

# **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

[www.integrativescience.ca](http://www.integrativescience.ca)

# **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](http://www.integrativescience.ca)

## **NOTE about this document:**

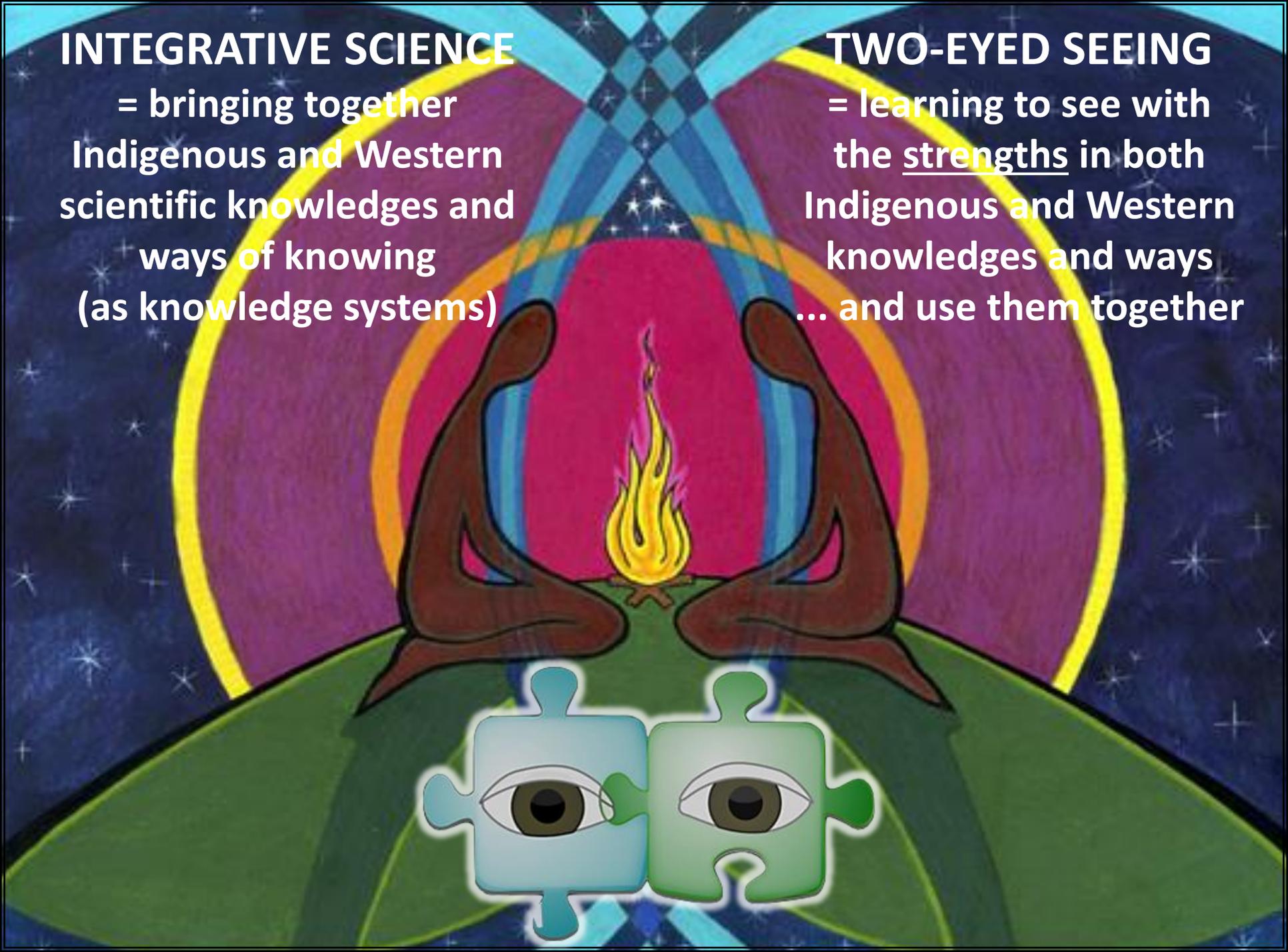
- Prepared in Winter 2014, this document along with others sought to convey understandings pertaining to *Integrative Science as a concentration with innovative MS&T science courses* within the *Bachelor of Science Community Studies (BScCS) four year degree* at Cape Breton University. They were prepared 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

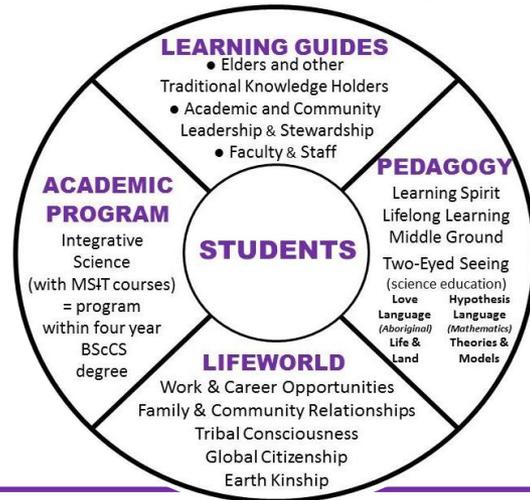
= bringing together  
Indigenous and Western  
scientific knowledges and  
ways of knowing  
(as knowledge systems)

## TWO-EYED SEEING

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

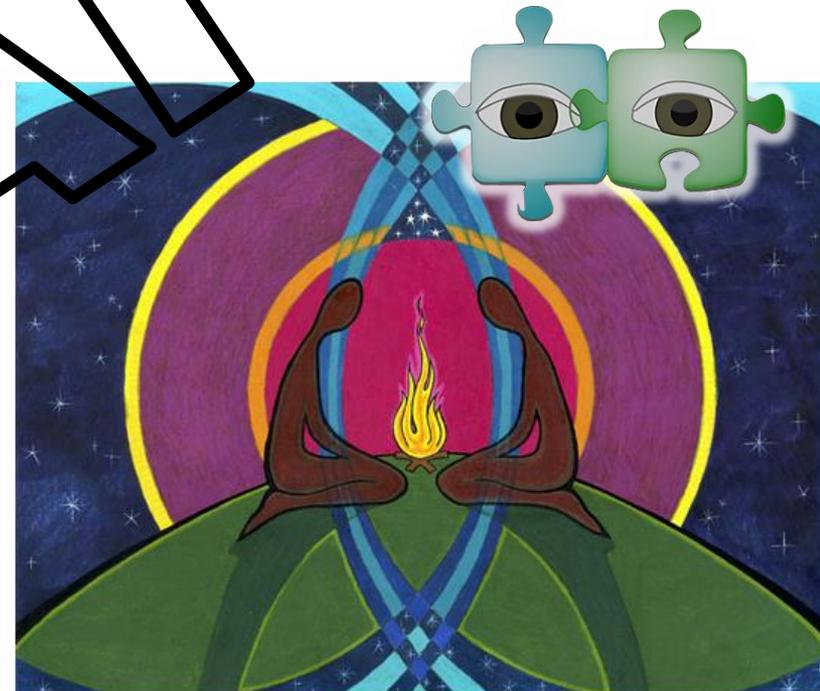


a document to share  
 “information, resources, positioning, and congruencies”  
 towards better and broader understandings of  
**Integrative Science and Two-Eyed Seeing**



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.

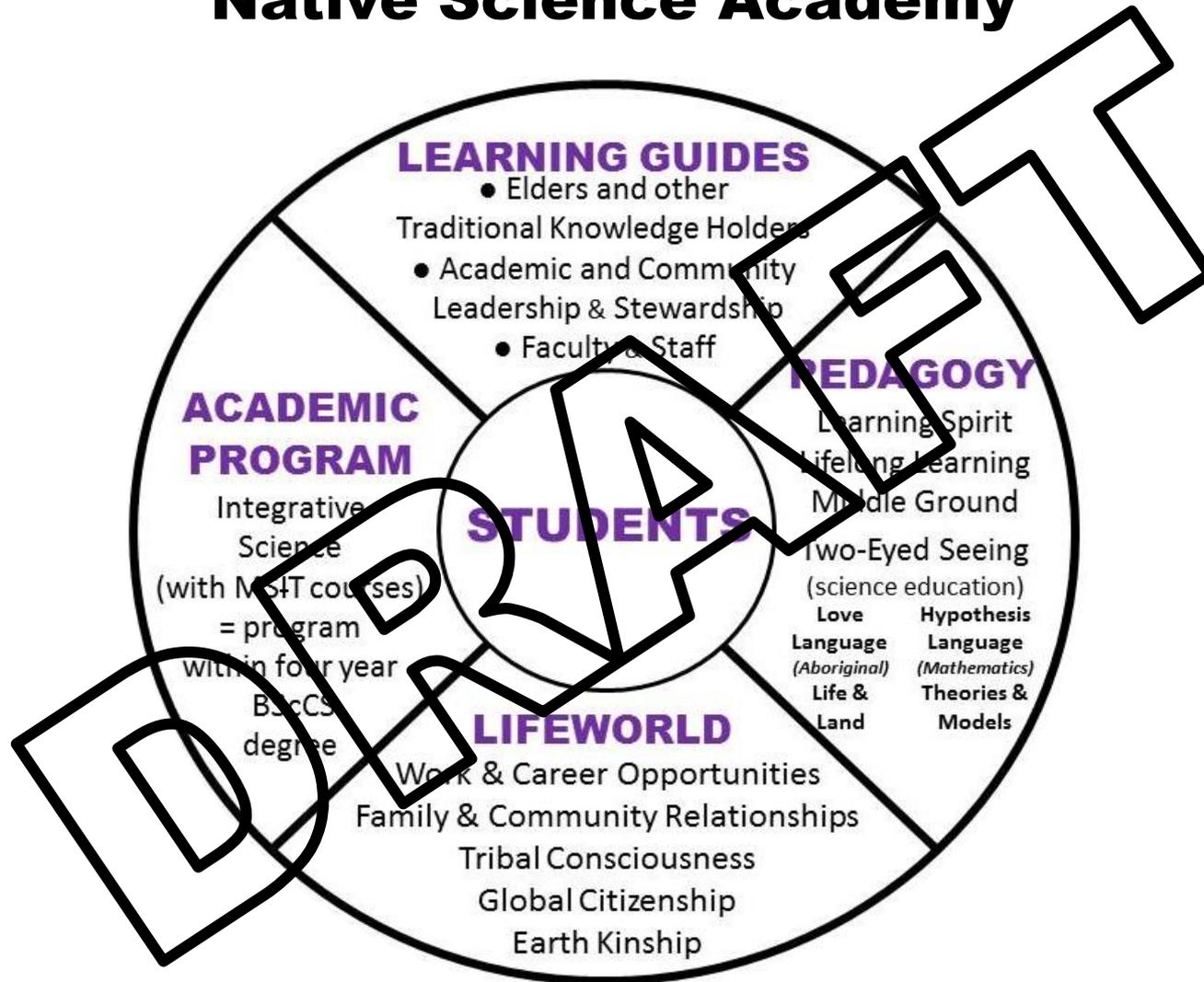
The documents in the series rely heavily on the use of images, congruent with the request that Integrative Science encourage learning in a visual way, a request made by Inukman community members when the academic program was conceived in the mid-1990s. The ability to read images and ponder a visual landscape – 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](http://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. Saked 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.

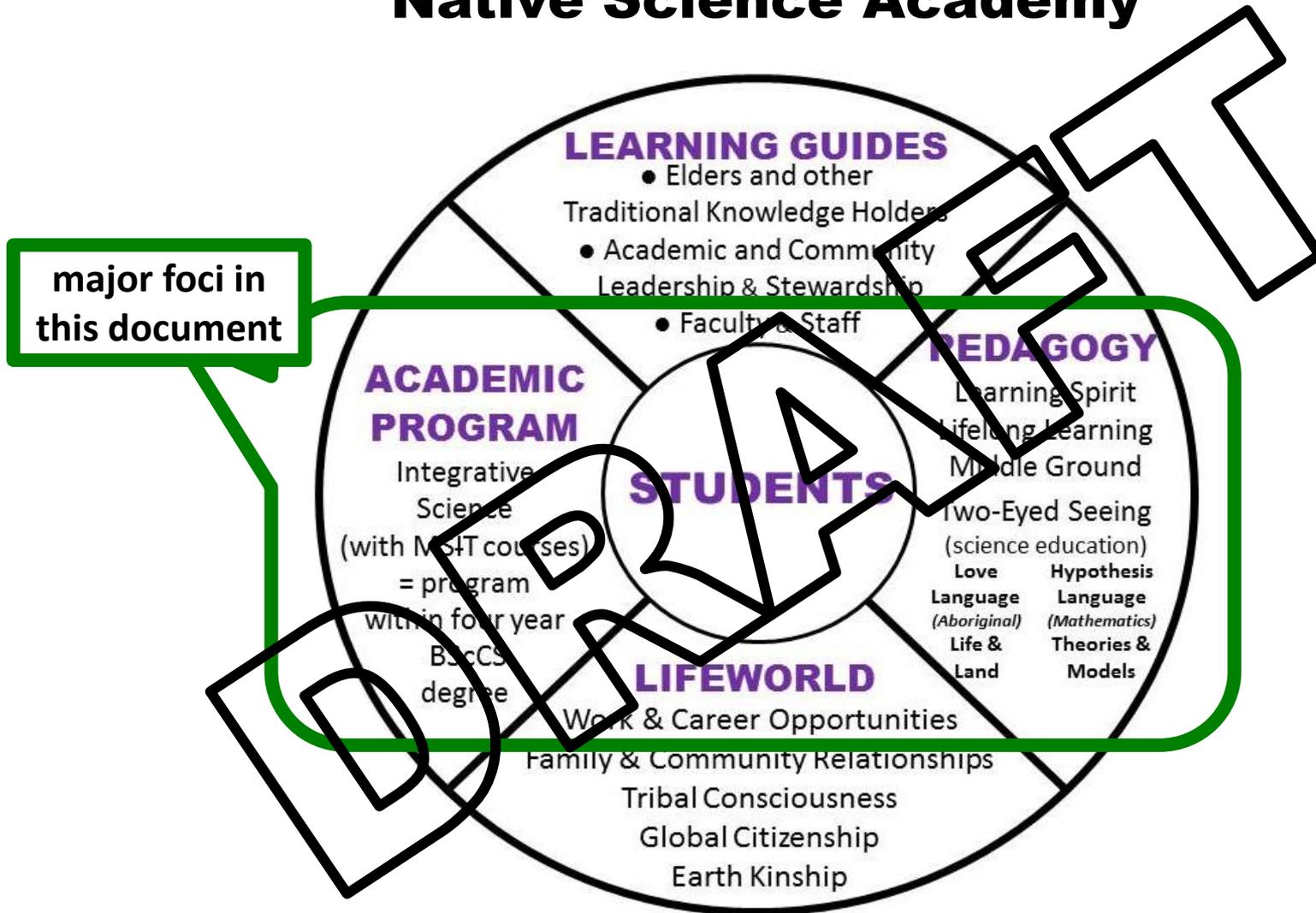
# Integrative Science view on “science”

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**

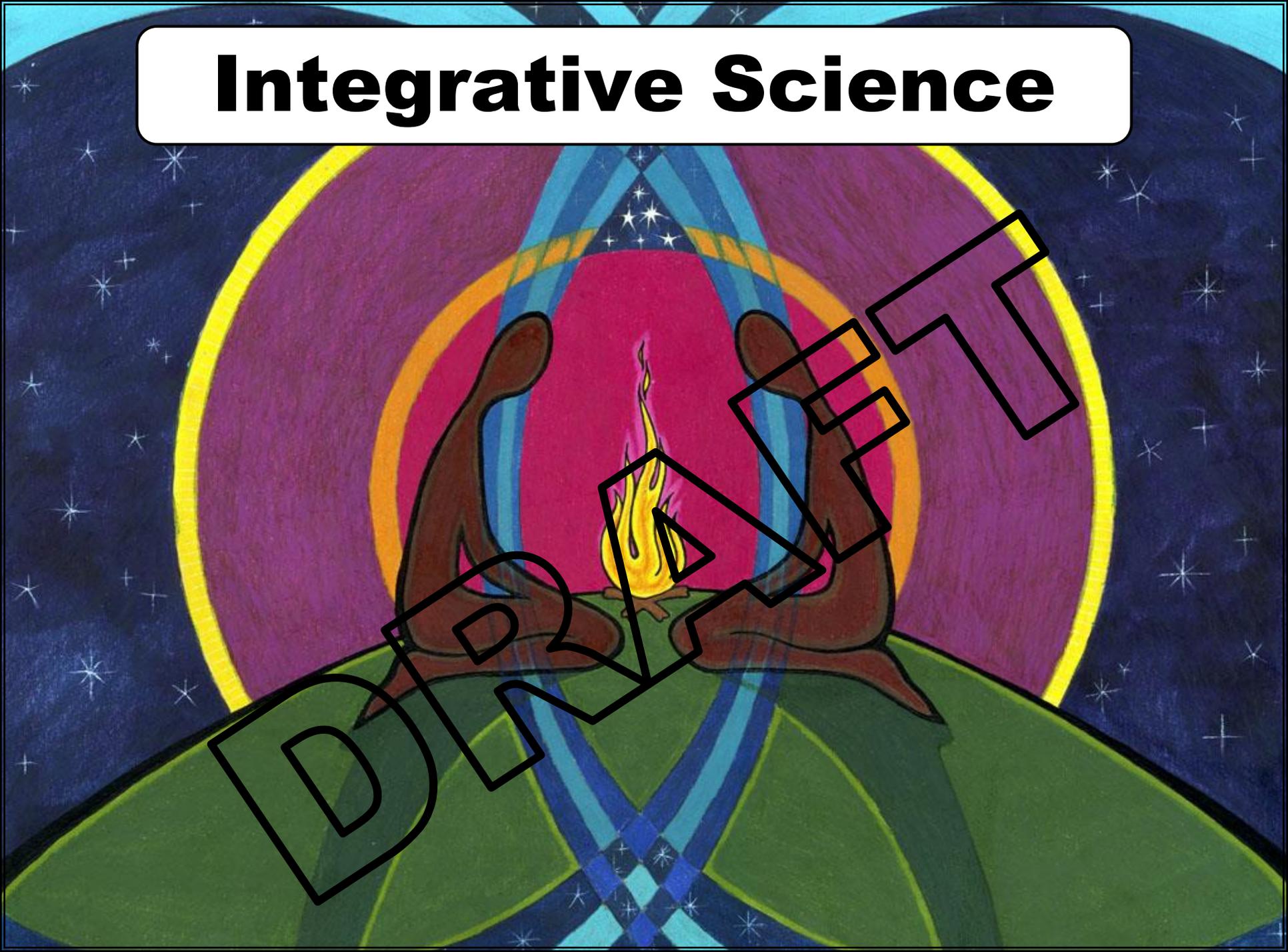
### **PREMISE:**

- 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



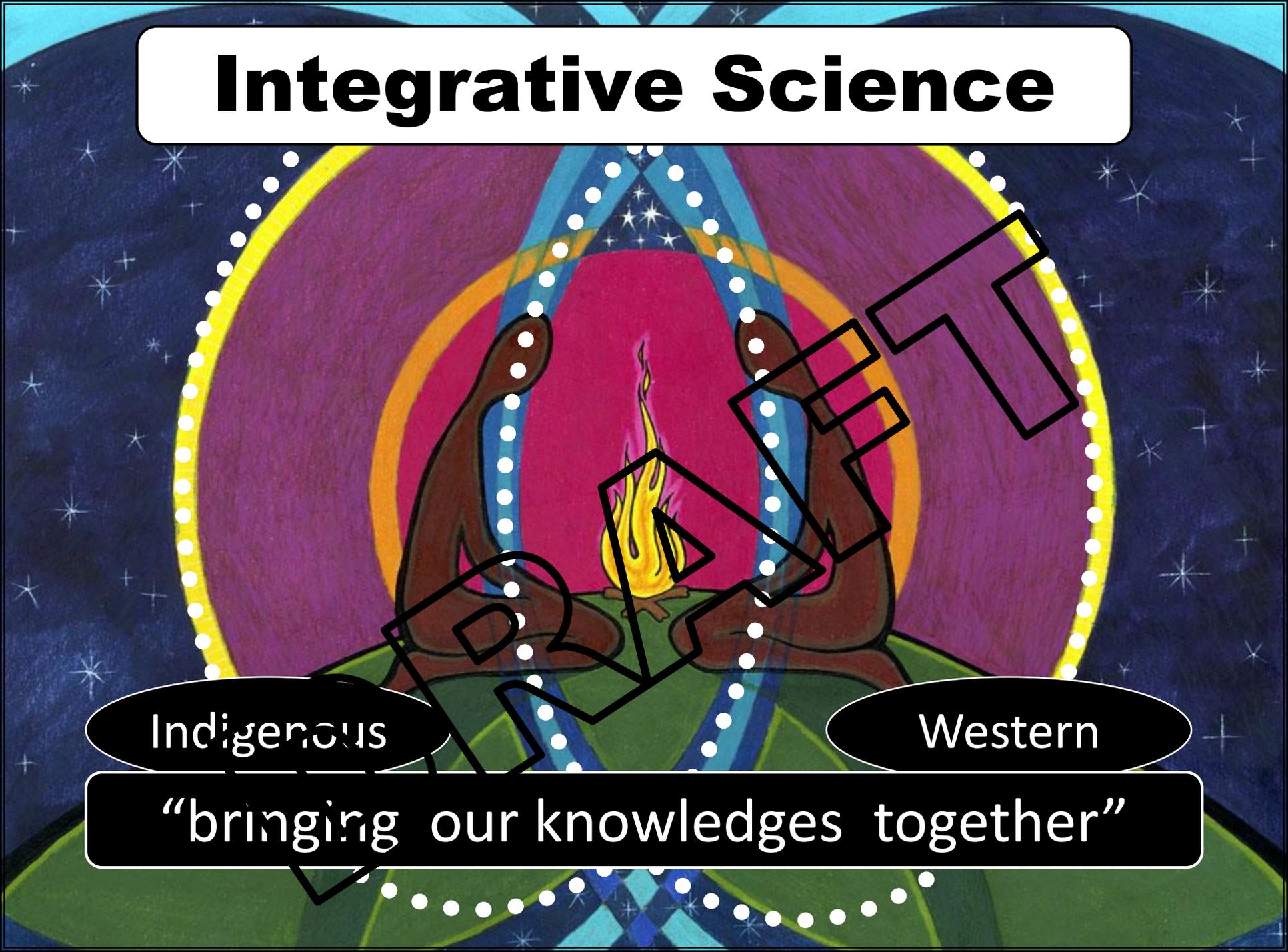
# Integrative Science

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

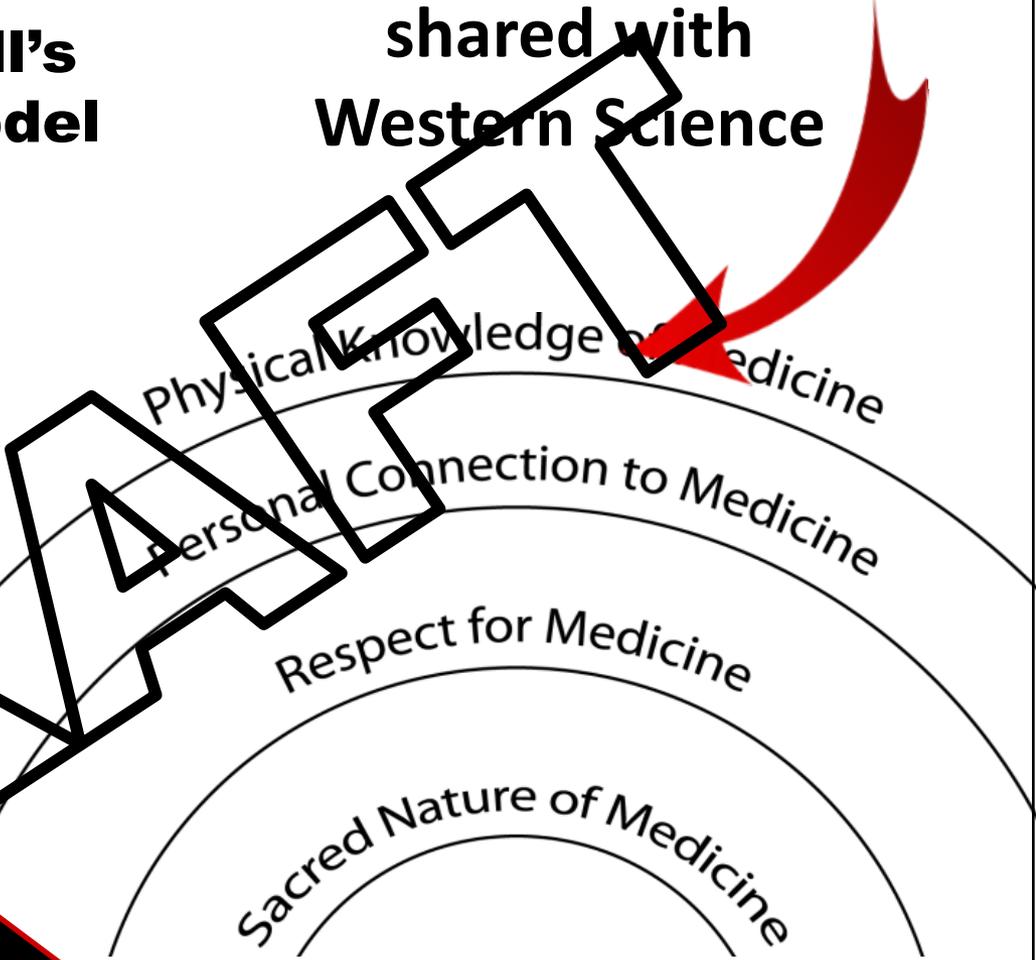
Western

“bringing our knowledges together”

# Integrative Science

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

shared with  
**Western Science**

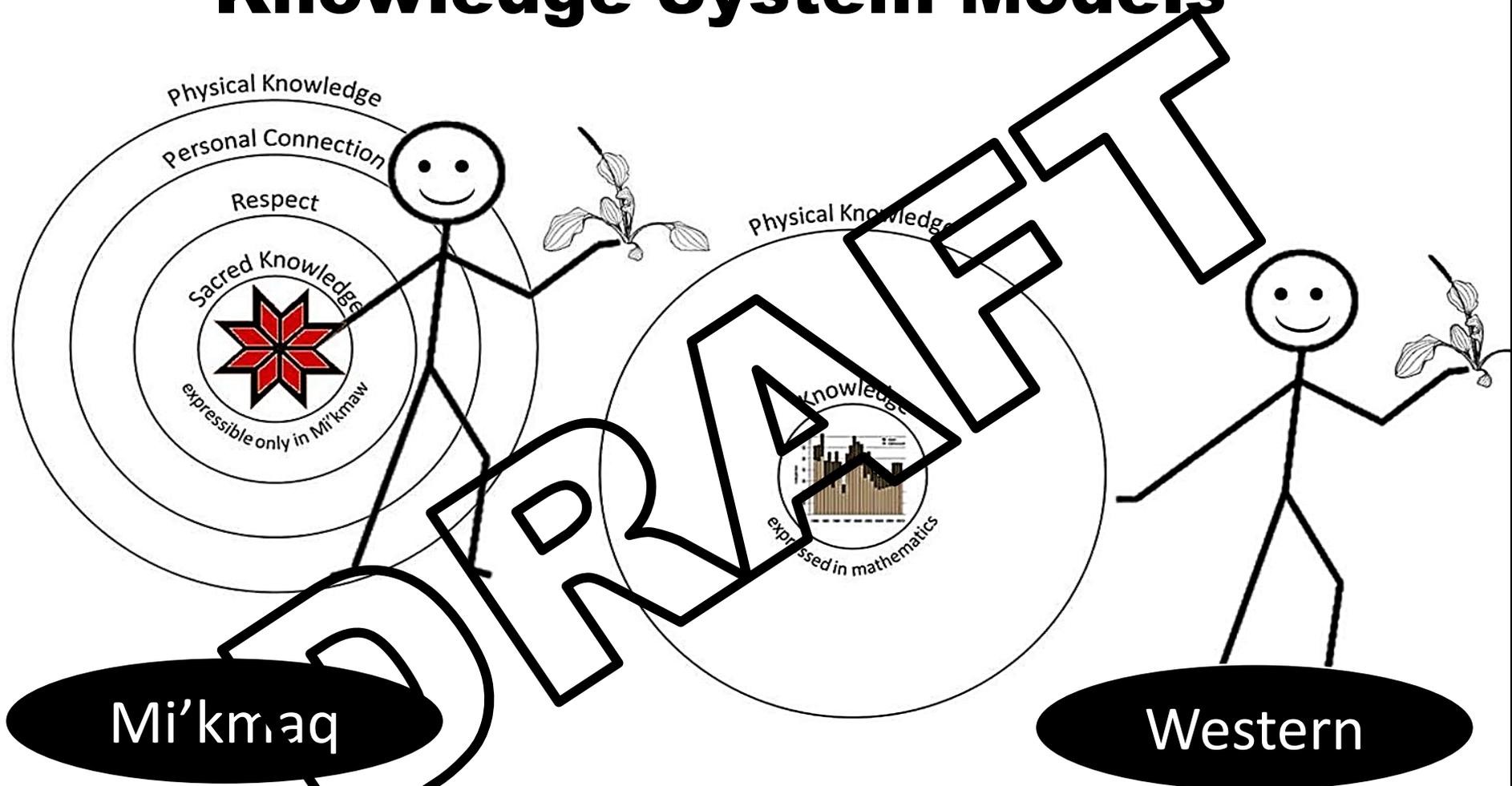


**DRAFT**

**4 concentric circles**

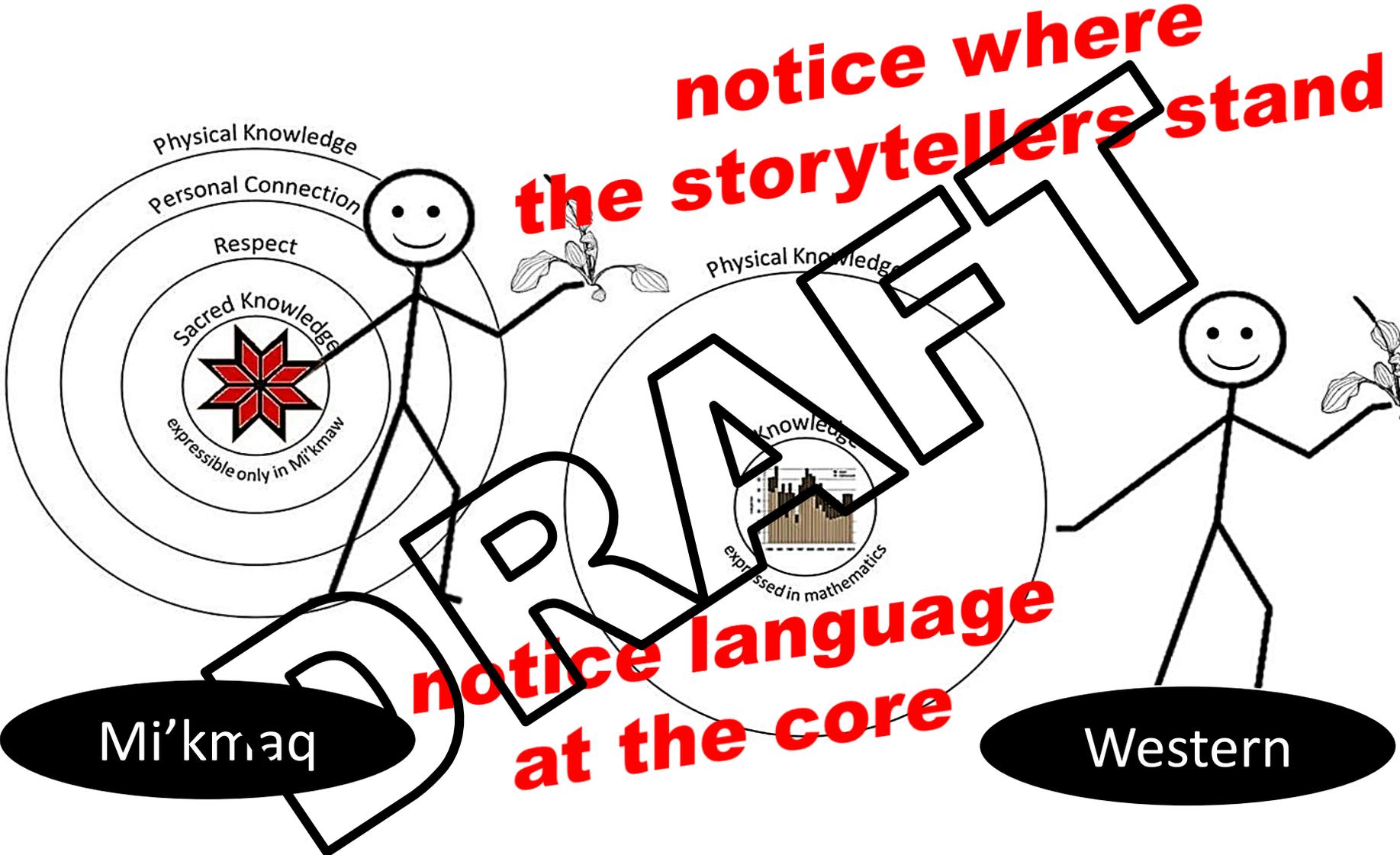
# Integrative Science

## Knowledge System Models



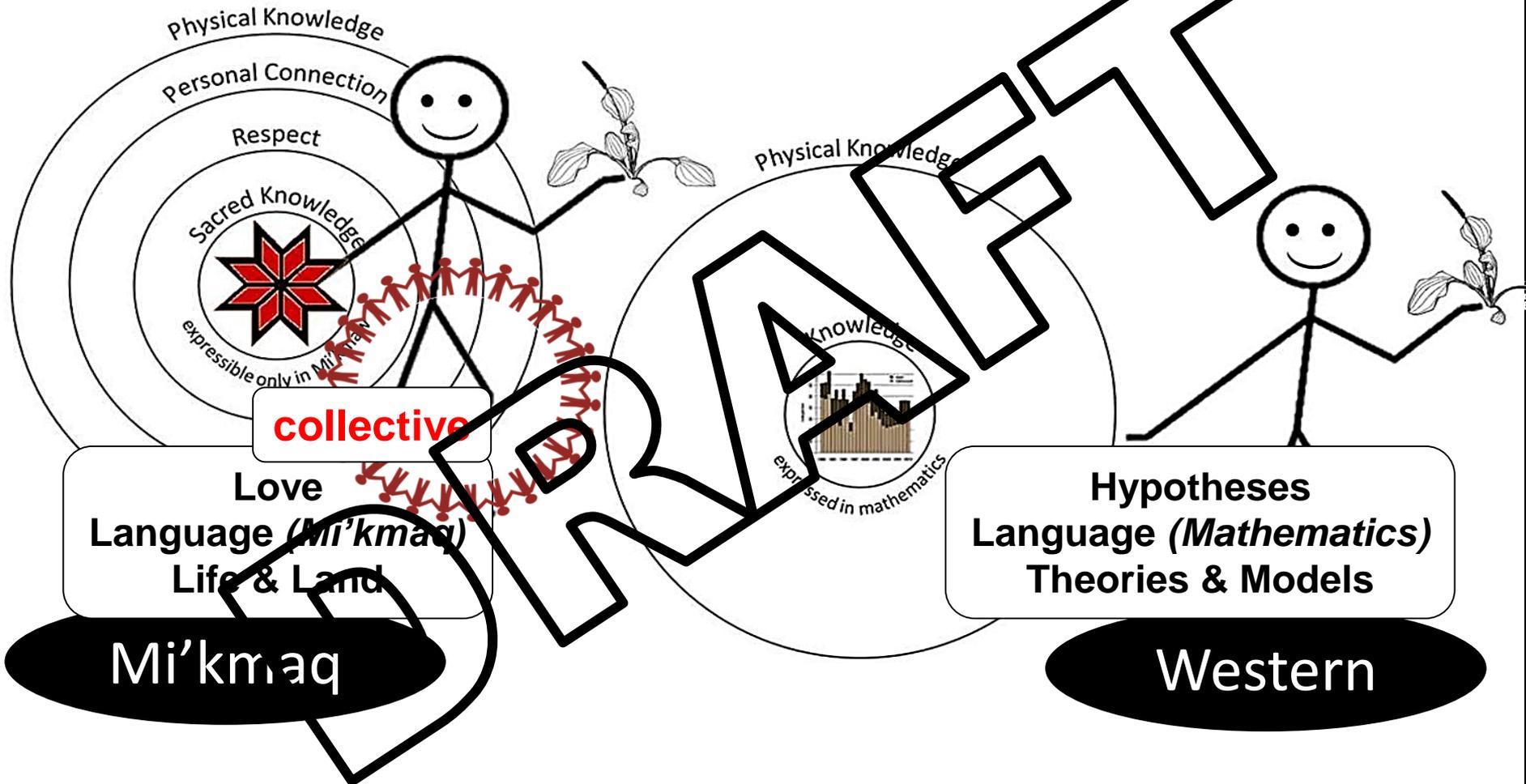
adapted from Elder Murdena Marshall

# 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)
- nucleons (neutrons & protons)
- fundamental particles (quarks & leptons)

My Mi'kmaq

^ Science stories are

stories of

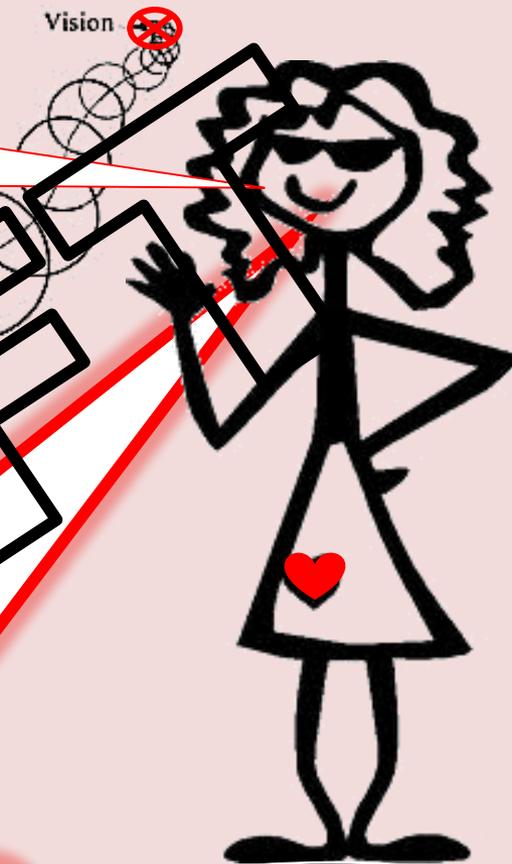
interconnectiveness

Our stories are alive.

**Place  
Emergence  
Participation**

... and I am  
in the story

Vision ~~is~~



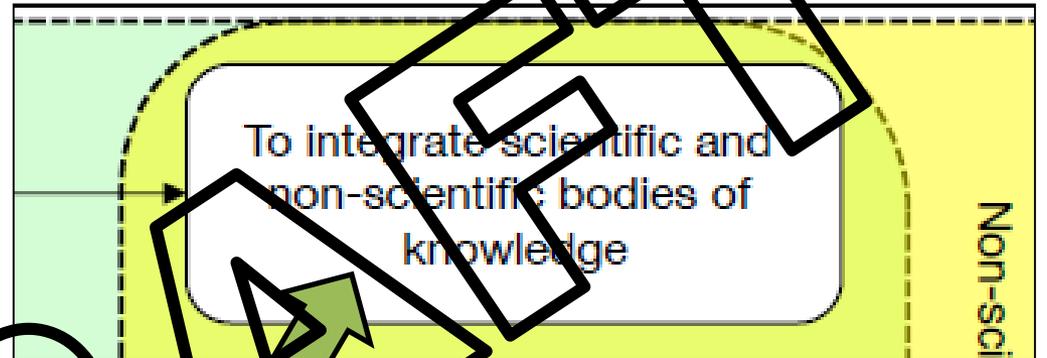
**Spirit  
everywhere**

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”?



To integrate scientific and non-scientific bodies of knowledge

Non-sci

... 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.

**DEFINITION**

# 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!**

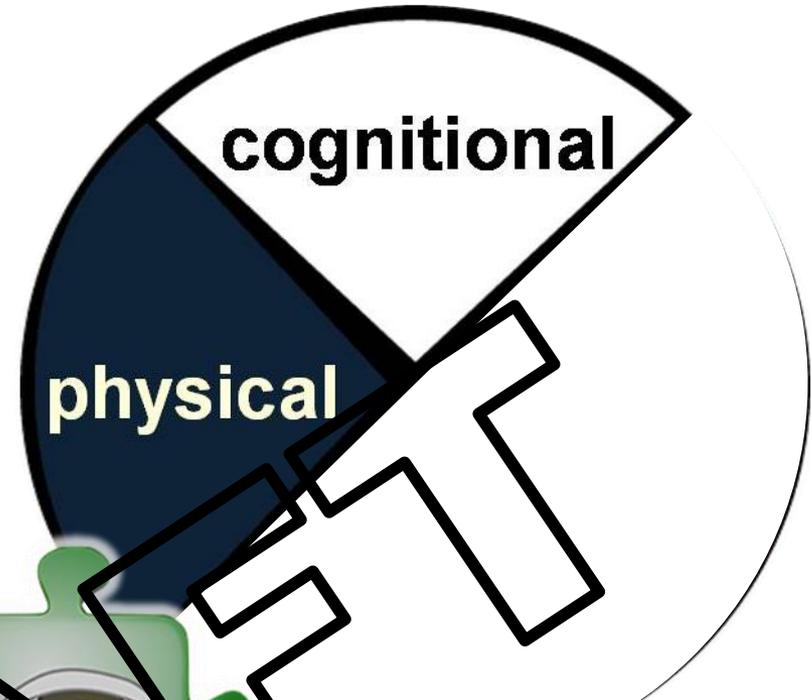
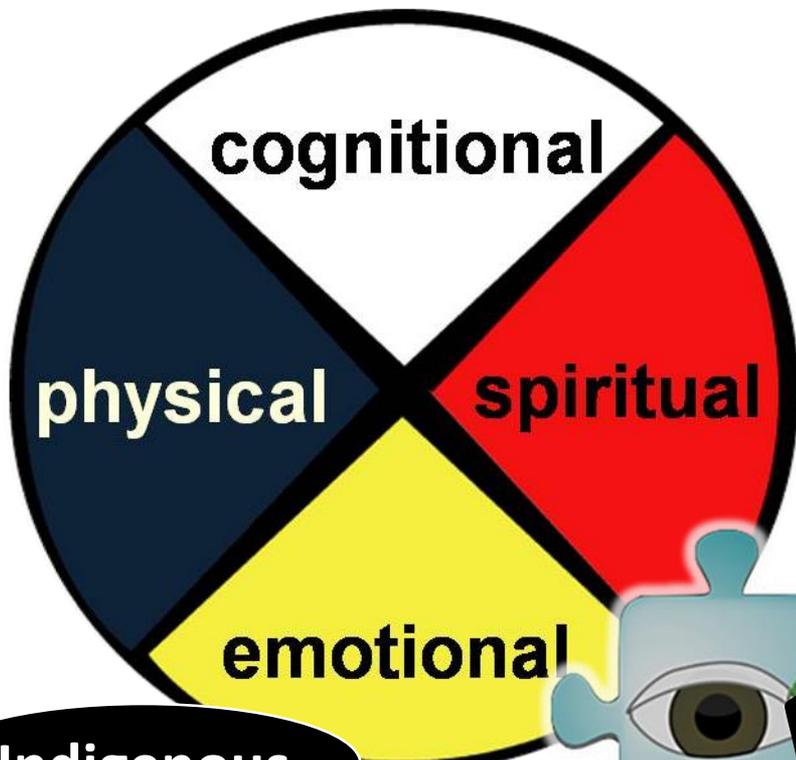
# INTEGRATIVE SCIENCE:

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!**



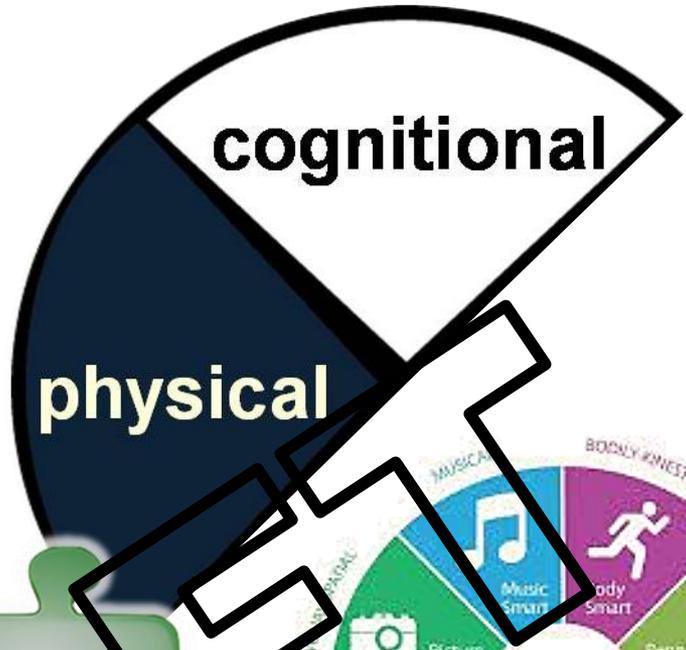
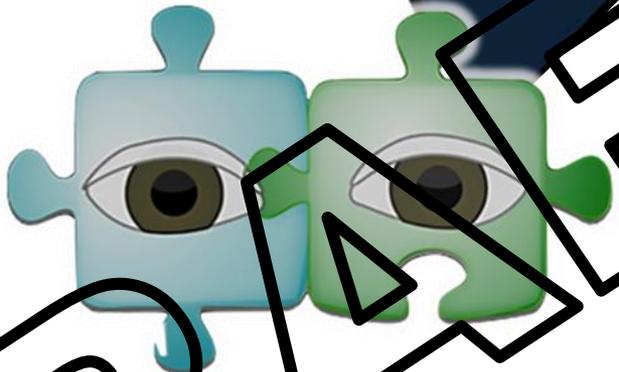
How do we learn “patterns”?

# 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!

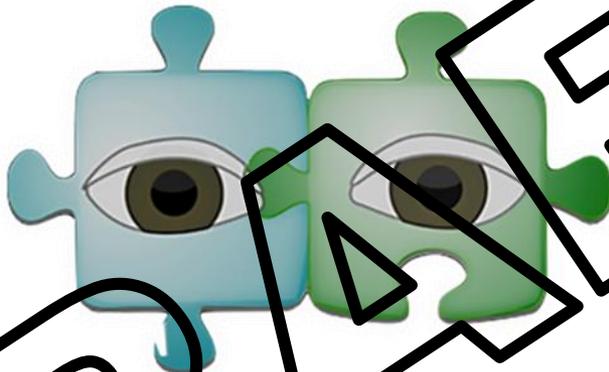


How do we learn “patterns”?

# 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”



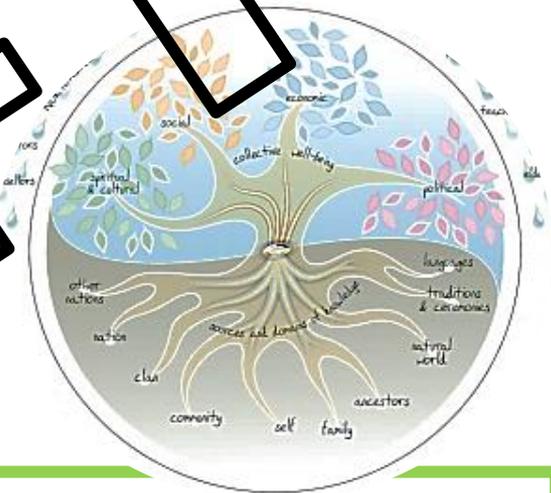
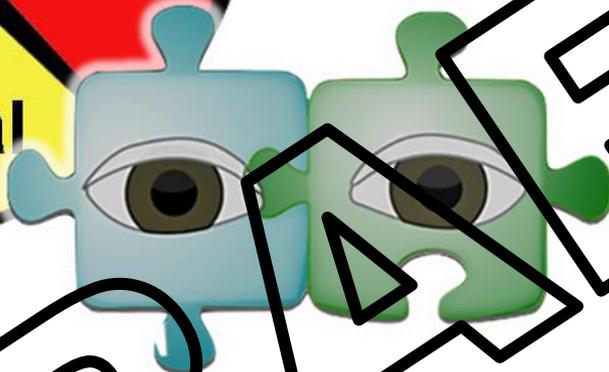
How do we learn “patterns”?

### 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?

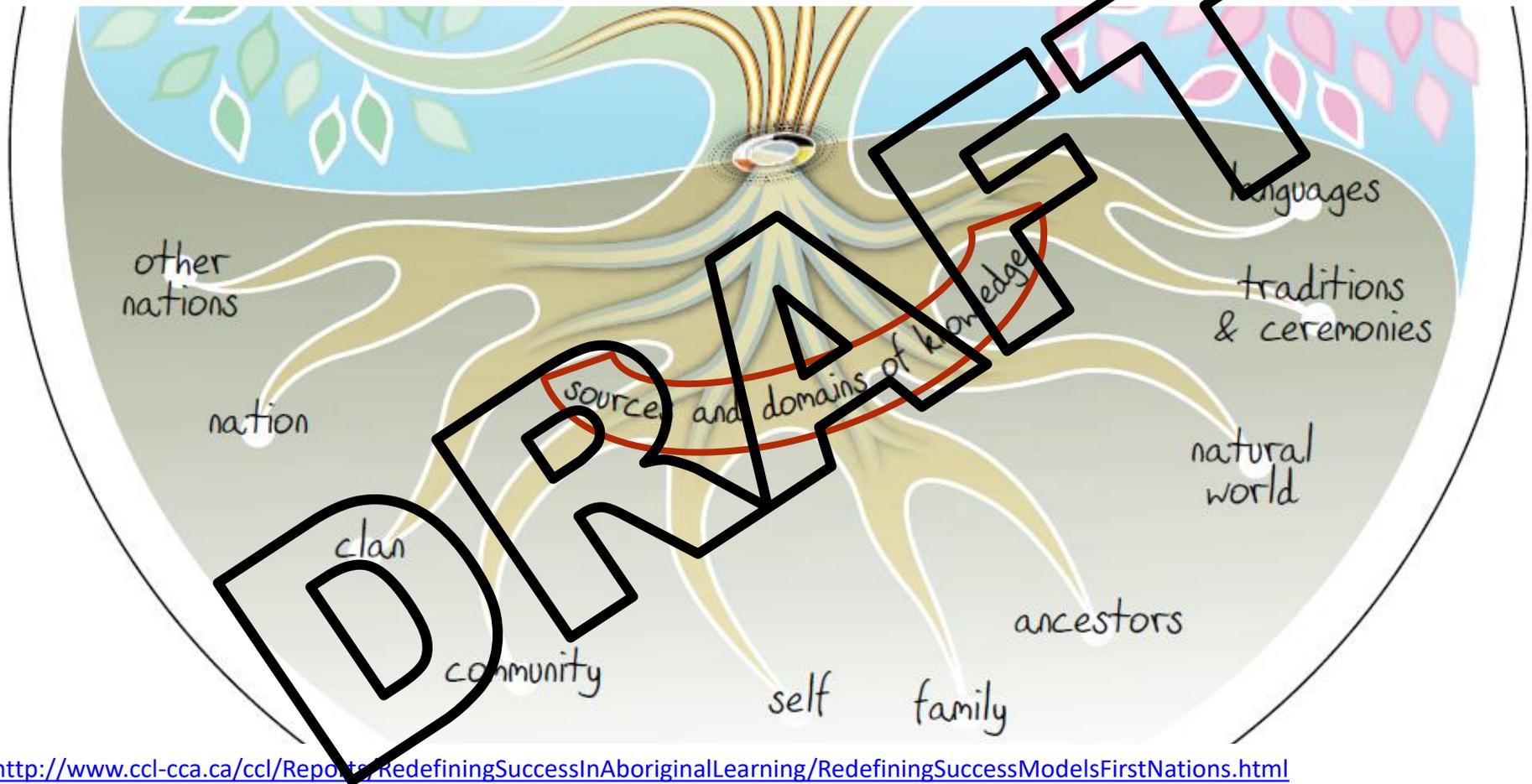
# Science stories are pattern knowledge!

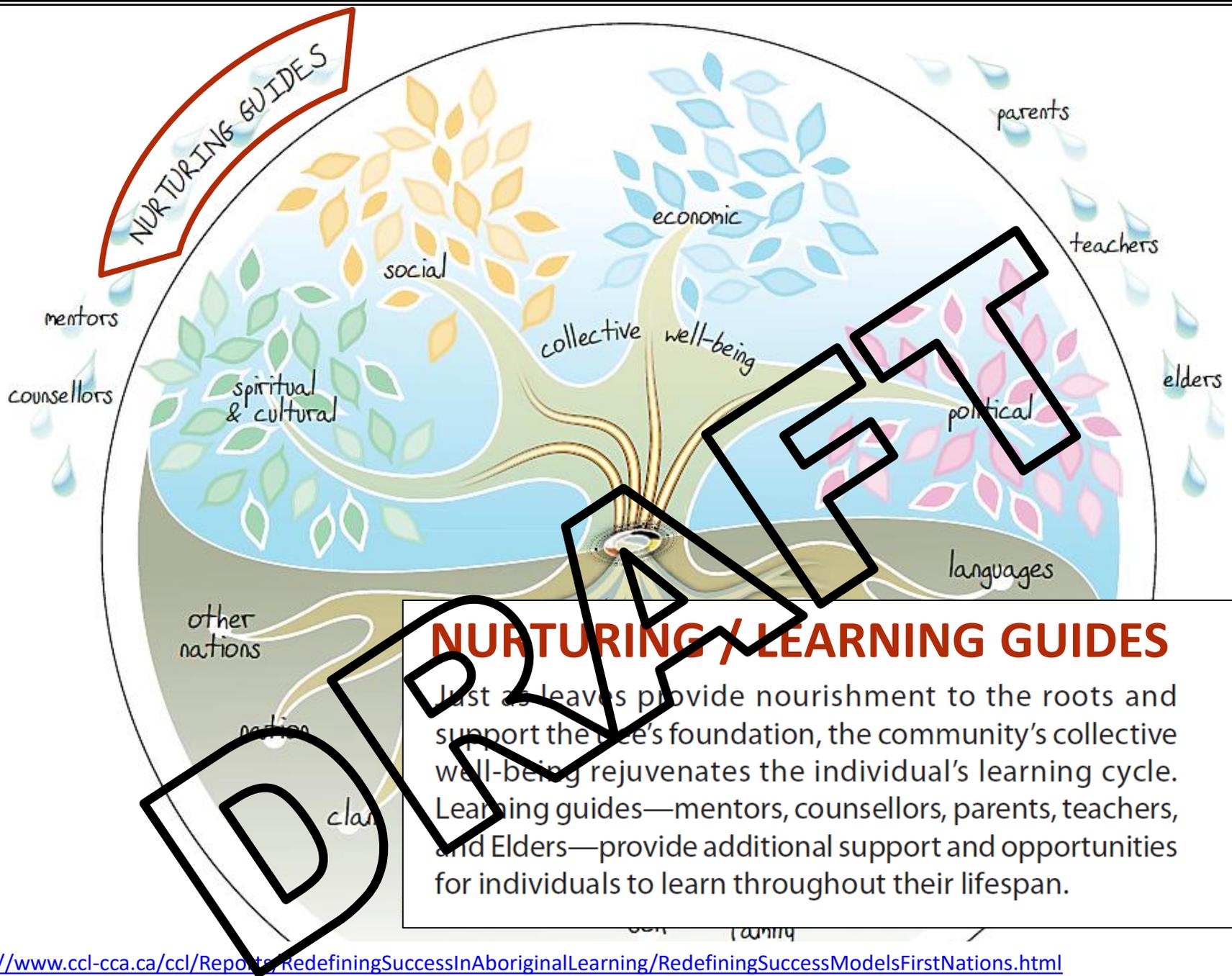


# ROOTS

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

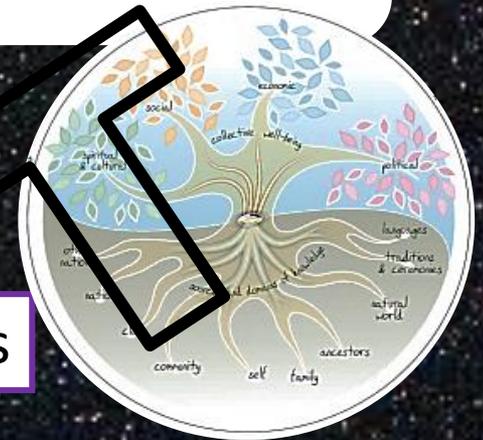
picture smarts

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

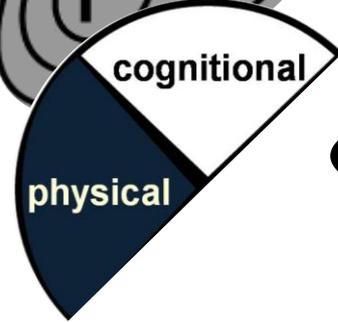
nature smarts

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.



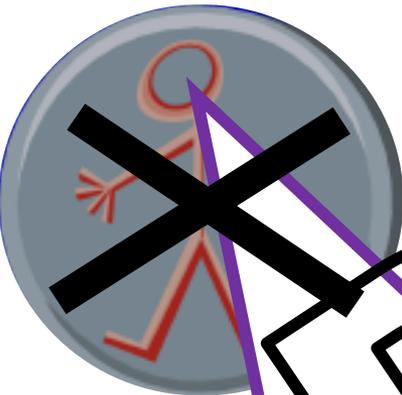
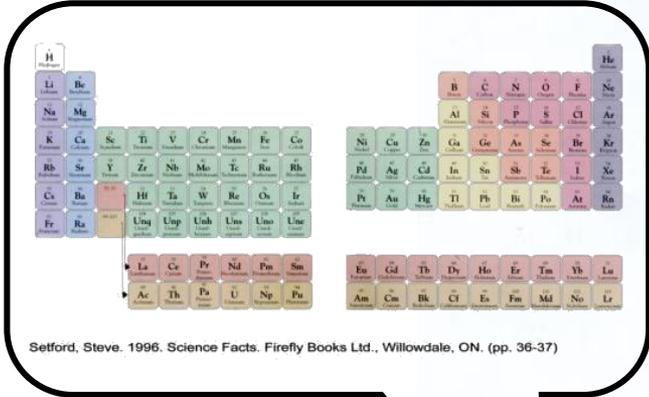
My ^

# 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)

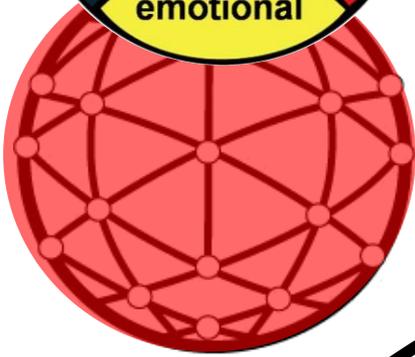
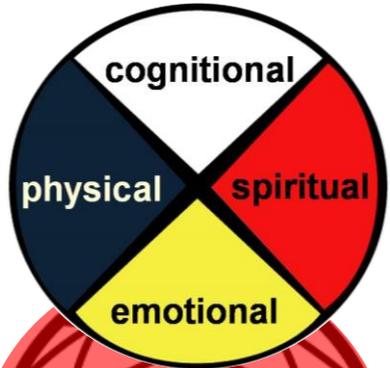
Consciousness is "problematic"; spirit does not exist.

My world is many "its" (objects).

Western Science

# Science stories are pattern knowledge!

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

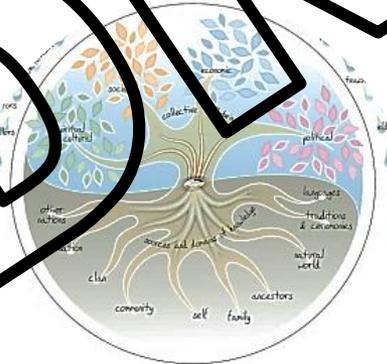


- word smarts
- math smarts
- music smarts
- picture smarts
- body smarts
- people smarts
- self smarts
- nature smarts
- spirit smarts

*Howard Gardner's "multiple intelligences theory"*



**Indigenous Science**



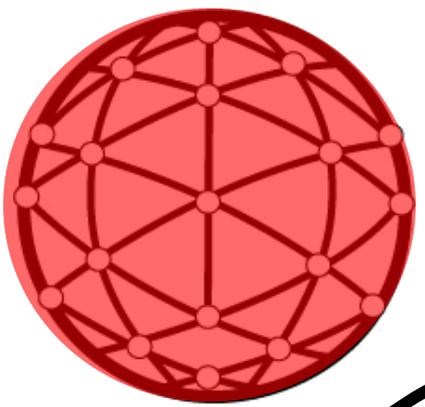
... and I also acknowledge many and diverse knowledge sources and domains, as well as learning guides ...

My  
^

Science stories are

stories  
of

interconnectiveness

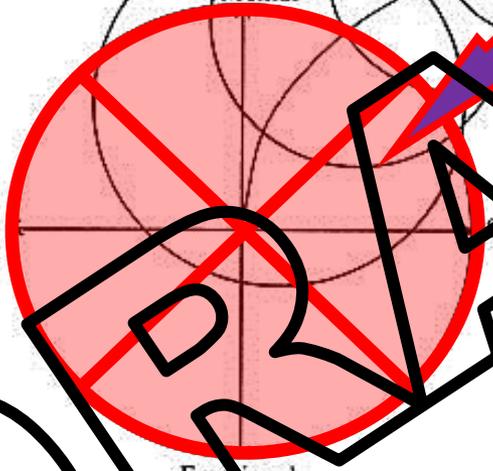


Physical

Mental

Volitional

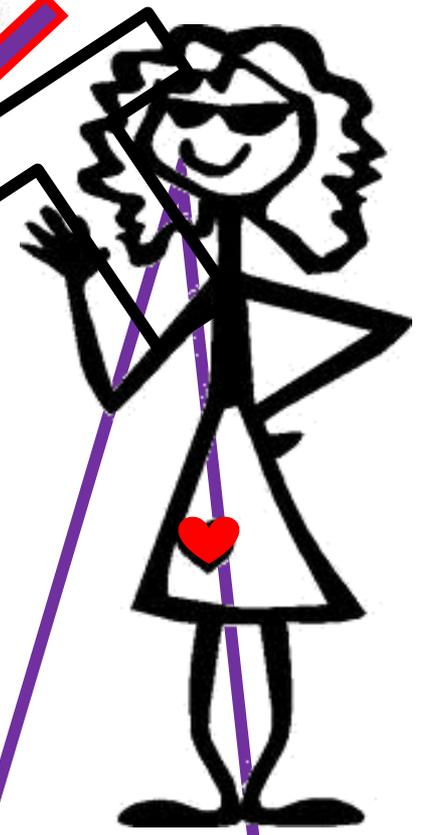
Vision



Spiritual

Emotional

Spirit is present.

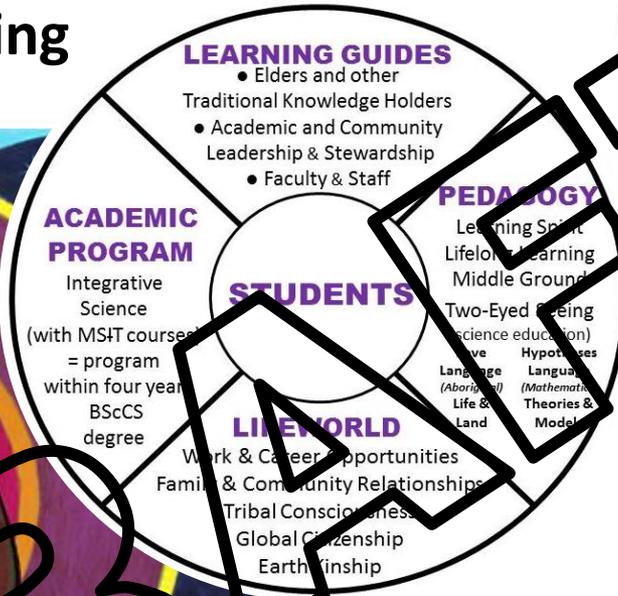
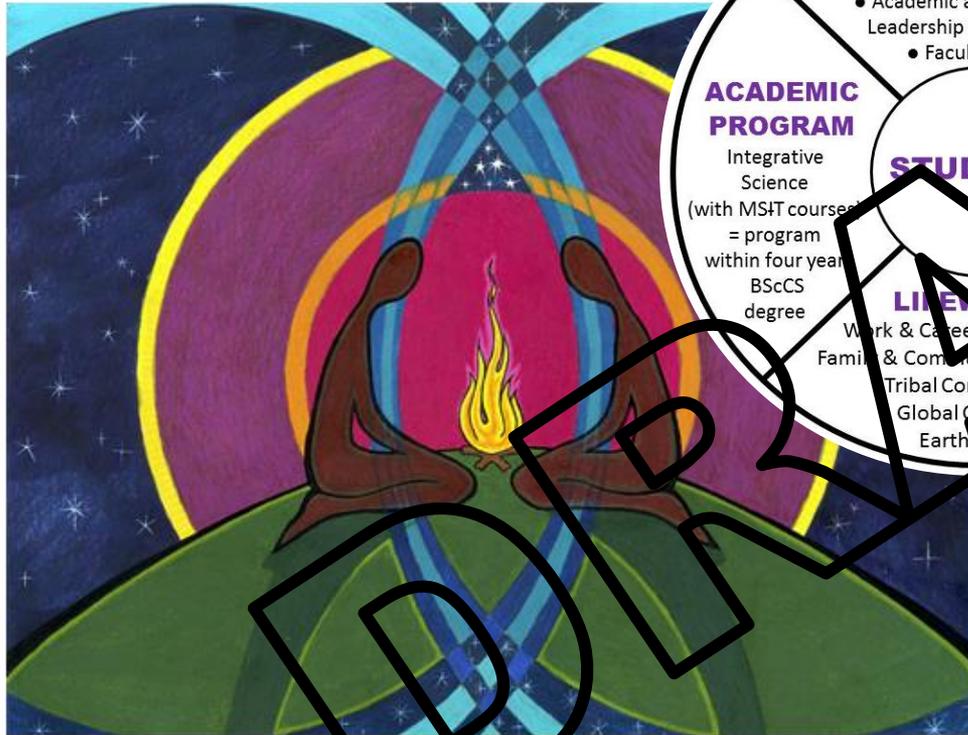


Indigenous  
Science

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

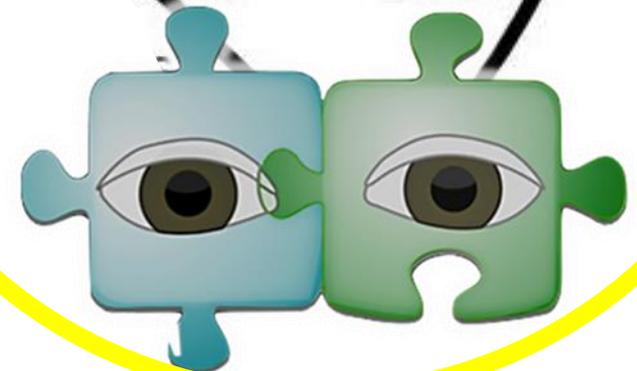
# INTEGRATIVE SCIENCE

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



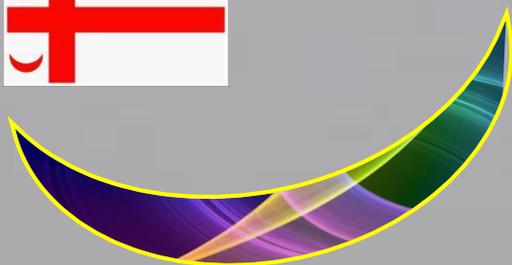
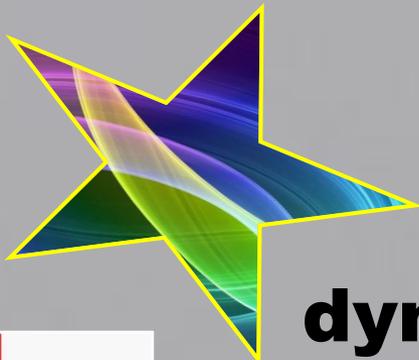
## PEDAGOGY

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



# Integrative Science:

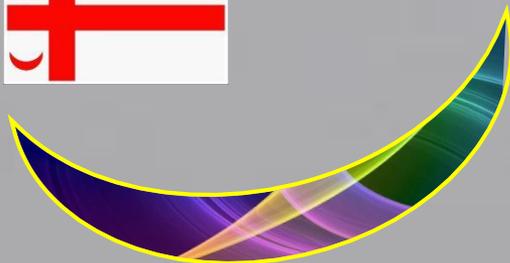
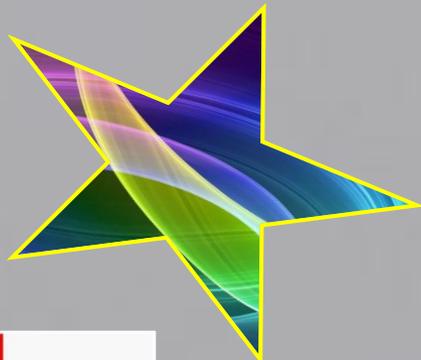
**science =  
dynamic, pattern-based knowledge  
shared through stories  
about our interactions  
with and within nature**



**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)



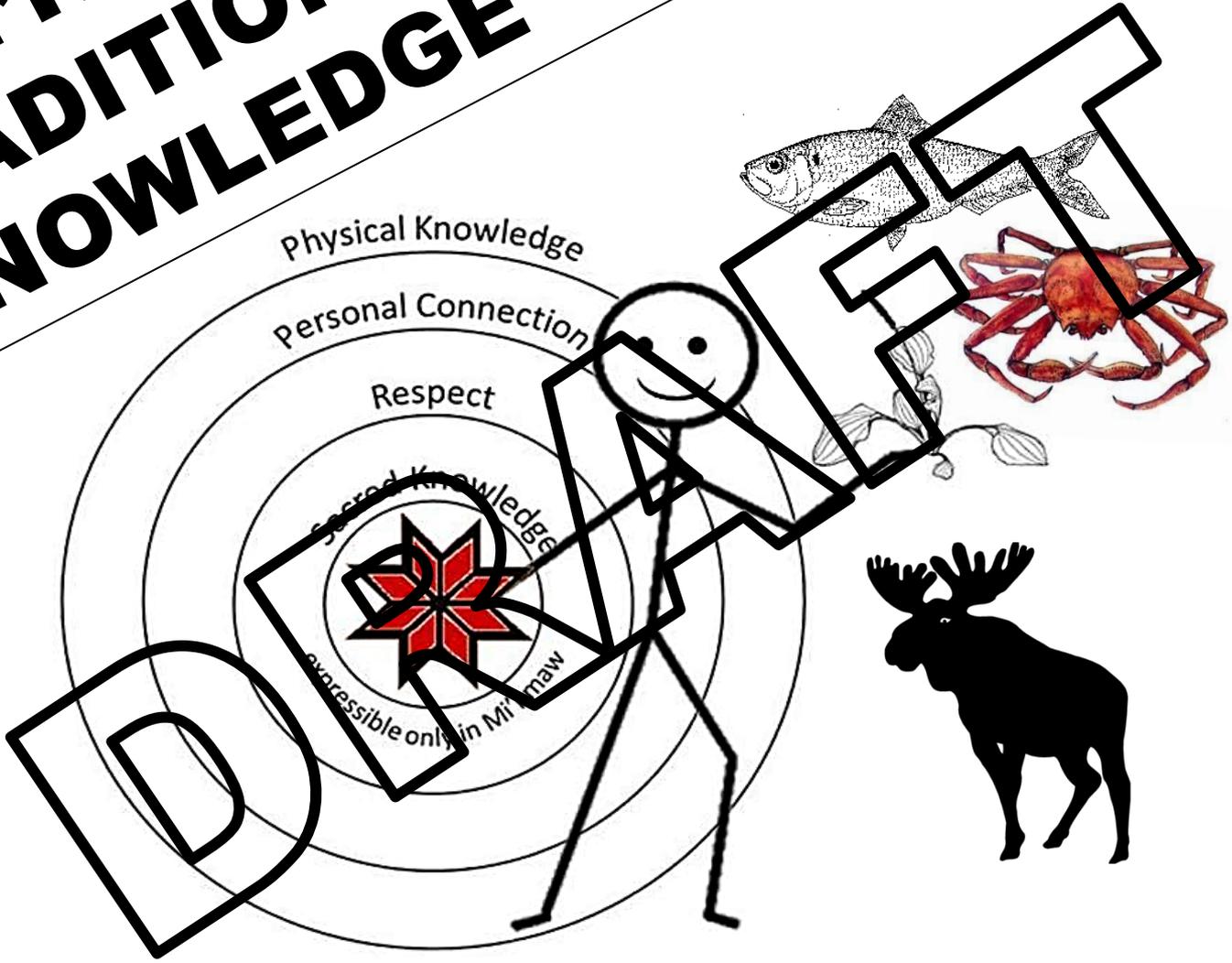
**FINAL REPORT** (APC Contract #2013-008 and Project #4125)  
submitted to the Atlantic Policy Congress of First Nations Chiefs  
Penultimate Draft - 20 MARCH 2013

**Project Team / Report Authors**

Cheryl Bartlett, CM, PhD  
Albert Marshall, Elder, LLD  
Murdena Marshall, Elder, LLD

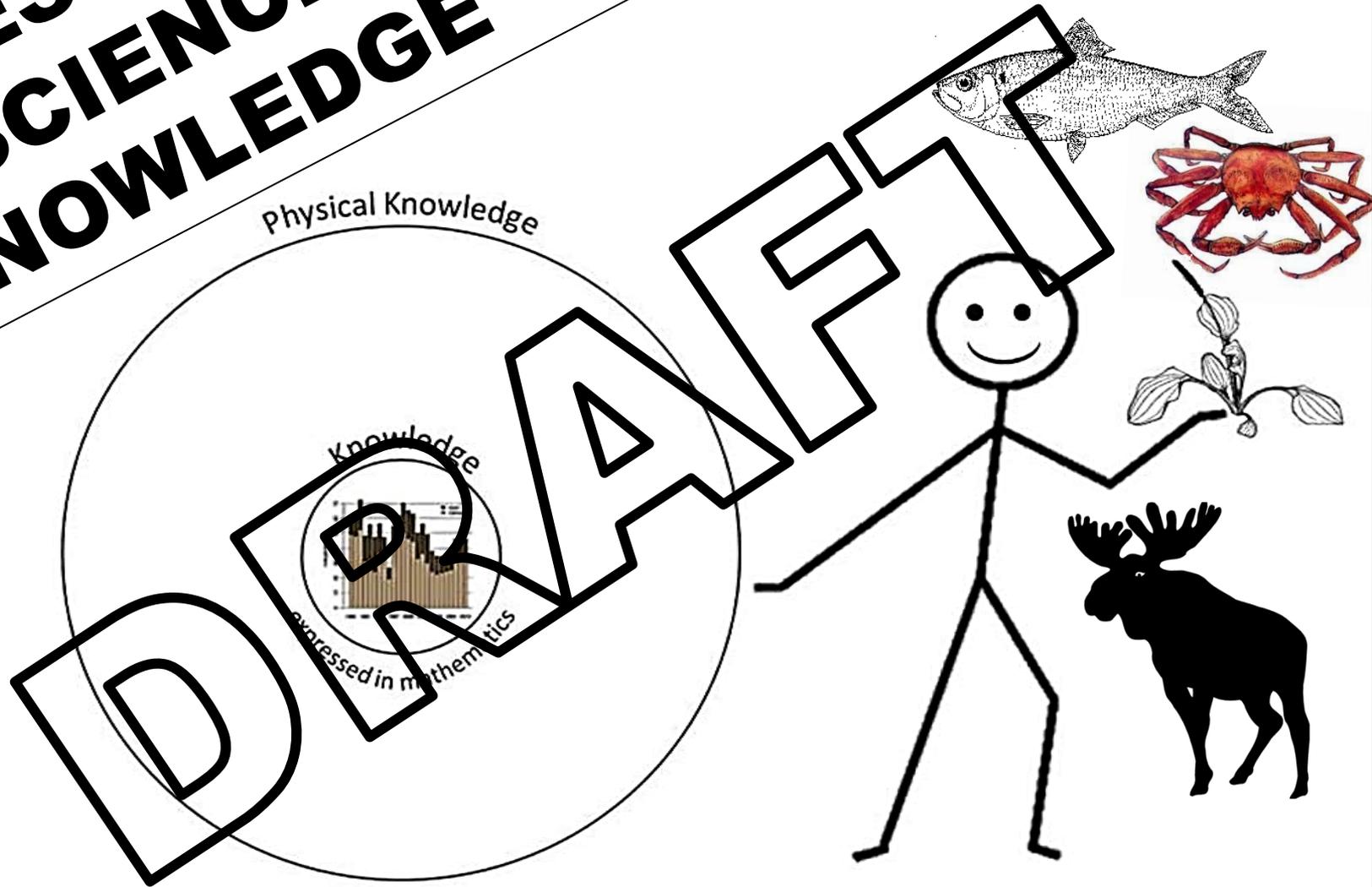
Concentric Circles Model for ATK / MTK  
adapted from Elder Murdena Marshall

# MI'KMAQ TRADITIONAL KNOWLEDGE

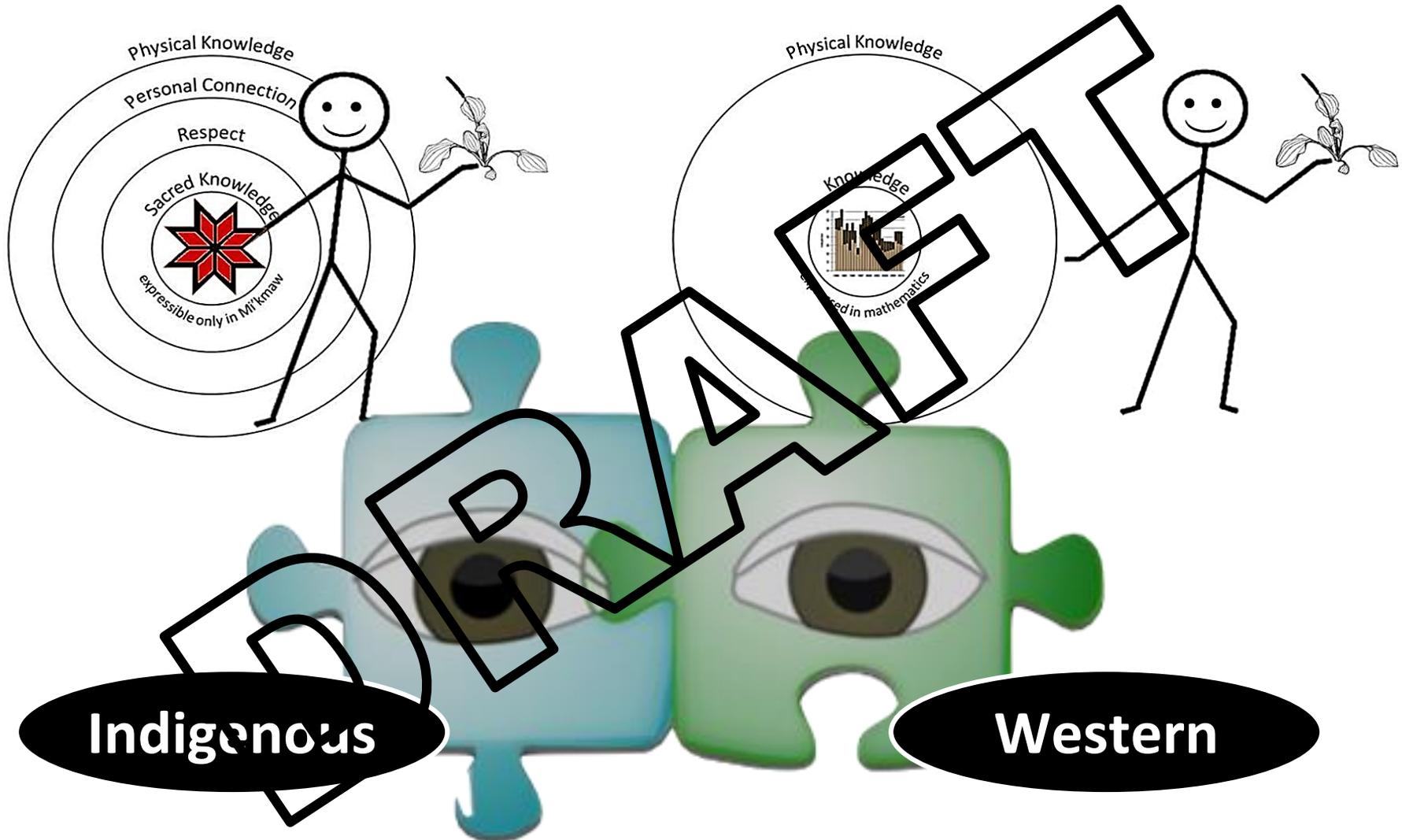


Model for Western Science patterned after  
“Concentric Circles Model for ATK / MTK”  
by Elder Murdena Marshall

**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



Fishing Trawls

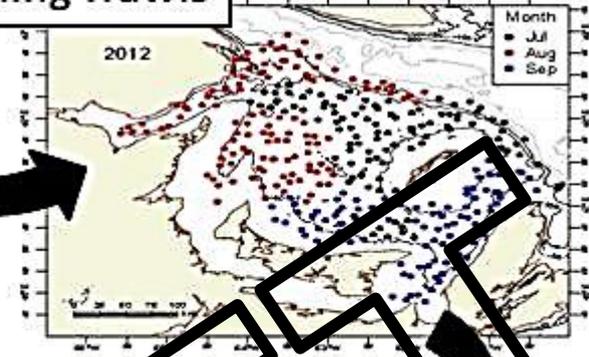
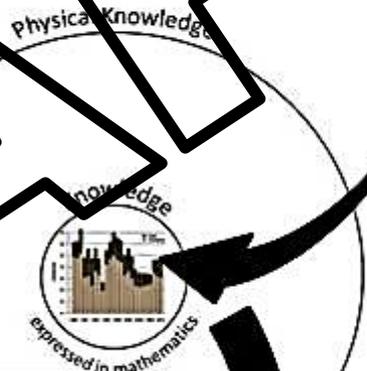
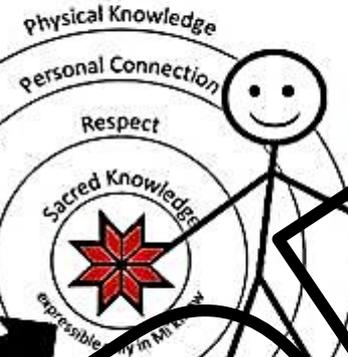


Figure 8. Monthly geographic distribution of trawls landed during the 2012 survey

Personal Observations & Stories

Trawl Results



Collective Oral Knowledge ATK / MTK

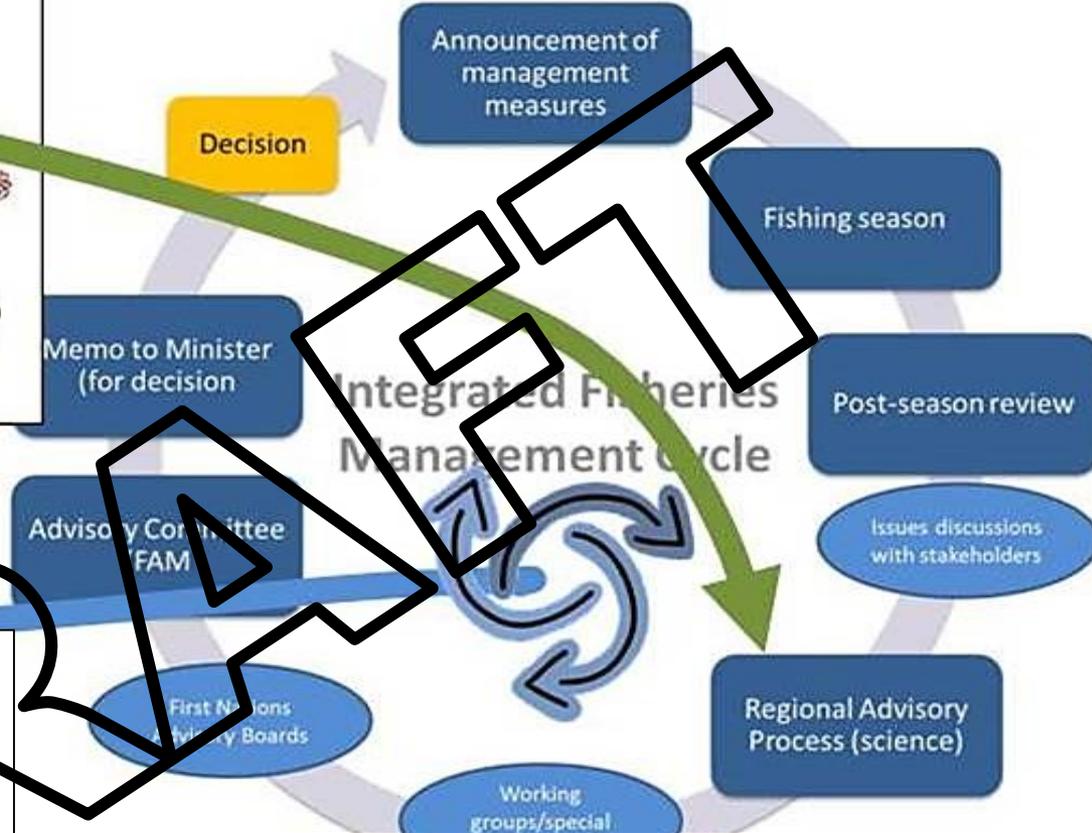
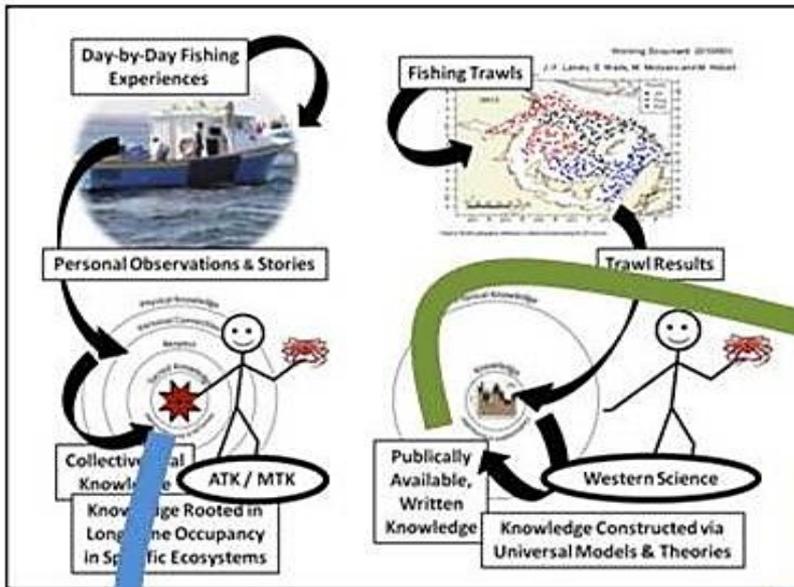
Publically Available, Written Knowledge

Western Science

Knowledge Rooted in Long Time Occupancy in Specific Ecosystems

Knowledge Constructed via Universal Models & Theories

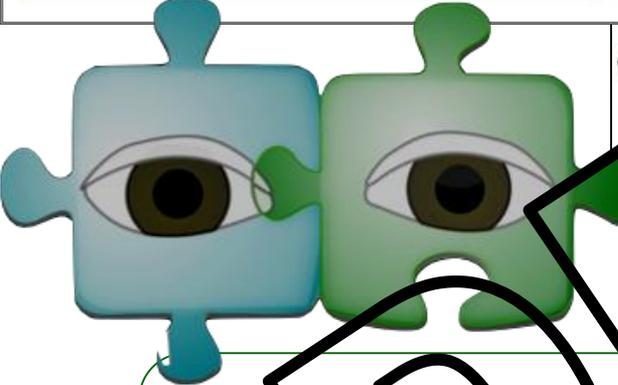
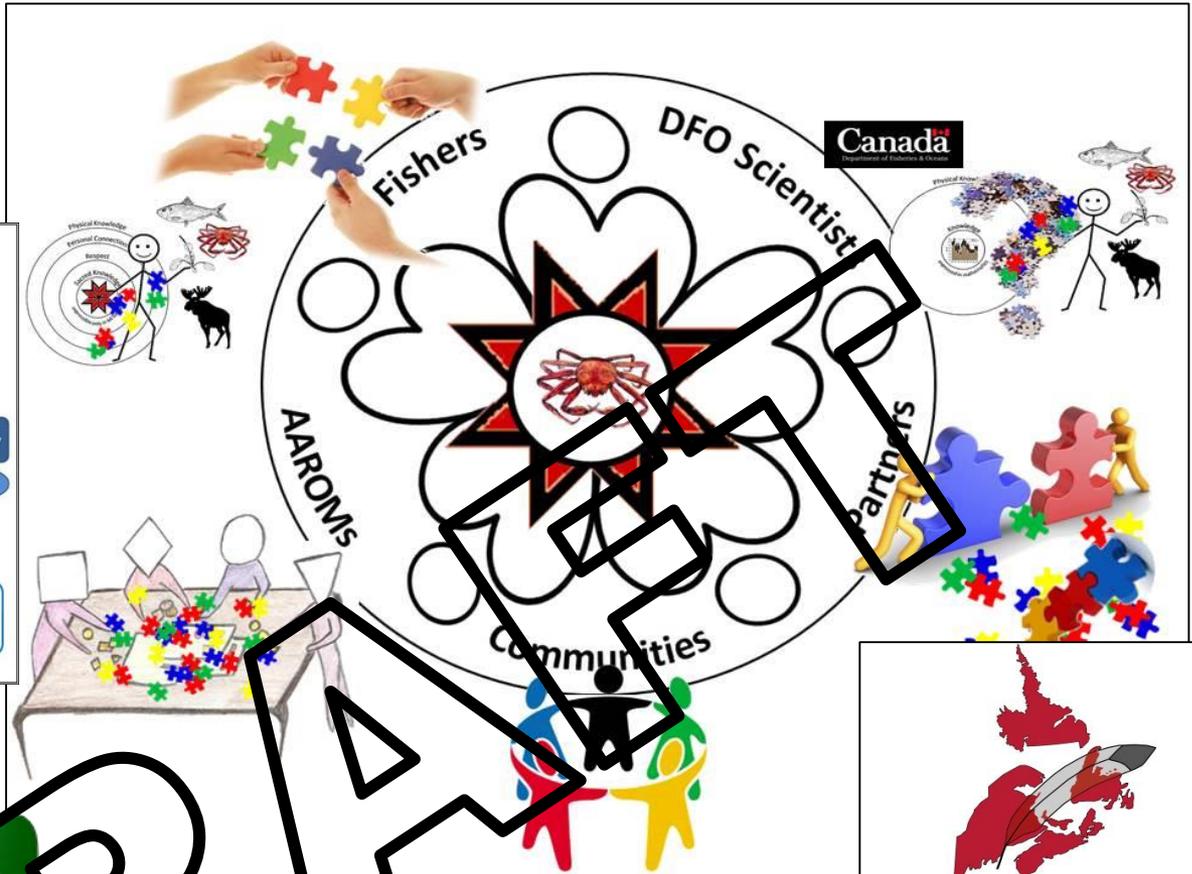
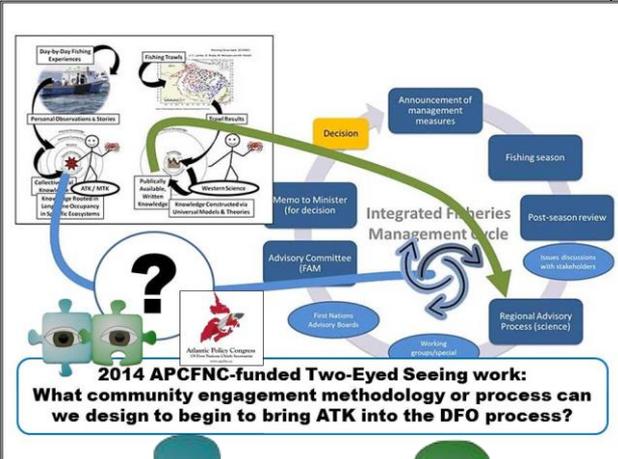
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**2014 APCFNC-funded Two-Eyed Seeing work:**

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





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

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

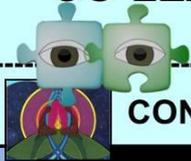
Ntua'q kinuk me'ki kina'masultinew aq wli nstmnew eptuaptasimkewey. Nuta'q wla etuapmkewey ankite'tm nej kulaman wen pipanikkesij kisi apoqnmuatishu nsitmnew. Ta'nik teto'qi msitmu'k miamuj kekinamu'kik ta'n koqoewey. Etuaptimkewey, miamuj weji kmitu'tij mimajik, ta'n telukwek aq kepmite'tasin. Kejitu 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



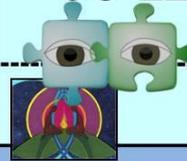
### CONCEPTS and ACTIONS (epistemologies)

- 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

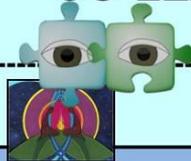
dynamic, testable, published knowledge independent of personal experience that can enable prediction and control (and "progress")

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

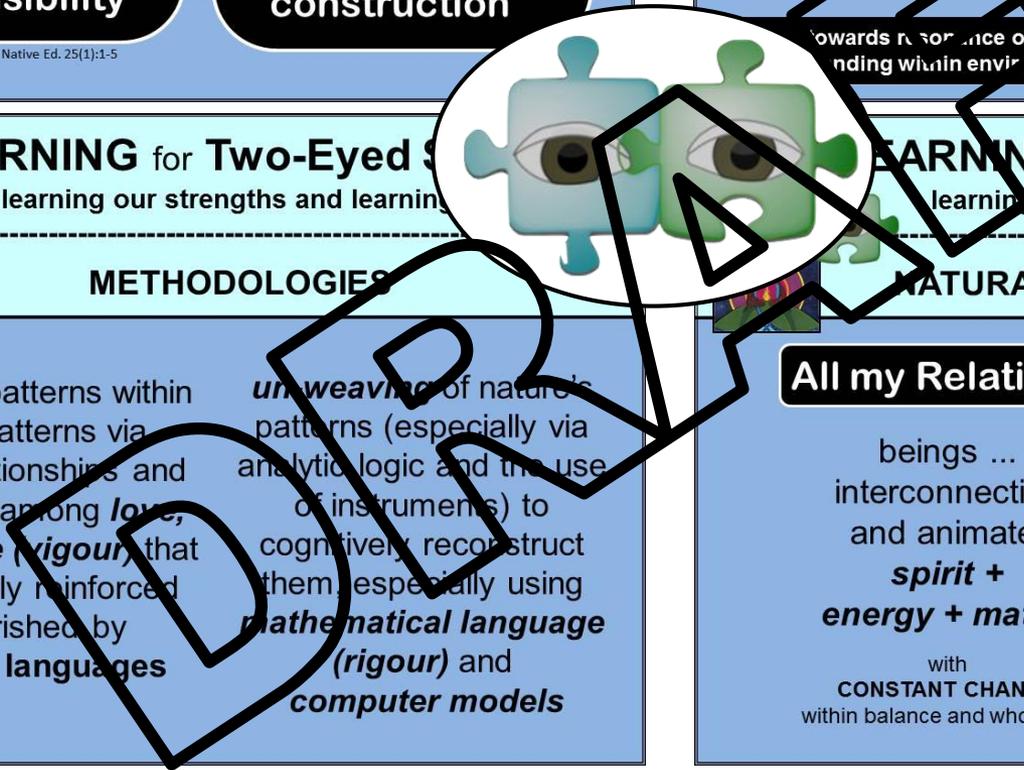
### NATURAL WORLD (ontologies)

#### 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)

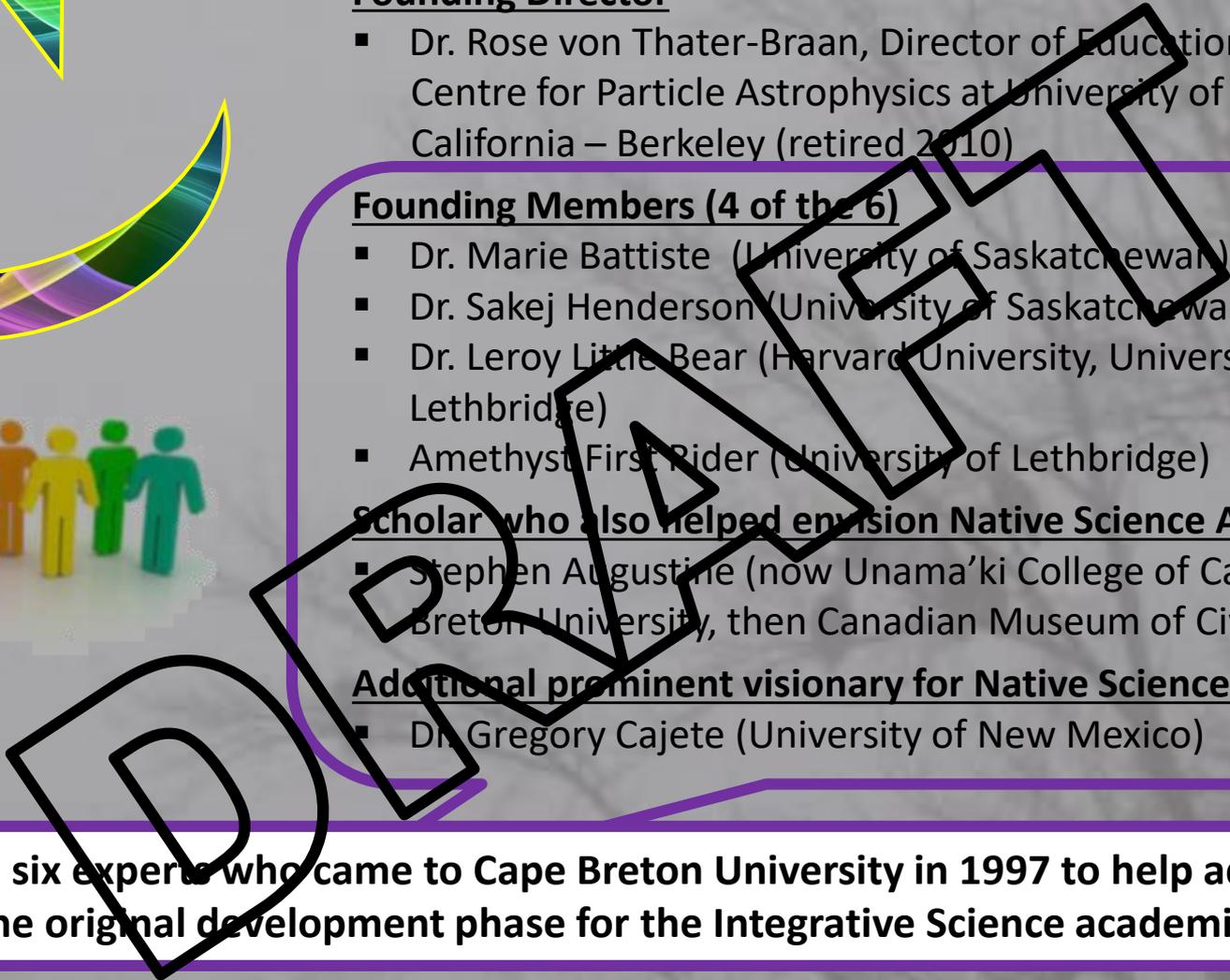
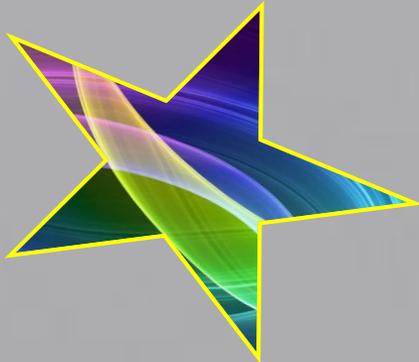
## Scholar who also helped envision Native Science Academy

- 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**



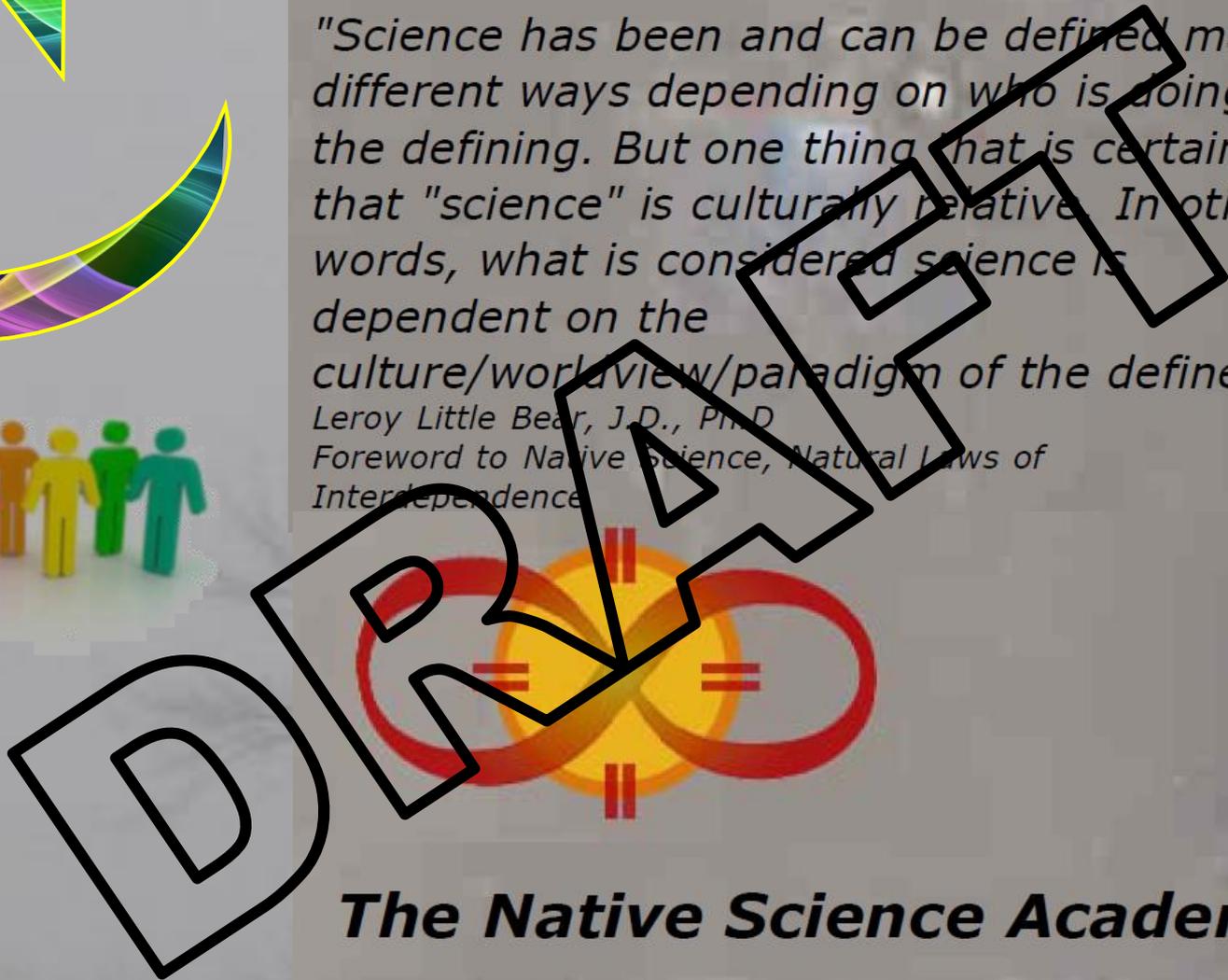
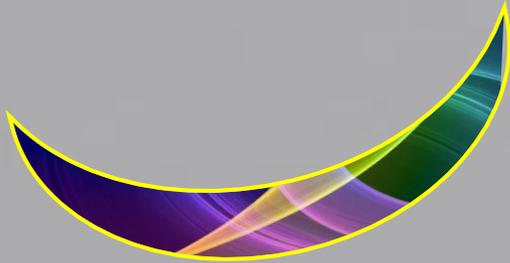
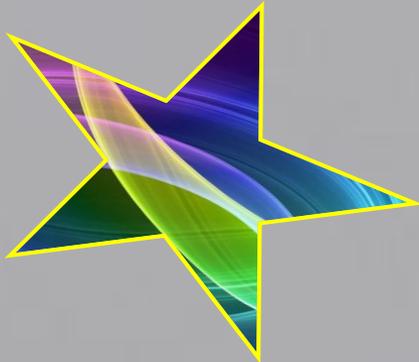
# Native Science Academy

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*"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*

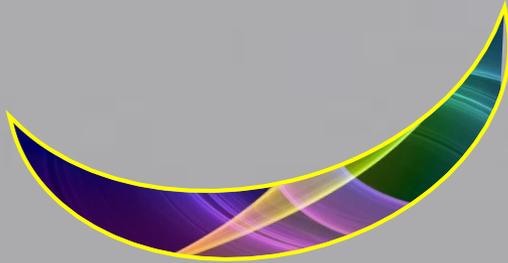
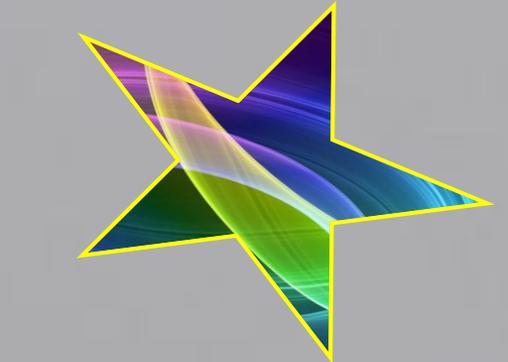
***The Native Science Academy***



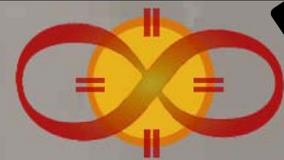
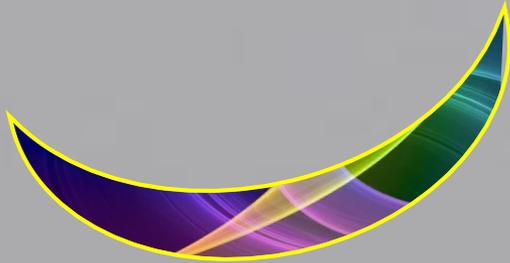
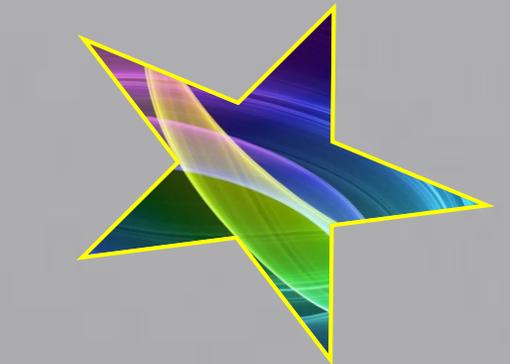
# Principles of Native Science

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*

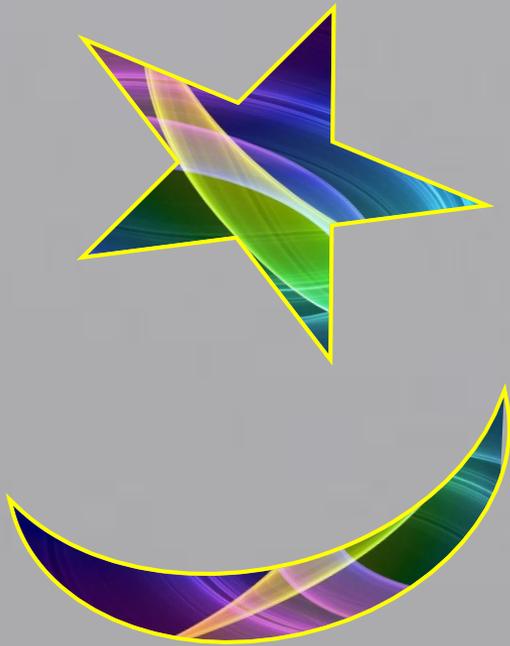


*The Native Science Academy*

<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.



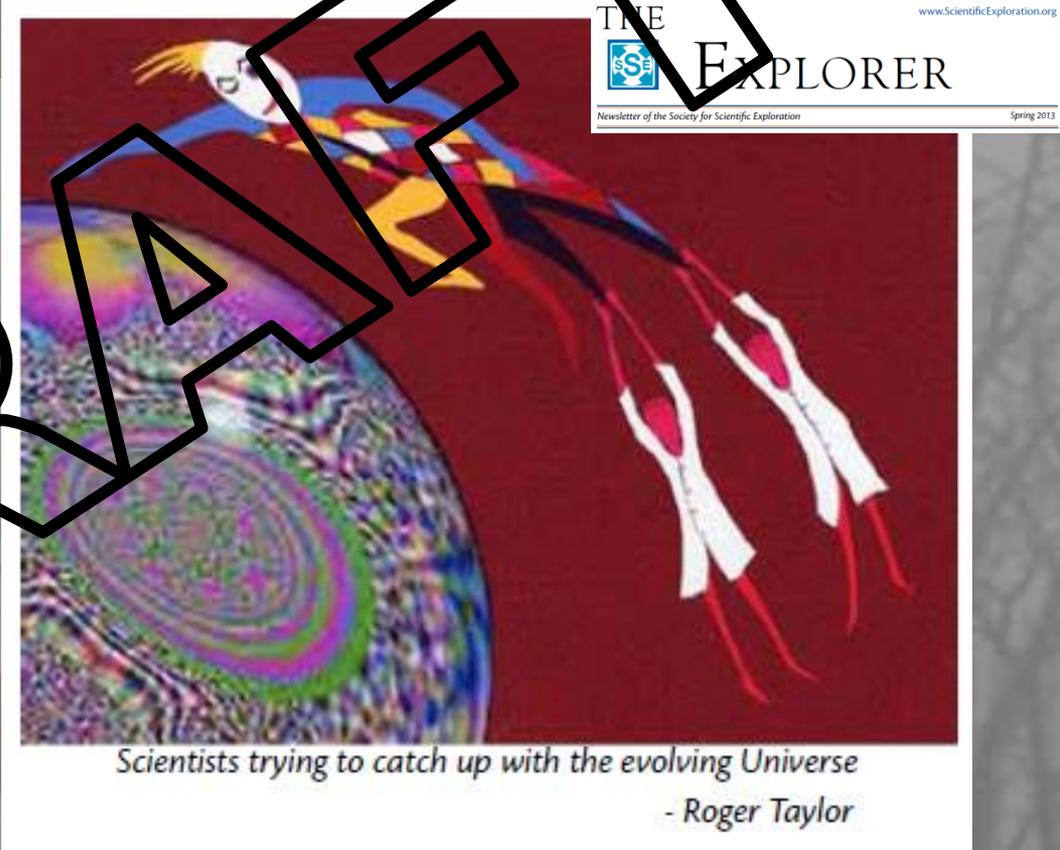
## Recent developments in Western science have brought it closer to Native science views:

- 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.



**The Native Science Academy**

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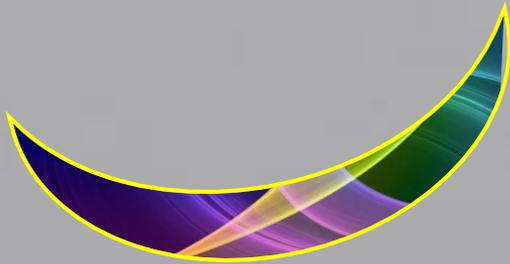
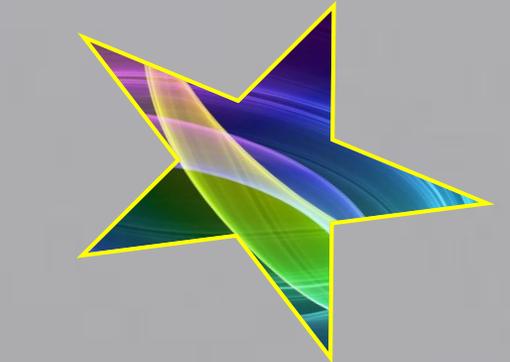


*Scientists trying to catch up with the evolving Universe*  
- Roger Taylor

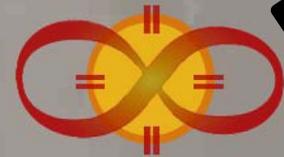
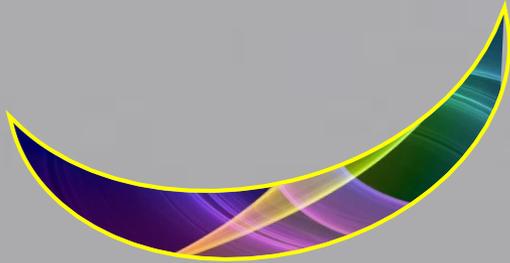
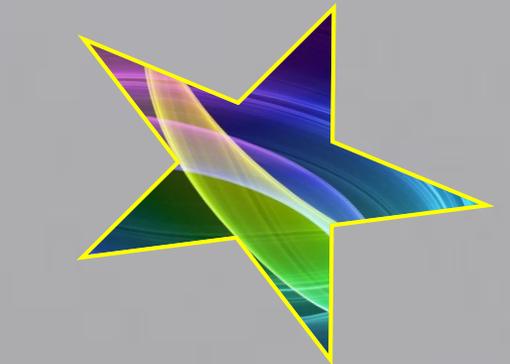
## The Native Paradigm

*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



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## Methodology

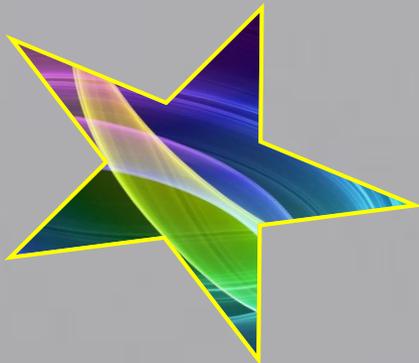
### Native Science

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

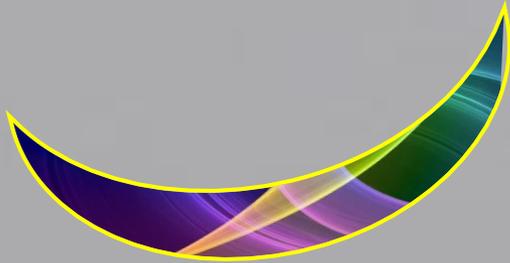
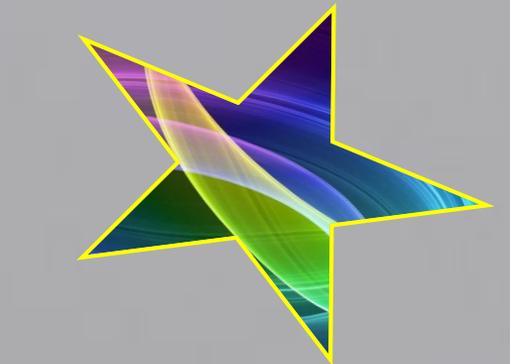
## Methodology (cont'd)

### 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.



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<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)

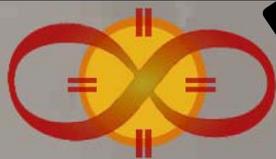
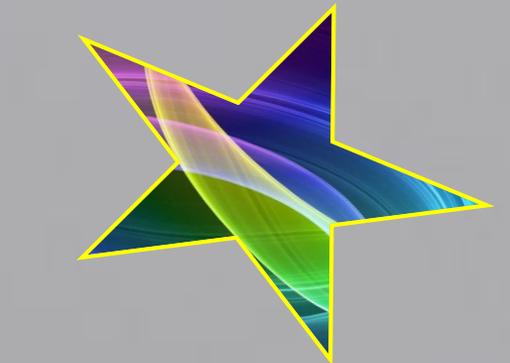
**Measurement.** Western Science relies mainly on measurement as a basis for confirmation of new knowledge. If something is not subject to measurement, it is not considered scientific.

[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.

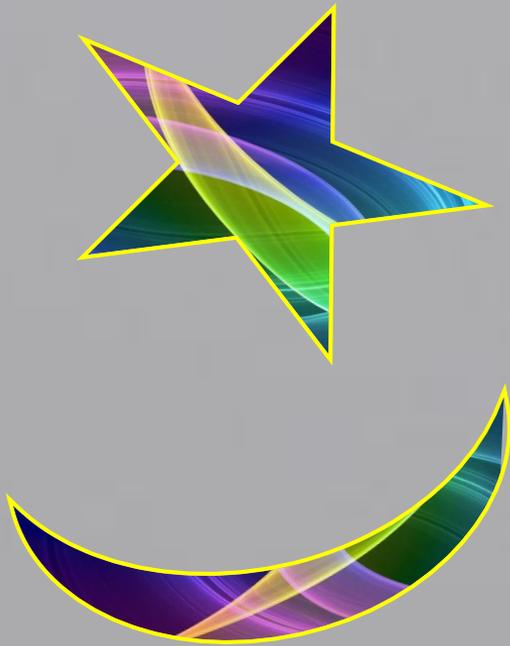
The [Western] scientific pursuit of truth uses no end of tools, ranging from sensitive scales to register the weight of a hair to observatories of the heavens.

Jane Jacobs, p. 65, 2004.

Dark Age Ahead. Vintage Canada.



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## How Knowledge is Held:

### Native American

#### Individual.

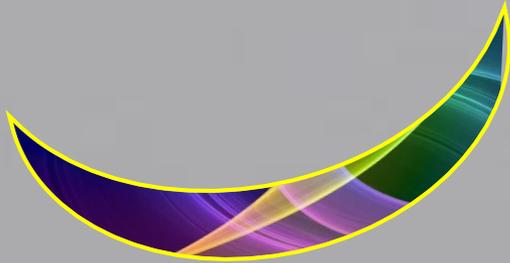
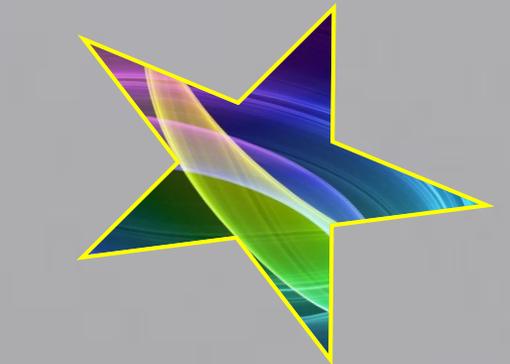
- Can gain knowledge through lived experience.
- Can gain knowledge through dreams.
- Can gain knowledge through vision quests.

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

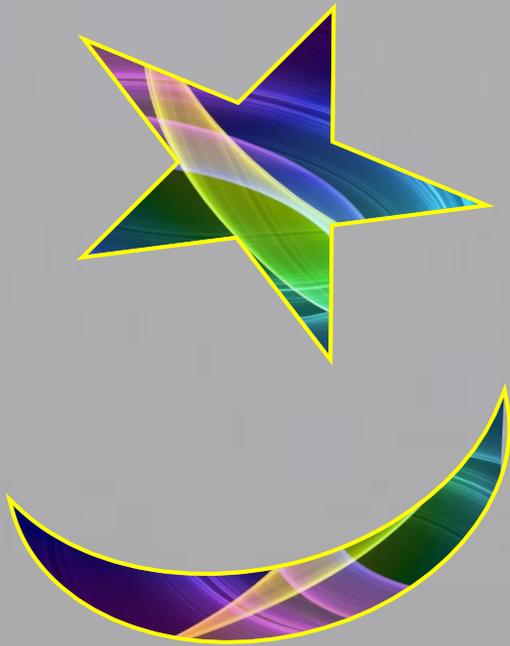
**Church.** Prior to the industrial revolution, the main knowledge holder was the church.

**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.



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## General and Expert Knowledge

### Commonality of Native and Western Science

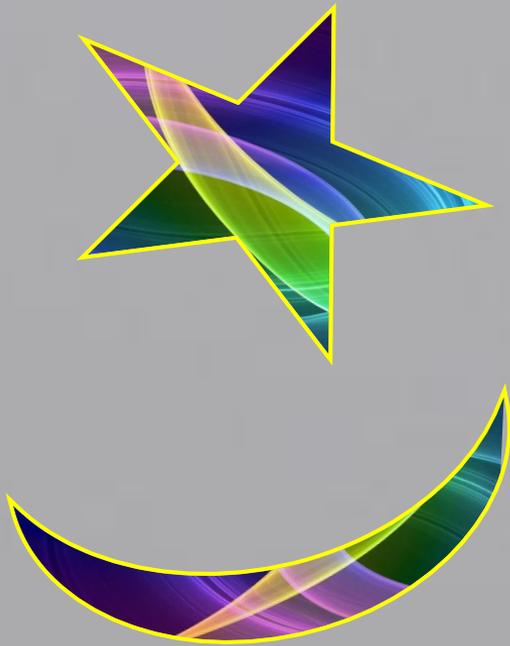
- General knowledge is accessible to the public ("the nation")
- Expert knowledge is only accessible to experts and can be accessed through developing sufficient expertise
- Expert knowledge requires specialized language and training.



**DRAFT**



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## 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)



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# 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

