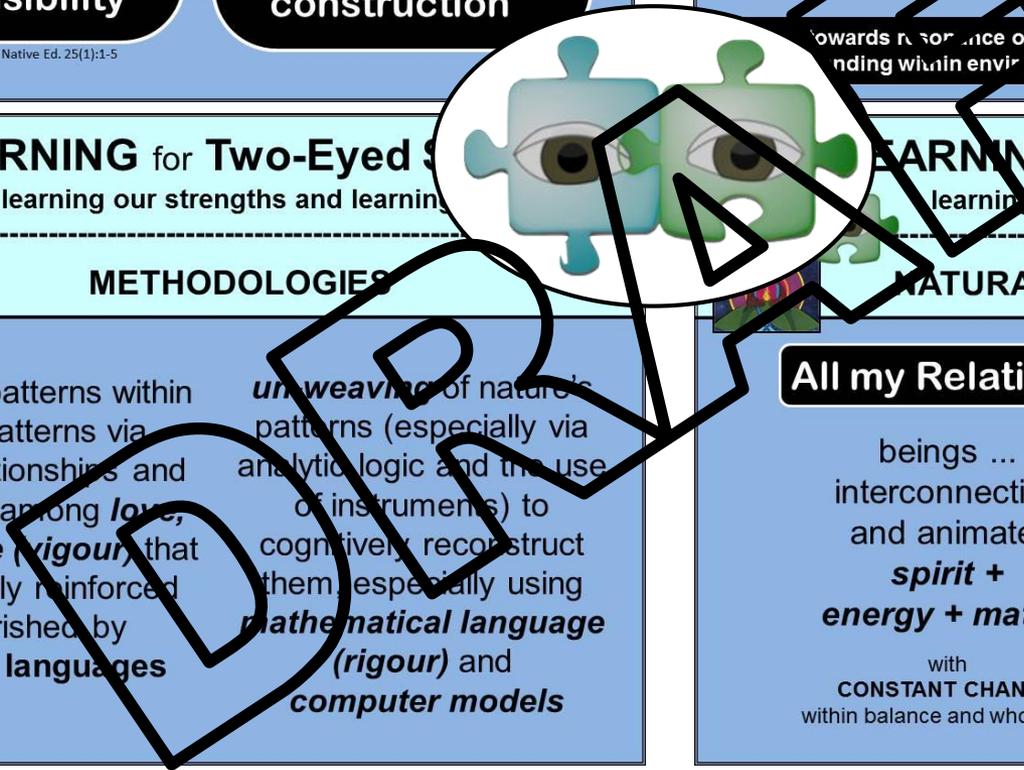
NATURAL WORLD (ontologies)

All my Relations

beings ... interconnective and animate:
spirit + energy + matter
with **CONSTANT CHANGE** within balance and wholeness

parts & wholes

objects ... comprised of parts and wholes characterized by systems and emergences:
energy + matter
with **EVOLUTION**



Native Science Academy

<http://www.silverbuffalo.org/NativeScienceAcademy.html>

Founding Director

- Dr. Rose von Thater-Braan, Director of Education, Centre for Particle Astrophysics at University of California – Berkeley (retired 2010)

Founding Members (4 of the 6)

- Dr. Marie Battiste (University of Saskatchewan)
- Dr. Sakej Henderson (University of Saskatchewan)
- Dr. Leroy Little Bear (Harvard University, University of Lethbridge)
- Amethyst First Rider (University of Lethbridge)

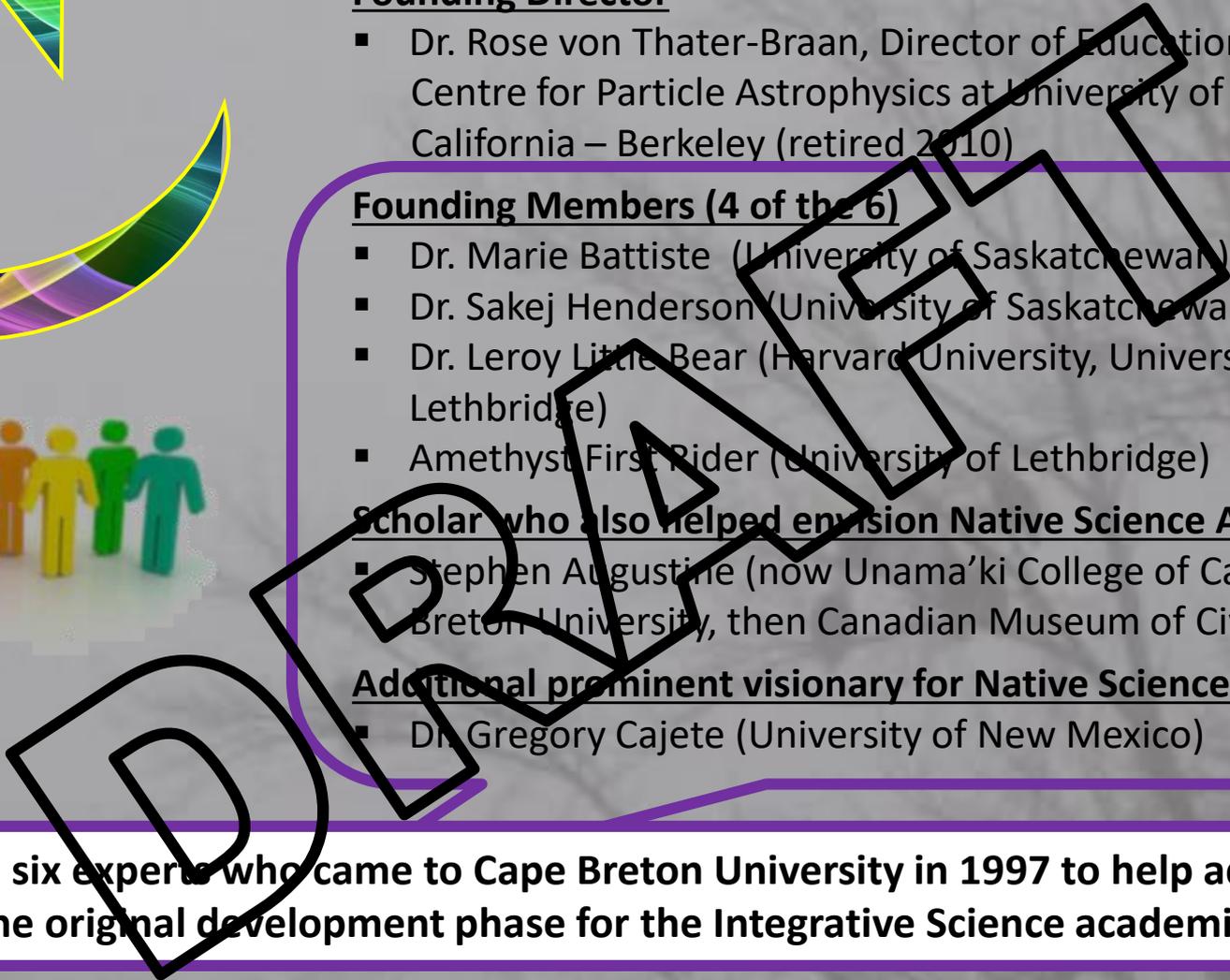
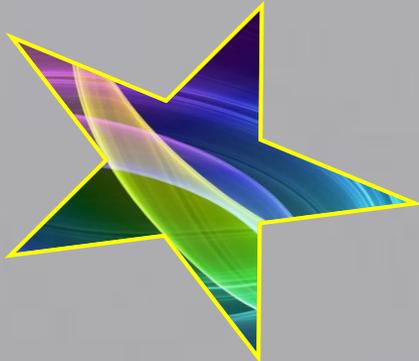
Scholar who also helped envision Native Science Academy

- Stephen Augustine (now Unama'ki College of Cape Breton University, then Canadian Museum of Civilization)

Additional prominent visionary for Native Science

- Dr. Gregory Cajete (University of New Mexico)

the six experts who came to Cape Breton University in 1997 to help advise during the original development phase for the Integrative Science academic program



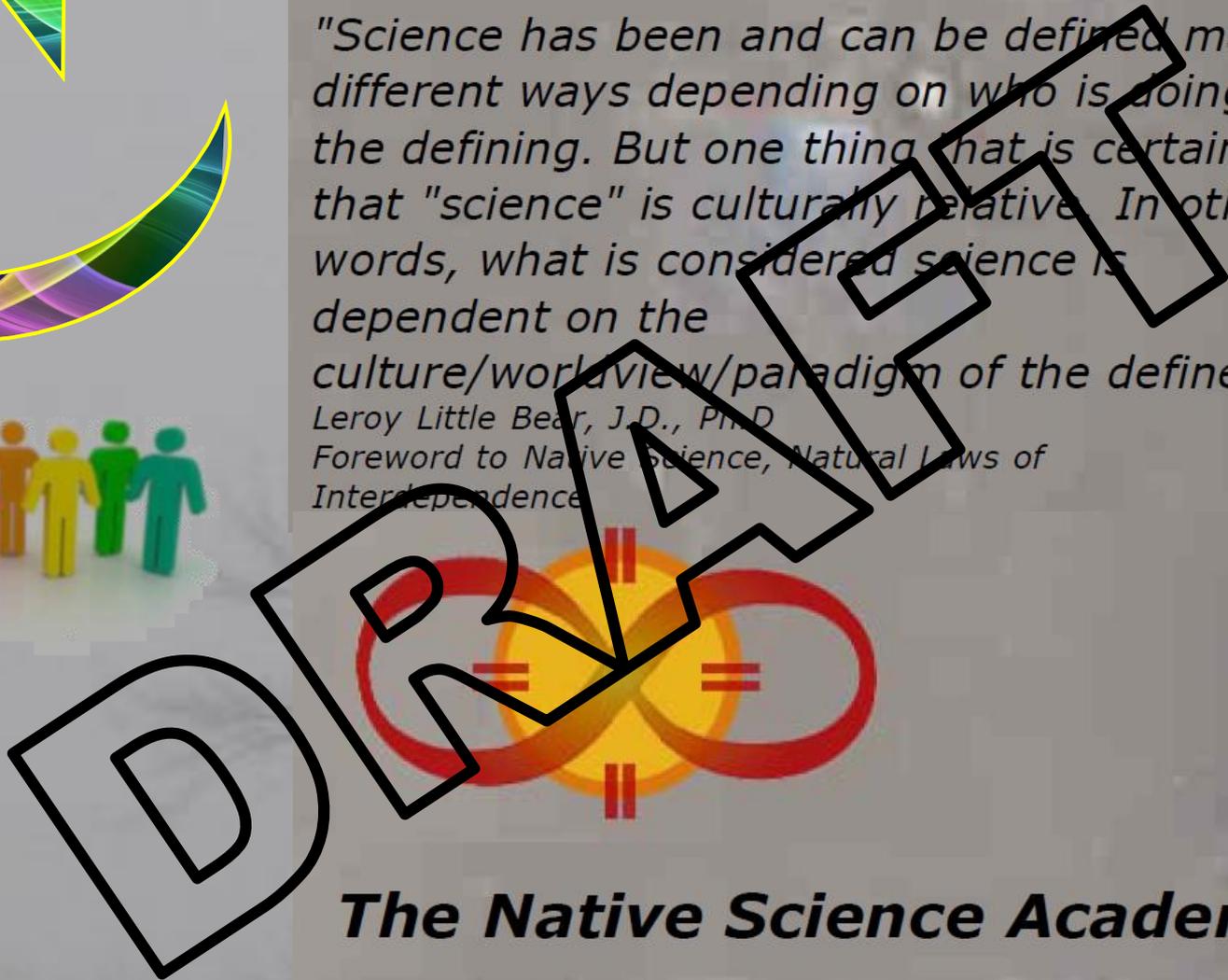
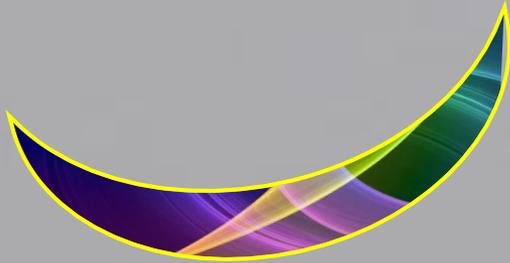
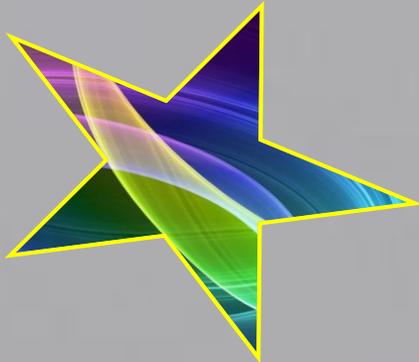
Native Science Academy

<http://www.silverbuffalo.org/NativeScienceAcademy.html>

"Science has been and can be defined many different ways depending on who is doing the defining. But one thing that is certain is that "science" is culturally relative. In other words, what is considered science is dependent on the culture/worldview/paradigm of the definer."

*Leroy Little Bear, J.D., Ph.D.
Foreword to Native Science, Natural Laws of Interdependence*

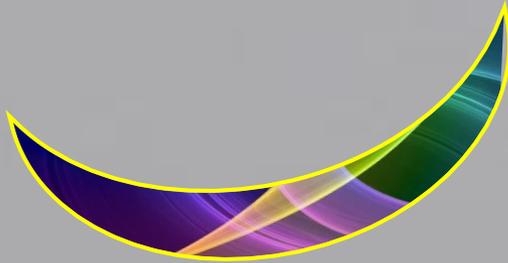
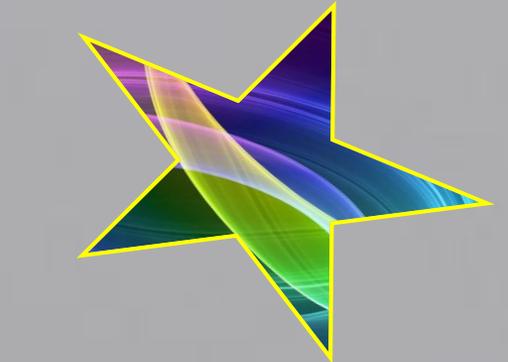
The Native Science Academy



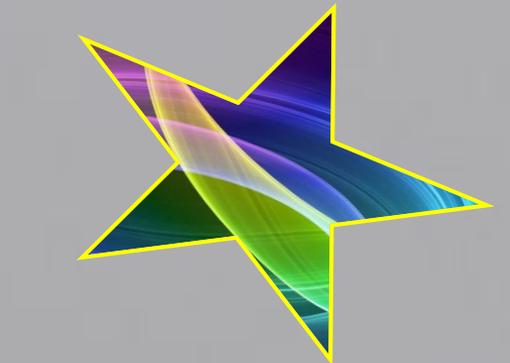
Principles of Native Science

Certain elements of the Native Science Paradigm are common to Western science while others go beyond the conventional framework. For example, the following tenets are held by both Western and Native science:

- Basic relationships, patterns and cycles in the world can be properly understood by a mathematical approach.
- The simplicity and beauty of nature reflects a dynamic, multi-dimensional enduring harmony in the Universe.
- Curiosity about the natural world is an essential motivation and careful observation an essential discipline for acquiring scientific knowledge.
- Imagination and creativity are essential for the advancement of science, although these processes are understood poorly in Western science.
- Scientific knowledge, once gained by individuals, is contributed to the community, and appropriate technologies must be developed to meet societal needs while simultaneously protecting the environment.



The Native Science Academy

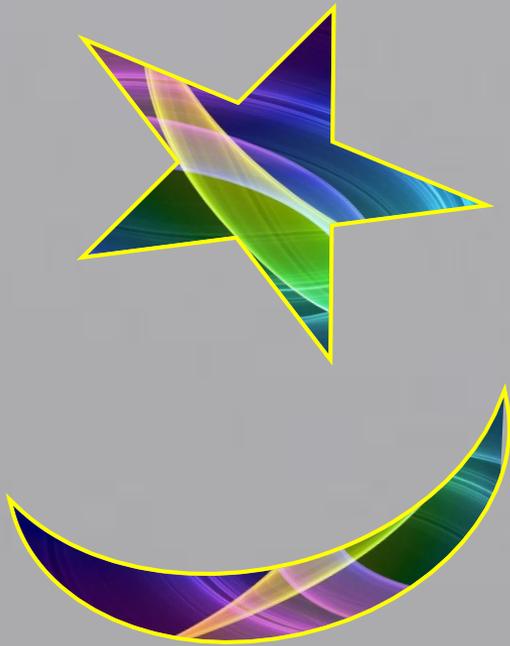


The Native Science Academy

<http://www.silverbuffalo.org/NativeScienceAcademy.html>

Native Science extends these tenets in the following ways:

- Native science does not view living systems reductively, but rather grants them full integrity and ontological standing. Such integrity and standing is likewise granted to the rest of the universe, in which everything is viewed as animate and having spirit.
- Based on this worldview, the human being logically is in existential relationship to all domains of nature with corresponding responsibilities.
- As self-conscious agents, human beings must recognize our role and responsibility to assist in maintaining dynamic balances of the natural world through participation and renewal.
- Responsibilities people naturally feel towards communities and individuals are extended also to 'place,' because each place reflects the whole order of nature.
- Knowledge holders must be ethical elders and leaders.
- The technologies we develop should not only be appropriate and non-destructive but also reflect and contribute to these balances and renewal.
- Human actions should emerge from a source beyond individual motive, and instead be sanctioned through ritual and ceremony reflecting a larger spiritual world order.



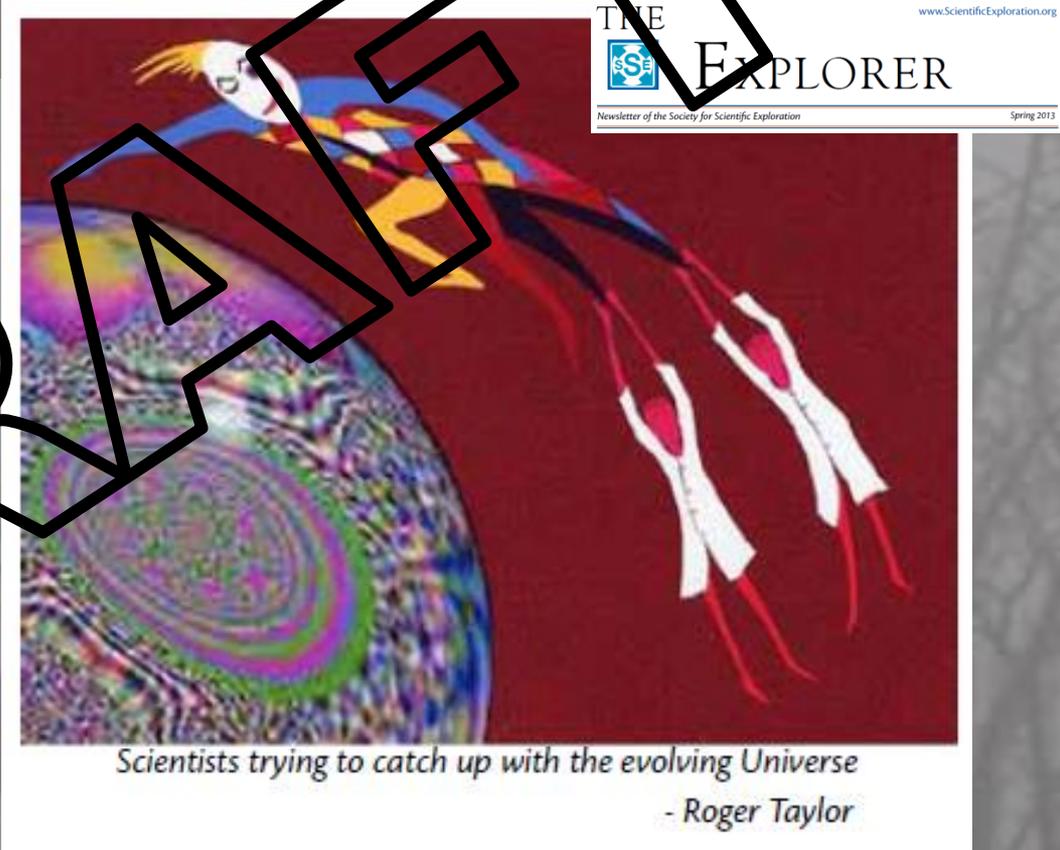
Recent developments in Western science have brought it closer to Native science views:

- Complex, adaptive systems display emergent properties at high levels of organization
- Self-organizing systems are leading to appreciating life from the level of the cell to that of the planet
- Quantum mechanics and relativity theory have led to profound changes in concepts of space, time and causality.



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<http://www.silverbuffalo.org/NativeScienceAcademy.html>

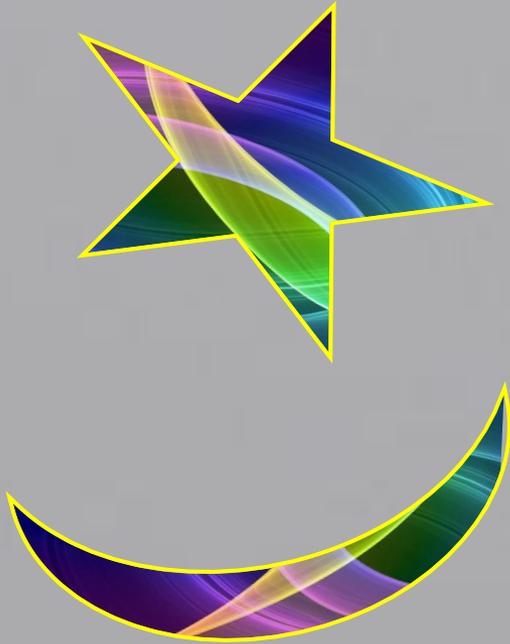


Scientists trying to catch up with the evolving Universe
- Roger Taylor

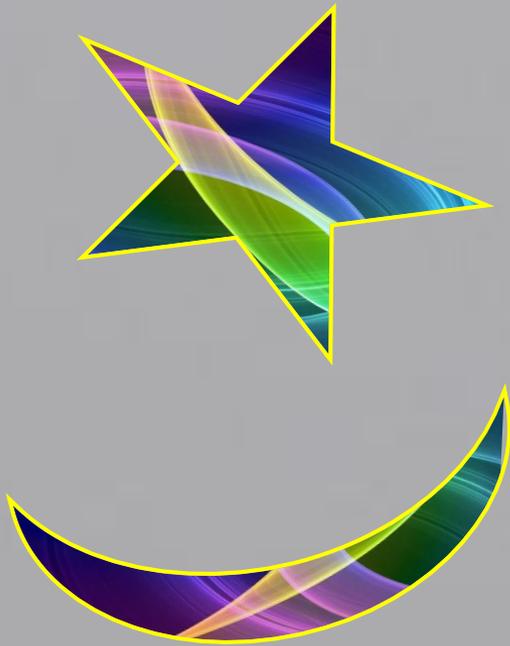
The Native Paradigm

Through the Native paradigm we experience a relational universe and know that our relationship with the interconnected web of life sits at the heart of deep learning. Fundamental to these relationships is the openness of the human to the continual flow of energy in the universe. As this openness is developed, it enables people, and potentially societies, to remain in harmony with a continually evolving cosmos. This cosmos, the universe and everything within it, is experienced as a living phenomenon. Lastly, knowledge is embodied and contextual: abstract ideas do not constitute knowledge so much as does capacity evident in a person or group, and all knowledge is inseparable from its social and physical setting. This means that knowledge intrinsically encompasses a moral and ethical dimension, and who holds the knowledge is inseparable from the knowledge itself. This paradigm gives rise to philosophies that underlie and give distinctive form to science, law, health, ethics and governance - in short, all aspects of native life and culture.

DRIVER



The Native Science Academy



Methodology

Native Science

Observation. The Native scientific approach to seeking knowledge is done through long term observation of the total web of relational networks with the intent of maintaining balance and harmony.

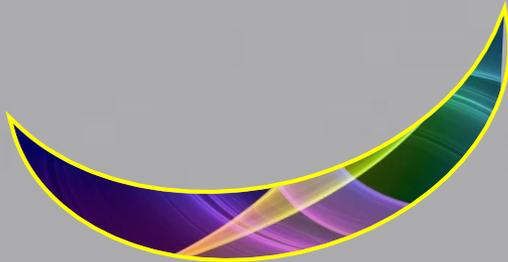
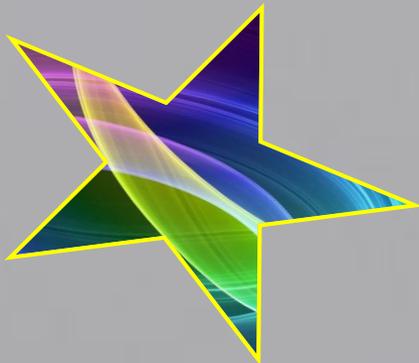
Lived Experience. The day to day experiences of the individual and collective which may be based on knowledge gained through all of the above.

Search (as opposed to research). The Native view is that all of the universe consists of energy waves which are in a state of constant flux transforming, combining, recombining, deforming, etc. One can say that the Native person is forever "surfing the flux" to discover regular patterns, which then can be used as reference points.

"All My Relations." Knowledge can come from "All My Relations"- that is from meaningful connections with all domains of nature. Knowledge may come to a person from "All My Relations" in a state of awakesness, in a vision, or dream.



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The Native Science Academy

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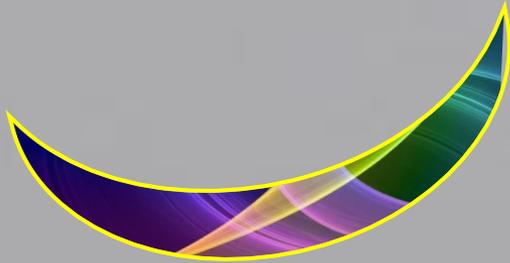
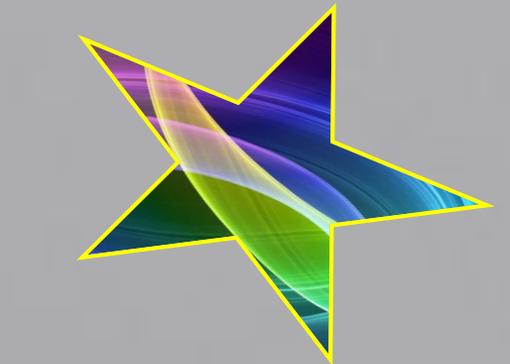
Methodology (cont'd)

Native Science

Dreams. Reality is not limited to a state of awakensness. Dream reality is part of the overall reality and lived experience. Knowledge can come from dreams in the same way knowledge can come from experiences in a state of awakensness - both are subject to validation, which is done through testing conducted in a state of awakensness to ascertain the uses and values contained in the knowledge.

Visions. Visions are a more intentional and disciplined search for knowledge, as opposed to dreams, which can happen any place. Vision quests, for example, require careful and diligent preparation, including a range of ceremonial protocol.

Story, song, and ceremony. Story, song, and ceremony are manifestations of regular patterns in the flux, which are used for knowledge and renewal purposes.



The Native Science Academy

<http://www.silverbuffalo.org/NativeScienceAcademy.html>

Western Science

Observation. Observation in western science is mainly mathematically based. Observation is connected with predictive testing.

Experimentation. Observation is complemented by experimentation, which is the "the fast-forwarding" of nature's processes. It is the curiosity seeking aspect of science. "Let us see what will happen if we do such and such....if we combine "A" with "X".

Research. Disciplined and organized activity to discover, understand and share marks science as a social system.

Technology. Technology encompasses the equipment and tools of western science as well as its embodiment. It serves the role of being the gateway to new knowledge, but it also mediates the relationship between humans and nature. Instruments of observation literally stand between human senses and natural phenomena. While they extend and amplify those senses, they may also serve to 'shift the burden' to the instrument, as opposed to developing human sensing and awareness. Application technologies likewise separate users from the knowledge embodied in the technology and from many of the consequences of using the technology.

Western Science (cont'd)

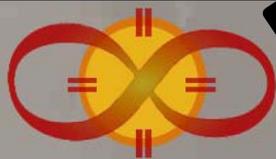
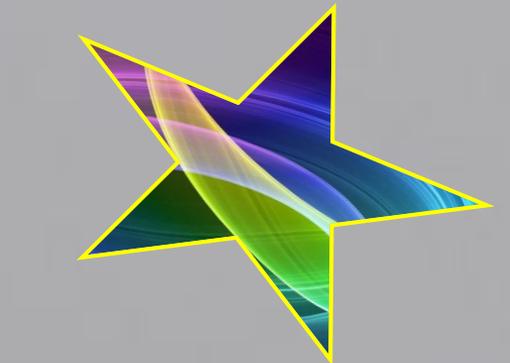
Measurement. Western Science relies mainly on measurement as a basis for confirmation of new knowledge. If something is not subject to measurement, it is not considered scientific.

[Western] Science is distinguished from other pursuits by the precise and limited intellectual means that it employs and the integrity with which it uses its limited means.

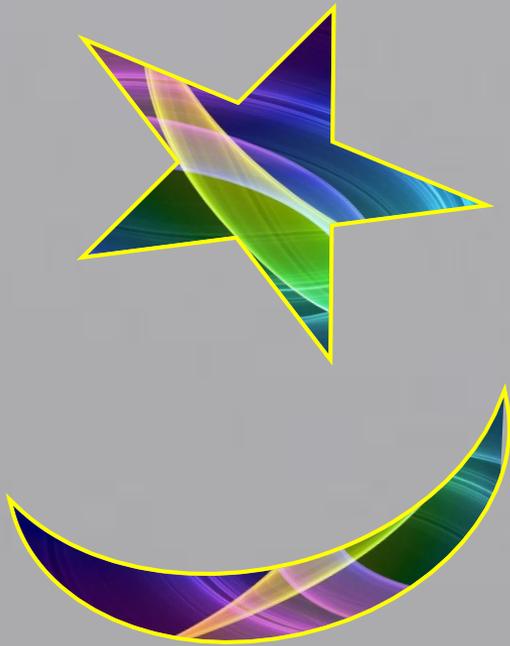
The [Western] scientific pursuit of truth uses no end of tools, ranging from sensitive scales to register the weight of a hair to observatories of the heavens.

Jane Jacobs, p. 65, 2004.

Dark Age Ahead. Vintage Canada.



The Native Science Academy



The Native Science Academy

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How Knowledge is Held:

Native American

Individual.

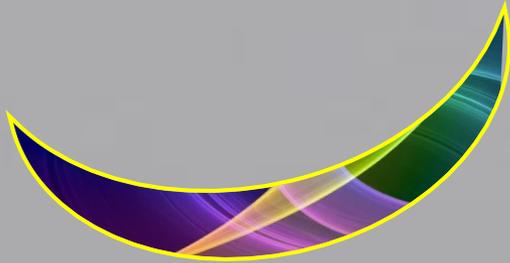
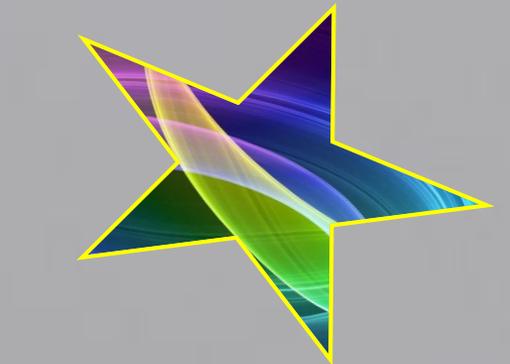
- Can gain knowledge through lived experience.
- Can gain knowledge through dreams.
- Can gain knowledge through vision quests.

The knowledge may or may not be shared depending on the individual and his/her dream. An individual can be entrusted with knowledge as a keeper for the benefit of the "Nation" (the society as a whole), e.g., "Bundle Holders." The Bundles may be transferred to other individuals.

Sacred Societies. The societies hold knowledge about some particular aspect of the web of relationships. That knowledge can only be shared among members of the society, and a person who wants to be privy to that knowledge must become a member of that society. This is part of the checks and balances regarding knowledge in native cultures, so that potentially powerful knowledge is not abused. In turn, there are checks and balances on the knowledge keepers themselves: people know who they are and the members of these societies are continually watched by the society at large to gauge their integrity.

Nation. Lived experience by the whole nation, which would include individual and collective experiences. This knowledge is conveyed by and arises out of traditional oral history.

DRIVER



How Knowledge is Held:

Western

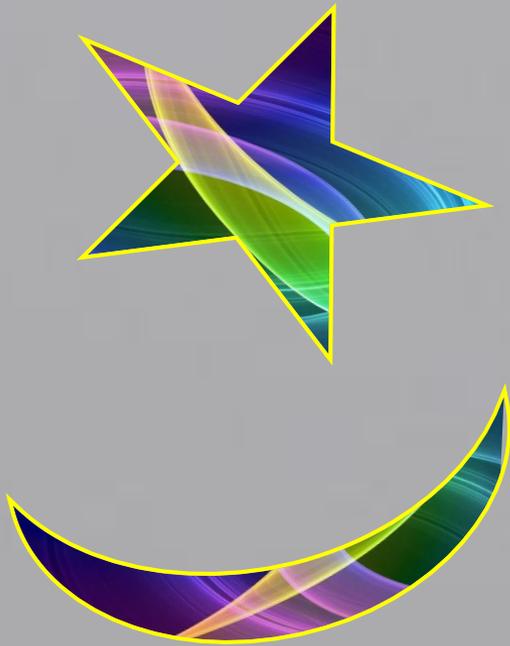
Church. Prior to the industrial revolution, the main knowledge holder was the church.

Scientists. Since the industrial revolution, scientists have taken over from the Church as the main knowledge holders. Scientists are the curiosity-seekers about what reality is all about. They do not take responsibility for how society utilizes their discoveries.

Knowledge Patented/Copyrighted. Knowledge that individuals have come to know but that is protected (for a limited time) for the sole economic gain of the knowledge holder. Supported as an economic incentive for innovation.



The Native Science Academy



General and Expert Knowledge

Commonality of Native and Western Science

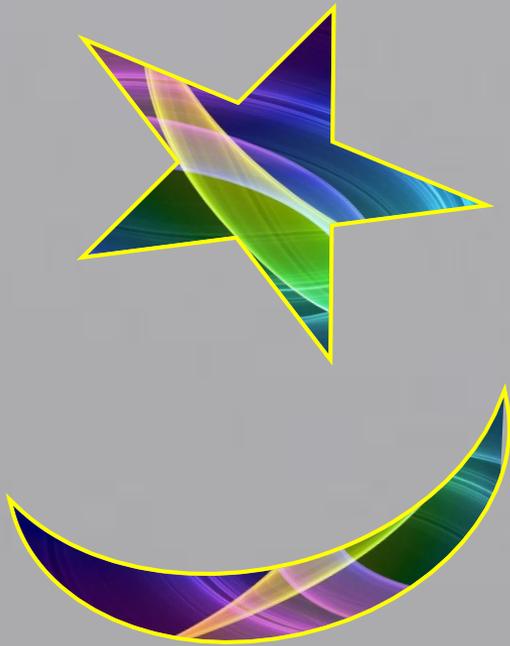
- General knowledge is accessible to the public ("the nation")
- Expert knowledge is only accessible to experts and can be accessed through developing sufficient expertise
- Expert knowledge requires specialized language and training.



DRAFT



The Native Science Academy



Differences Between Native and Western Science

- Language of expert knowledge in Western Science is technical and usually mathematical
- Language of expert knowledge in Native Science is particular native language (e.g., Blackfoot)
- Access to expert communities is largely determined by individual choice in Western Science
- Access to expert communities is determined both by choice and by invitation in Native Science (in the case of sacred societies)



The Native Science Academy

INTEGRATIVE SCIENCE

= bringing together
Indigenous and Western
scientific knowledges and
ways of knowing
(as knowledge systems)

TWO-EYED SEEING

= learning to see with
the strengths in both
Indigenous and Western
knowledges and ways
... and use them together

