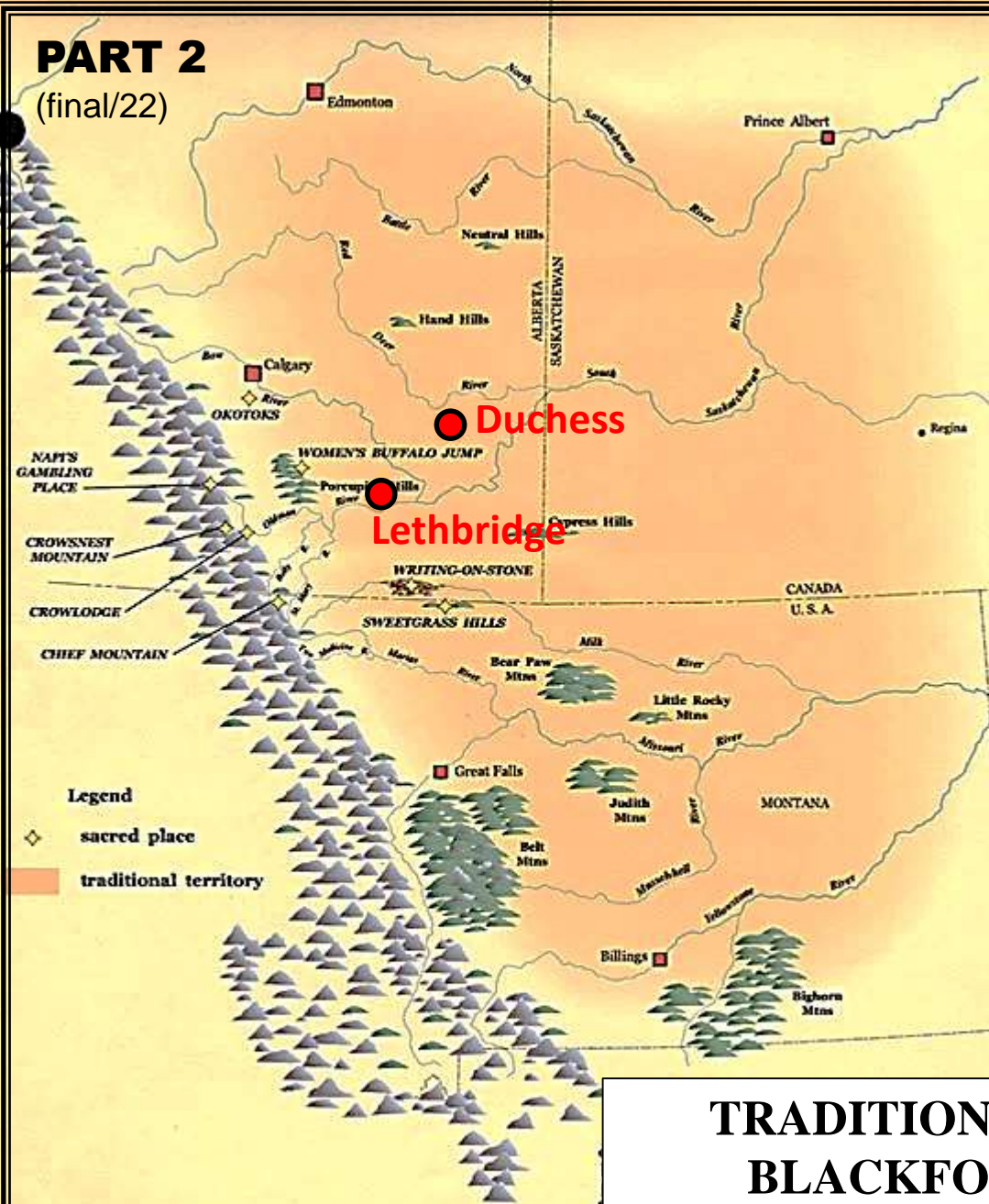


PART 2

(final/22)



**TRADITIONAL TERRITORY of the
BLACKFOOT CONFEDERACY**

SOMETIMES IT'S LIKE A HEAVY SLEDGE

Science, Two-Eyed Seeing, Co-Learning, and Cultural Humility

(Part 2: pattern-based science curricula / wholistic learning)

Cheryl Bartlett, CM, PhD

Professor Emerita

- retired Professor of Biology
- former Tier 1 Canada Research
Chair in Integrative Science

Cape Breton University

Sydney, NS

15 March 2017

course presentation for

Professor Michelle Hogue

University of Lethbridge

Lethbridge, Alberta



SOMETIMES IT'S LIKE A HEAVY SLEDGE

Science, Two-Eyed Seeing, Co-Learning, and Cultural Humility

(Part 2: pattern-based science curricula / wholistic learning)

PRESENTATION OUTLINE

- **Integrative Science**
→ who, what, why, how
- **Two-Eyed Seeing**
→ **Co-Learning**
and
Knowledge
Scrutinization
- **Cultural Humility**



**SOMETIMES IT'S LIKE A HEAVY SLEDGE
that we are trying to move – this sledge
represents our passions for ensuring the
ecological integrity of *Mawisikamukawey*.**



words of Elder Albert Marshall, Mi'kmaq Nation

**SOMETIMES IT'S LIKE A HEAVY SLEDGE
that we are trying to move – this sledge
represents our passions for ensuring the
ecological integrity of *Mawisikamukawey*.**



**We, the Elders, are
dragging that sledge
with all our might,
and we need others to
help us by pushing as
hard as you can on the
rear of the sledge.**

**But, it is we,
the Elders, who will
determine where it goes.**

words of Elder Albert Marshall, Mi'kmaq Nation

**OTHER TIMES THAT HEAVY SLEDGE
represents a passion we Elders hold
that western science can help address.**



**Then we, the Elders, will
help you with that sledge
... you drag, we push ...
while we all also constantly
exchange understandings
about where it is going
... and learn to abide by**

i'l'oqaptmu'k

**meaning “to revisit to renew,
to maintain movement in the
direction Spirit intended”.**

words of Elder Albert Marshall, Mi'kmaq Nation

Elders Albert & Murdena



me,
Cheryl Bartlett,
Sydney, NS

my Mom,
Florence Bartlett,
Brooks, AB

my friends, colleagues, and teachers,
Elders Albert and Murdena Marshall,
Eskasoni, NS; Mi'kmaq Nation

October 2010
Head-Smashed-In, AB



Elders and CRC team



various years,
various locations



University Science Students



Summer 2001
Framboise Beach, NS

Community Youth



July 2015 – Community Youth Camp
Listuguj First Nation, QC

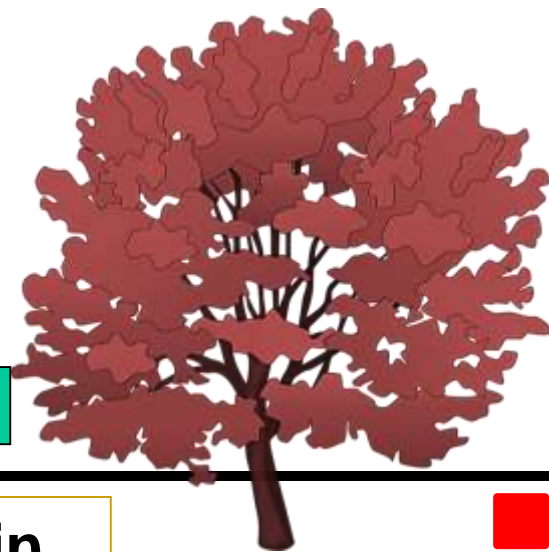


**October in
southern Alberta**





Red Maple



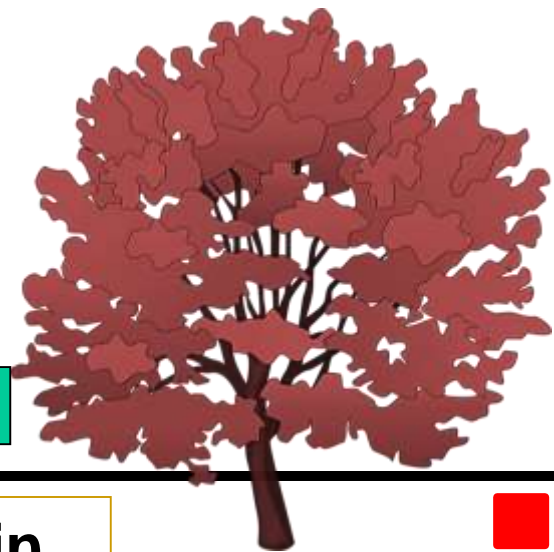
**October in
southern Alberta**

**October in
Unama'ki, NS**



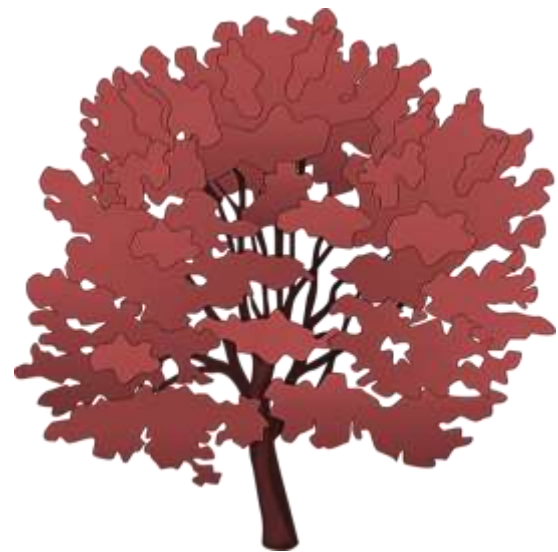


Red Maple



October in Unama'ki, NS







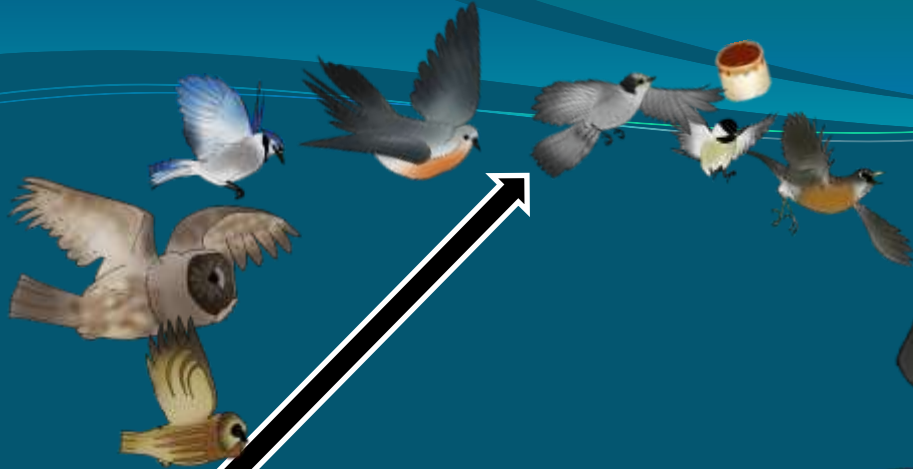
Jipjawej
Robin



Wow



Jiji'kes
Chickadee



Mikjaqoqwej
Moose Bird (Gray Jay)



Ples

Passenger Pigeon

Tities
Blue Jay





Ku ku kwes

Barred Owl



Kupkwe'j
Saw-whet Owl





TATAPN



Muin aqq Luiknek Te'sijik Ntuksuinu'k

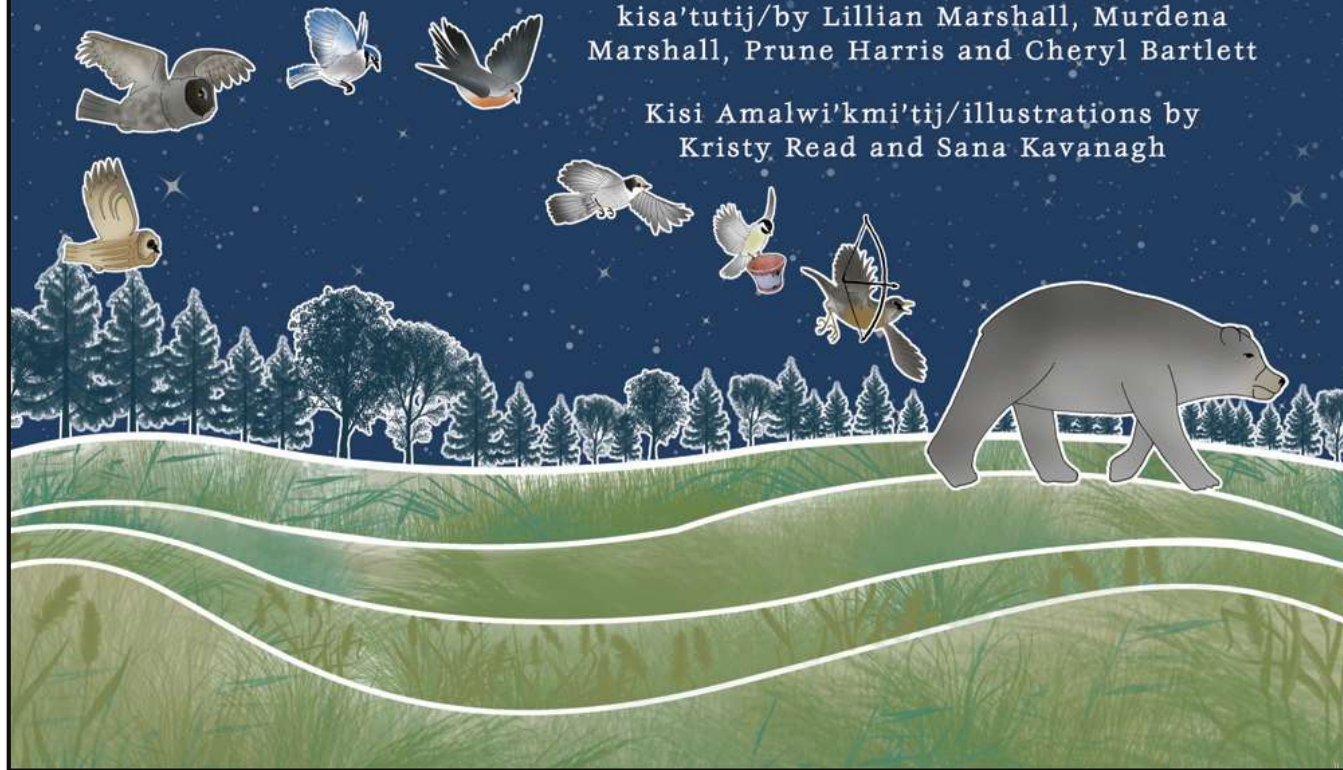
MI'KMAWEY TEPKIKEWAY MUSIKISKEY A'TUKWAQN

Muin and the Seven Bird Hunters

A MI'KMAW NIGHT SKY STORY

kisa'tutij/by Lillian Marshall, Murdena
Marshall, Prune Harris and Cheryl Bartlett

Kisi Amalwi'kmi'tij/illustrations by
Kristy Read and Sana Kavanagh



Muin and the Seven Bird Hunters ... a Mi'kmaq Night Sky Story





THE STORY
HAPPENS
OVER &
OVER



Muin is a Mi'kmaq Science Story ...

October in
southern Alberta



October in
Unama'ki



... a story of patterns and relationships in Unama'ki.
This story does not work in Blackfoot Territory.

We dance in order to expand the potential for something to happen.

Joseph Rael, 2009, in "Sound: Native Teachings + Visionary Art" (p. 55); Council Oak Books, San Francisco



**dancing
to learn ...
... learning
to dance**

**PATTERNS
and
RELATIONSHIPS**

The Periodic Table of the Elements in Western / mainstream science



... a story of patterns and relationships everywhere

The **Periodic** Table of the Elements in Western / mainstream science

The image displays a color-coded periodic table of elements. The elements are arranged in a standard periodic table layout, with colors used to group them into categories. The colors include shades of blue, green, yellow, orange, pink, and purple. The table includes elements from Hydrogen (H) to Oganesson (Og), with the lanthanide and actinide series shown as separate rows below the main body of the table. The word 'Periodic' in the title is circled in red.

H																	He		
Li	Be											B	C	N	O	F	Ne		
Na	Mg											Al	Si	P	S	Cl	Ar		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
Fr	Ra		Unq	Unp	Unh	Uns	Uno	Uuo											
		La	Ce	Pr	Nd	Pm	Sm												
		Ac	Th	Pa	U	Np	Pu												
									Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
									Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

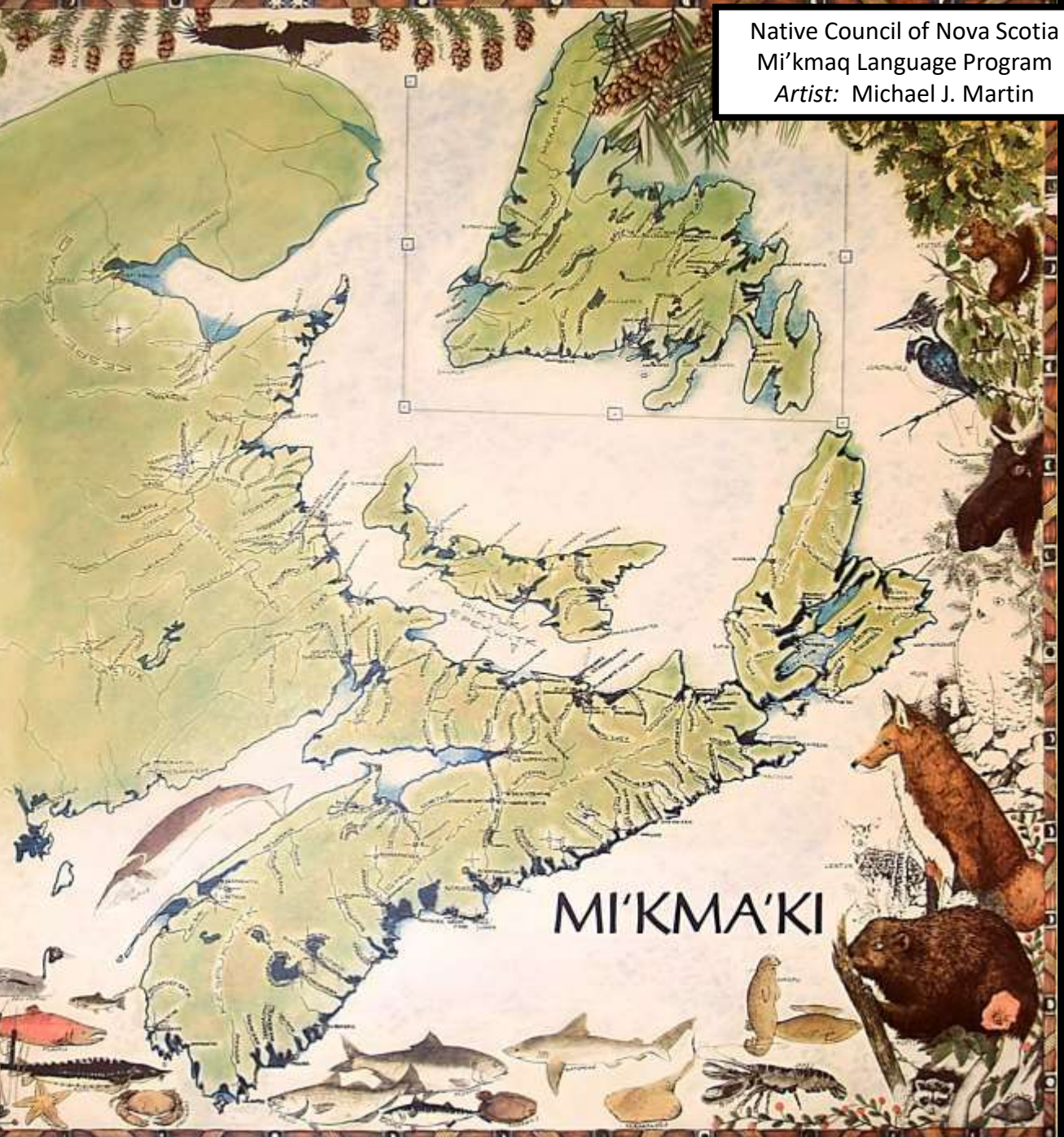
... a story of patterns and relationships everywhere

We dance in order to expand the potential for something to happen.

Joseph Rael



Native Council of Nova Scotia
Mi'kmaq Language Program
Artist: Michael J. Martin



Native Council of Nova Scotia
Mi'kmaq Language Program
Artist: Michael J. Martin

CAPE BRETON
UNIVERSITY

Island of
Cape Breton - Unama'ki

Eskasoni First Nation

Halifax

MI'KMA'KI



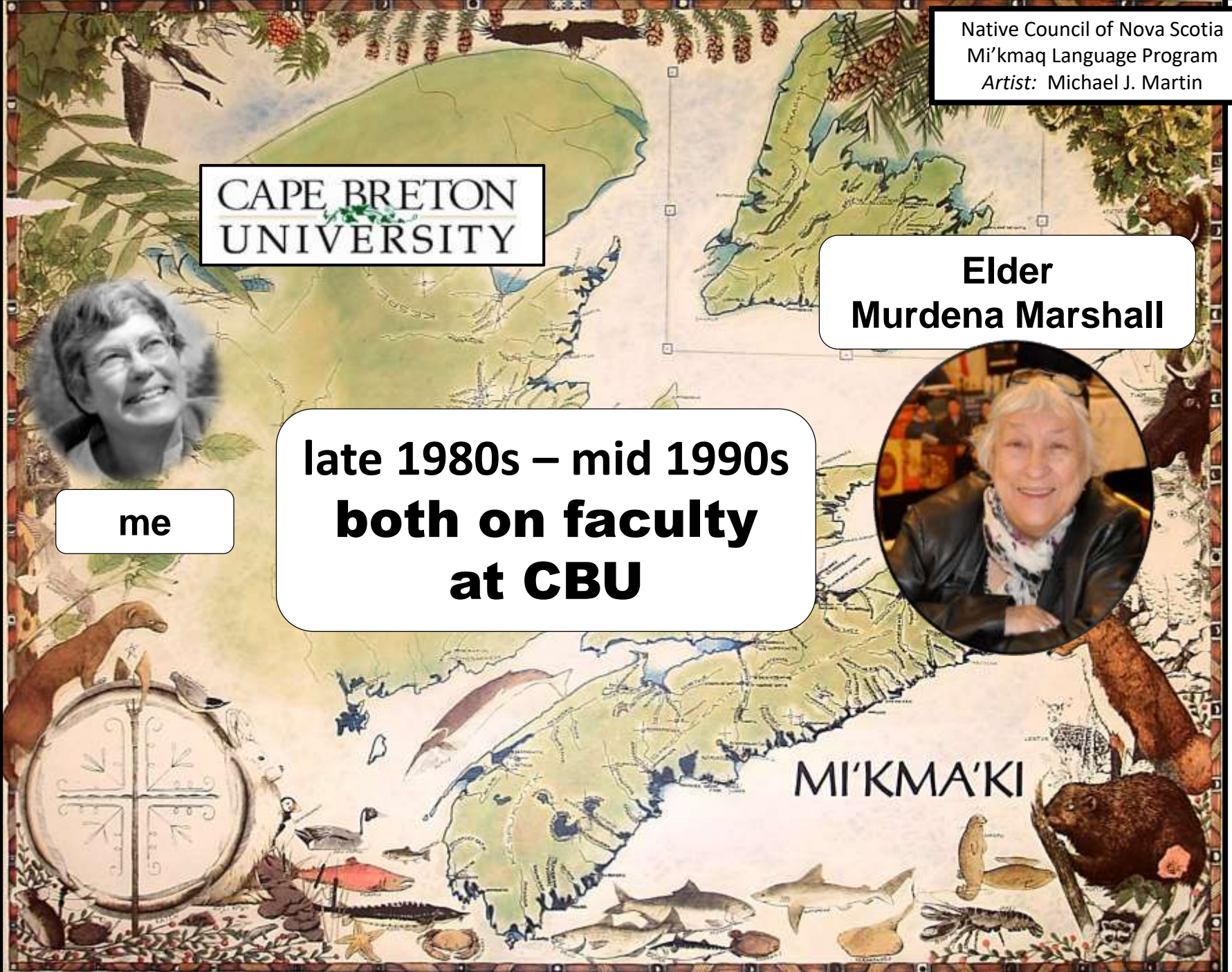
CAPE BRETON
UNIVERSITY

Elder
Murdena Marshall

me

late 1980s – mid 1990s
**both on faculty
at CBU**

MI'KMA'KI

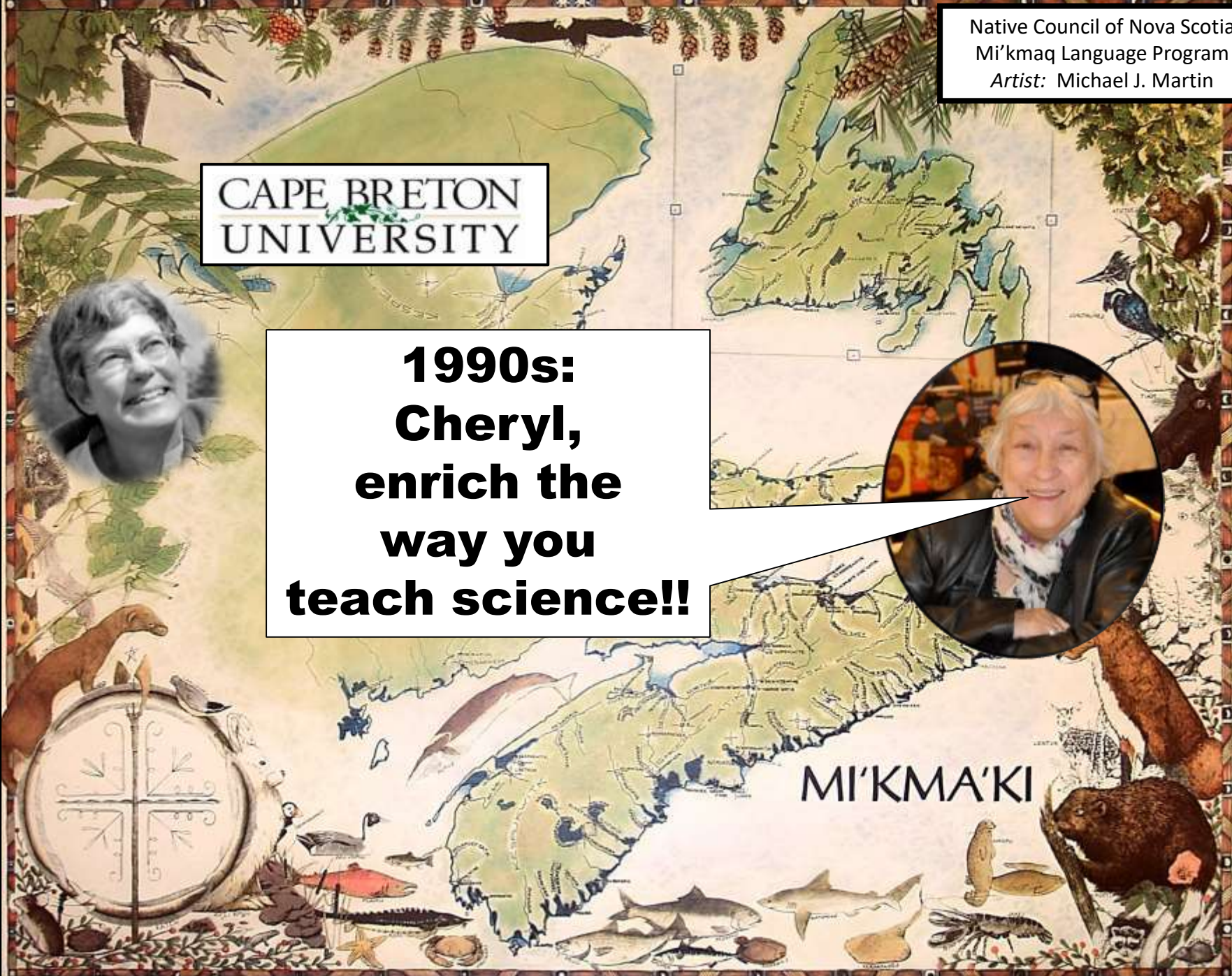


Native Council of Nova Scotia
Mi'kmaq Language Program
Artist: Michael J. Martin

CAPE BRETON
UNIVERSITY

**1990s:
Cheryl,
enrich the
way you
teach science!!**

MI'KMA'KI



Integrative Science



Integrative Science



our stories
our sciences

Indigenous

our worldviews

Western

“bringing our knowledges together”

Integrative Science



BScCS: a 4 yr SCIENCE degree

Bachelor of Science Community Studies

Degree Profile for:
**Toqwa'tu'kl Kijijitaqnn /
Integrative Science**

Bringing Knowledges Together
... from Western scientific and Aboriginal world views



1

core

2

concentration

3

electives

4

work placements

FOUR
parts
in the
overall
degree
program

- (credits)
- 1) 6 credits: Analysis and Decision Making (6 credits)
 - 2) 6 credits: Applied Research (6 credits)
 - 3) 6 credits: PUB 300: Community Intervention (6 credits)
 - 4) 6 credits: science and technology perspectives (6 credits): Phil 222, or equivalent
 - 5) 3 credits: world views and values (3 credits): Phil 251, Phil 253, or equivalent
 - 6) 3 credits: Aboriginal perspectives (3 credits): Mikm at 100 or 200 level, or 361, or equivalent
 - 7) 3 credits: business perspectives (3 credits): Buss 111, Buss 231, or equivalent
 - 8) 3 credits: public communication (3 credits): Comm 103, Comm 105, or equivalent

- Student's Electives (30 credits)
- 1) 3 credits: MSIT 101
 - 2) 3 credits: MSIT 103
 - 3) 3 credits: MSIT 201
 - 4) 3 credits: MSIT 202
 - 5) 6 credits: 1 + 2) 6 credits: Chem 121 + 122
 - 6) 6 credits: 3 + 4) 6 credits: Math 131 + 132, or Phys 100, or Phys 111 + 112
 - 7) 6 credits: 5 + 6) 6 credits (at least 3 credits must be at 300 level):
 - Geol 111
 - any PubH at 200 level or higher
 - any Envi at 200 level or higher

- Student's Electives (30 credits)
- 1) 3 credits: _____
 - 2) 3 credits: _____
 - 3) 3 credits: _____
 - 4) 3 credits: _____
 - 5) 6 credits: _____
 - 6) 3 credits: _____

Work Placements (paid or voluntary, each at least 120 hours)

- 1) _____
- 2) _____

An overall average of 60% (in courses over your four years) is required for graduation.



BScCS: a 4 yr SCIENCE degree

Bachelor of Science Community Studies

Degree Profile for:
**Toqwa'tu'kl Kijijitaqnn /
Integrative Science**



Bringing Knowledges Together
... from Western scientific and Aboriginal world views

1

core

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- 8) public communication (3 credits): Comm 103, Comm 105, or equivalent
- 9) *Public Health Perspectives (6 credits):* East 100, East 205 + Engl 207, or equivalent
- 10) *Public Health Perspectives (6 credits):* East 102 or 111, Buss 181, or equivalent
- 11) *Public Health Perspectives (6 credits):* East 182, Psych 201, or equivalent

2

concentration

3

electives

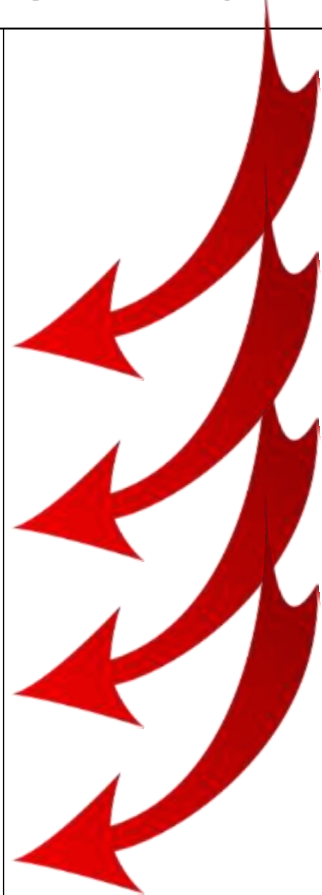
4

work placements

Work Placements (paid or voluntary, each at least 120 hours)

- 1) _____
- 2) _____

**An overall average of 60% (in courses
over your four years) is required for
graduation.**



**science
in all
parts
of degree
program**

BScCS: a 4 yr SCIENCE degree

Bachelor of Science Community Studies

**Indigenous & Western
sciences together in
MSIT
(8 half year courses)**

2

concentration

(courses)

1) 3 credits: MSIT 101	1 + 2) 6 credits: Chem 121 + 122
2) 3 credits: MSIT 103	
3) 3 credits: MSIT 201	3 + 4) 6 credits: Math 131 + 132,
4) 3 credits: MSIT 203	Phys 100, or Phys
5) 3 credits: MSIT 301	5 + 6) 6 credits (at least 3 credits must
6) 3 credits: MSIT 303	- Geol 111
7) 3 credits: MSIT 401	- any PubH at 200
8) 3 credits: MSIT 401	- any Envi at 200


Student's Electives (30 credits)

1) 3 credits: _____	6) 3 credits: _____
2) 3 credits: _____	7) 3 credits: _____
3) 3 credits: _____	8) 3 credits: _____
4) 3 credits: _____	9) 3 credits: _____
5) 3 credits: _____	10) 3 credits: _____

Work Placements (paid or voluntary, each at least 120 hours)

1) _____
2) _____

An overall average of 60% (in courses over your four years) is required for graduation.



BScCS: a 4 yr SCIENCE degree

Bachelor of Science Community Studies

**Indigenous & Western
sciences together in
MSIT
(8 half year courses)**

2

concentration

**PLUS
mainstream sciences
(chem, math/physics, environ)
(6 half year courses)**

An overall average of 60% (in courses over your four years) is required for graduation.



BScCS: a 4 yr SCIENCE degree

Bachelor of Science Community Studies

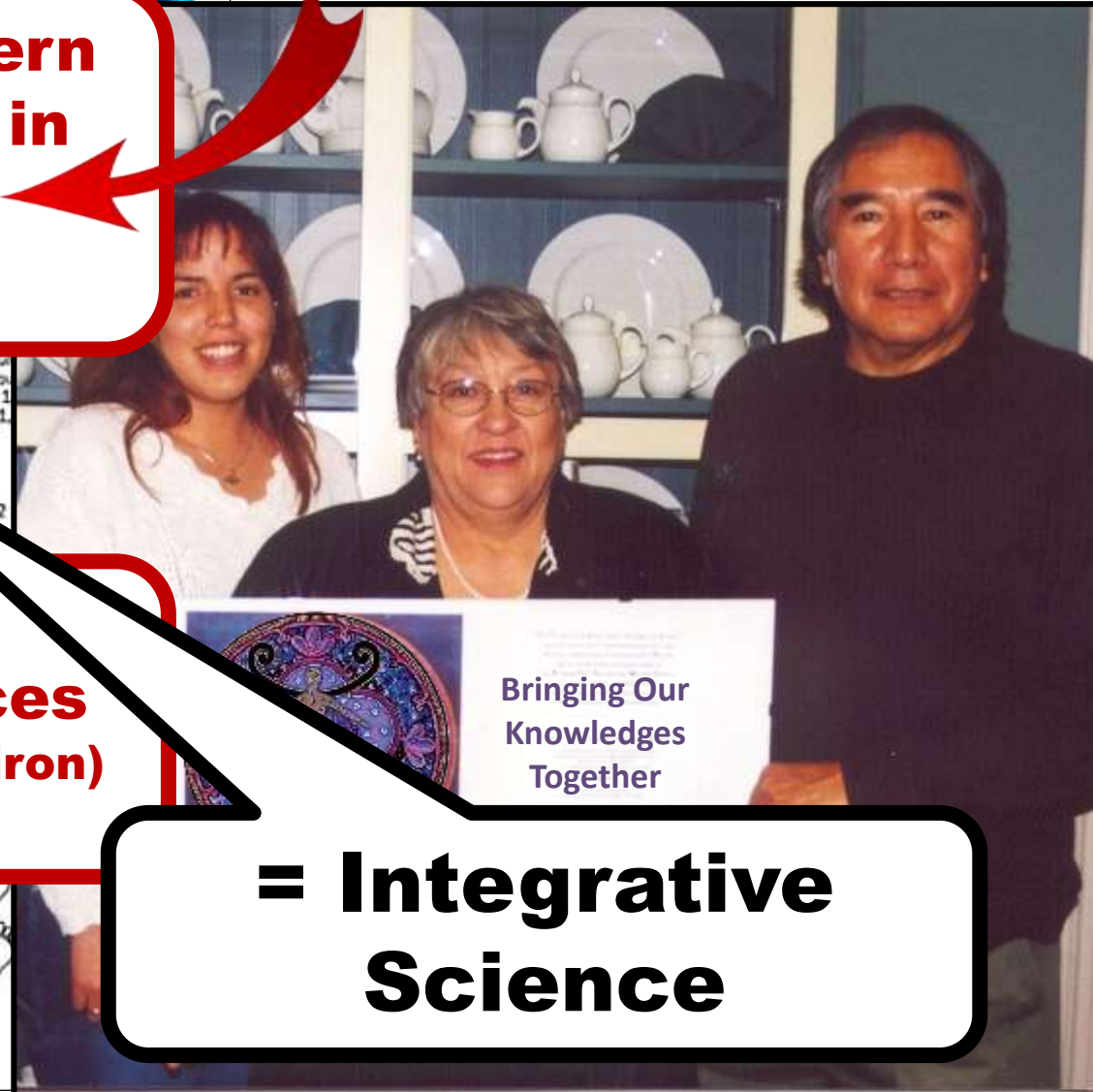
**Indigenous & Western
sciences together in
MSIT
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2

concentration

**PLUS
mainstream sciences
(chem, math/physics, environ)
(6 half year courses)**

An overall average of 60% (in courses over your four years) is required for graduation.



**= Integrative
Science**

a **GUIDING PRINCIPLE** **ETUAPTUMUK – TWO-EYED SEEING**

for Integrative Science
(or any intercultural collaboration)

**LEARN ... to see from one eye with
the best in the Indigenous ways of
knowing, and from the other eye
with the best in the Western (or
mainstream) ways of knowing**

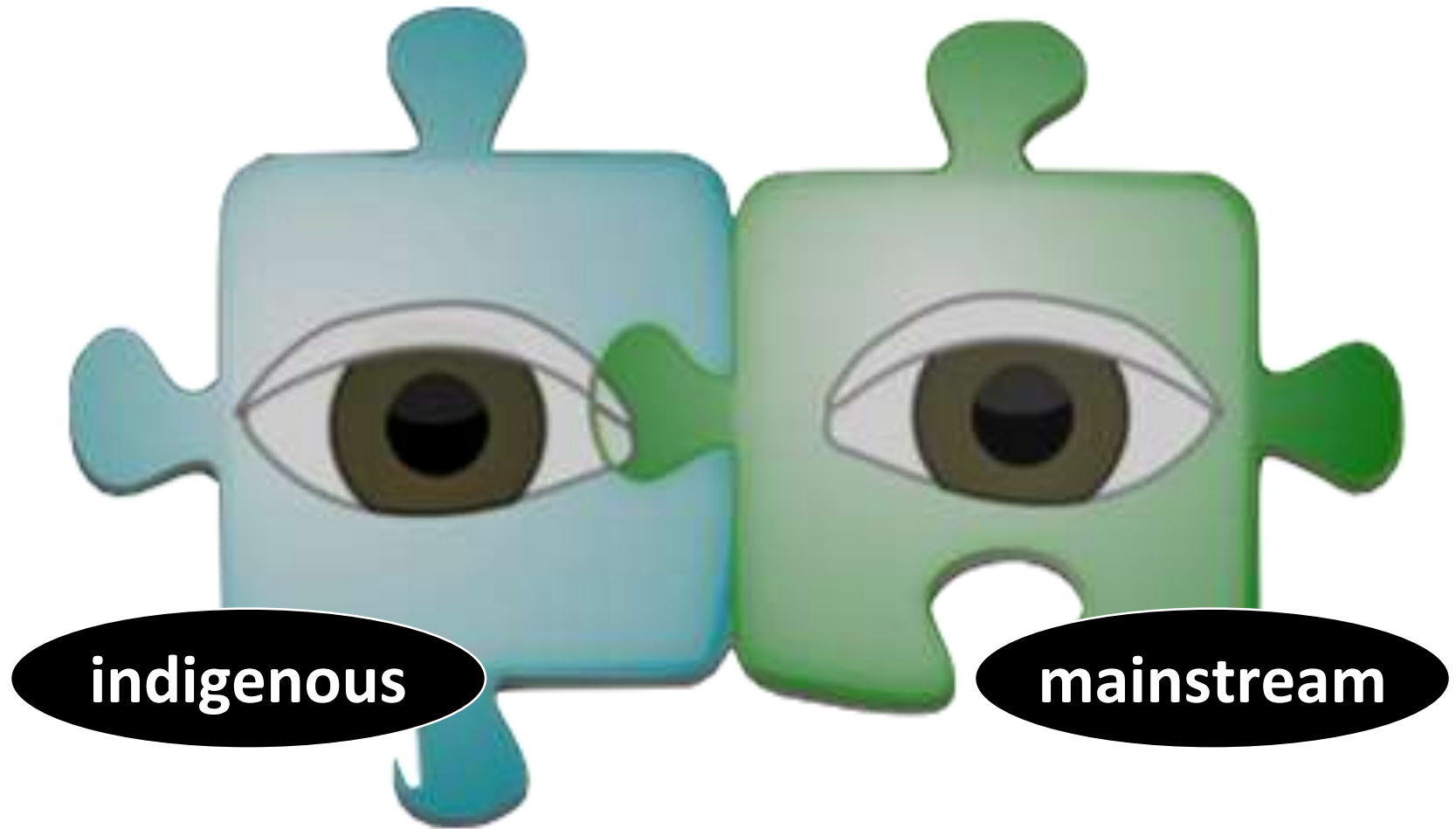
**... and LEARN to use both these
eyes together for the benefit of all.**

(words of Mi'kmaw Elder Albert Marshall)



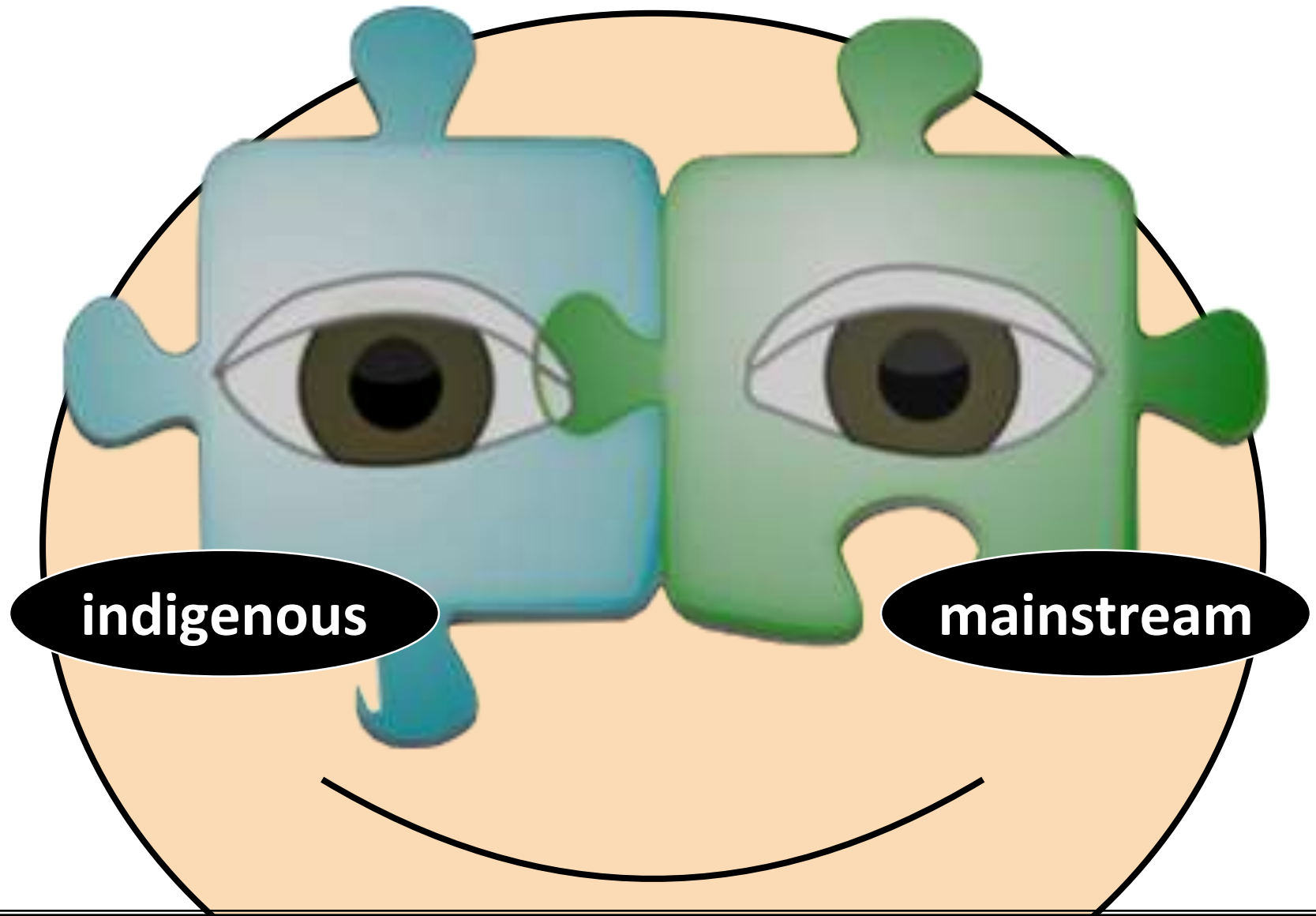
a **GUIDING PRINCIPLE**

ETUAPTUMUK - TWO-EYED SEEING



a **GUIDING PRINCIPLE**

for our minds, souls, Spirits ... not a “mechanism”



a **GUIDING PRINCIPLE**

ETUAPTUMUK – TWO-EYED SEEING

somewhat akin to:

Cultural Humility *(best known in health care arena)*

→ ***through on-going humility, becoming able to:***

- engage in self-reflection and self-critique
within one's journey of being a human, a lifelong learner,
and a reflective practitioner
- understand and bring into check power imbalances
that exist in all dynamics of communication and relationship
- acknowledge gaps in one's own knowledge
including remaining open to new ideas and contradictory
information and learning to see with the strengths in
different culture's "ways of knowing, doing, and being"



a **GUIDING PRINCIPLE** **ETUAPTUMUK – TWO-EYED SEEING**

SOMETIMES IT'S LIKE A HEAVY SLEDGE

This work of Co-Learning guided by Two-Eyed Seeing is not easy and so we need to understand that sometimes our most important job is to plant seeds for the future, for the youth, knowing seeds germinate when the time is right. This job of today requires that we do it as **We, Together**

Learning & Practising → Cultural Humility

How can we help critics understand, rather than fear?

Highlighting Elder Albert's words: "We, Together"

- ❖ Our knowledges and ways of knowing ... Indigenous and mainstream: we need to learn to see with the strengths of each and we need to learn to use them together, for the benefit of all people and the ecological integrity of the Earth.
- ❖ We need to embark on a co-learning journey 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.

How can we help critics understand, rather than fear?

Highlighting Elder Albert's words: "We, Together"

- ❖ Our knowledges and ways of knowing ... Indigenous and mainstream: we need to learn to see with the strengths of each and we need to learn to use them together, for the benefit of all people and the ecological integrity of the Earth.
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- ❖ 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.

Compare Albert's words to Jeffrey Simpson's

(Globe & Mail; 21 Feb 2014; "Money alone cannot fix Aboriginal education")
re *First Nations Control of First Nations Education Act* agreement signed in early February:

"... the big loser will be students, whose knowledge of basic science, math and other subjects will be so infused with cultural appropriateness by these theorists as to handicap them, rather than assist them, in wider Canadian society."

Integrative Science – MSIT courses

KEY:

**early input
via Talking Circles
and
Kitchen Table
Conversations**

with community
Elders, educators, and
leaders of organizations
plus interested others



Integrative Science – MSIT courses

KEY:
learn
with and from
Mawisikamukawey

photo by Clifford Paul, Membertou FN

Integrative Science – MSIT courses

KEY:
learn
with and from
Mawisikamukawey

This is what we truly believe, this is what reinforces our spirituality: that no one being is greater than the next, that we are part and parcel of the whole ... we are equal ... and that each one of us has a responsibility to the balance of the system.

(words of Mi'kmaq Elder Albert Marshall)

Integrative Science – MSIT courses

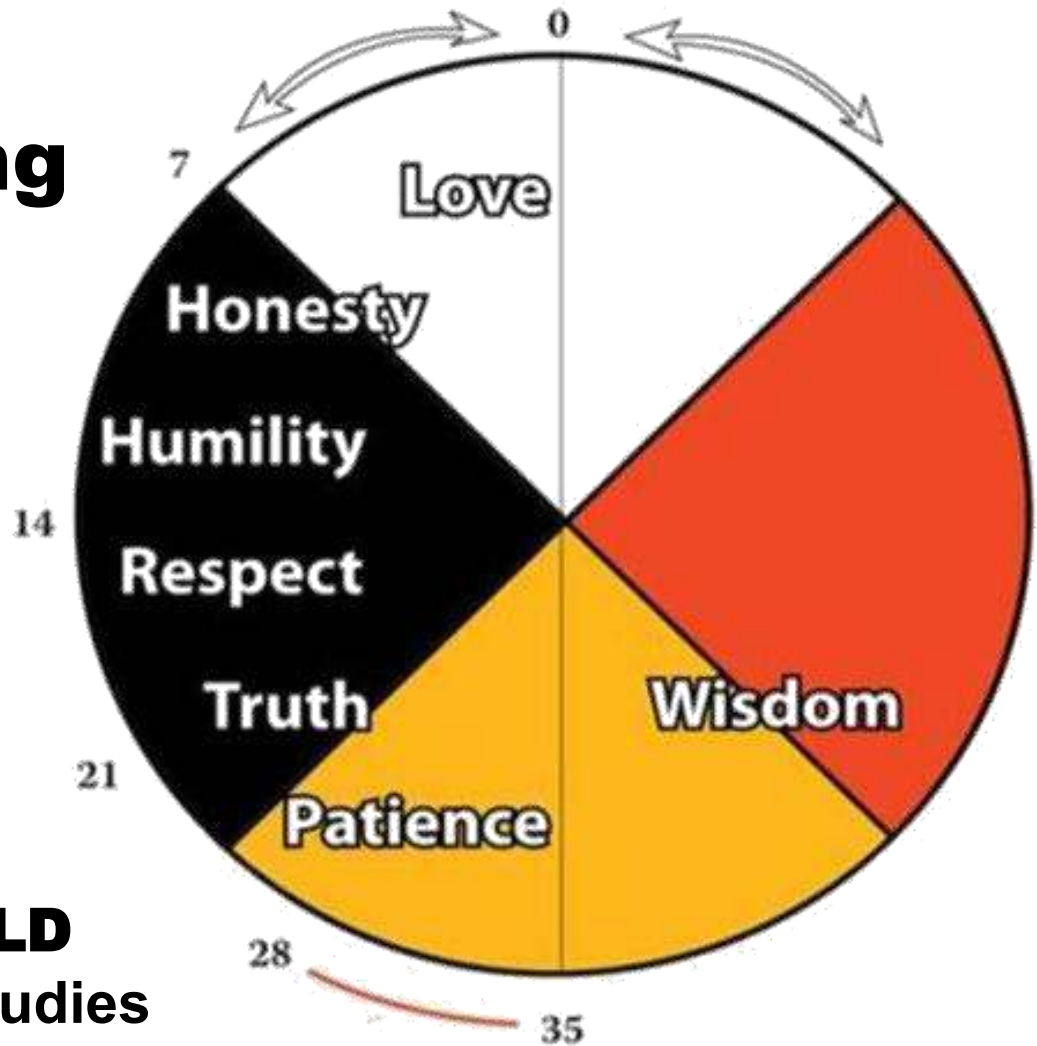
**KEY:
Visual Thinking**



Elder

Murdena Marshall, LLD

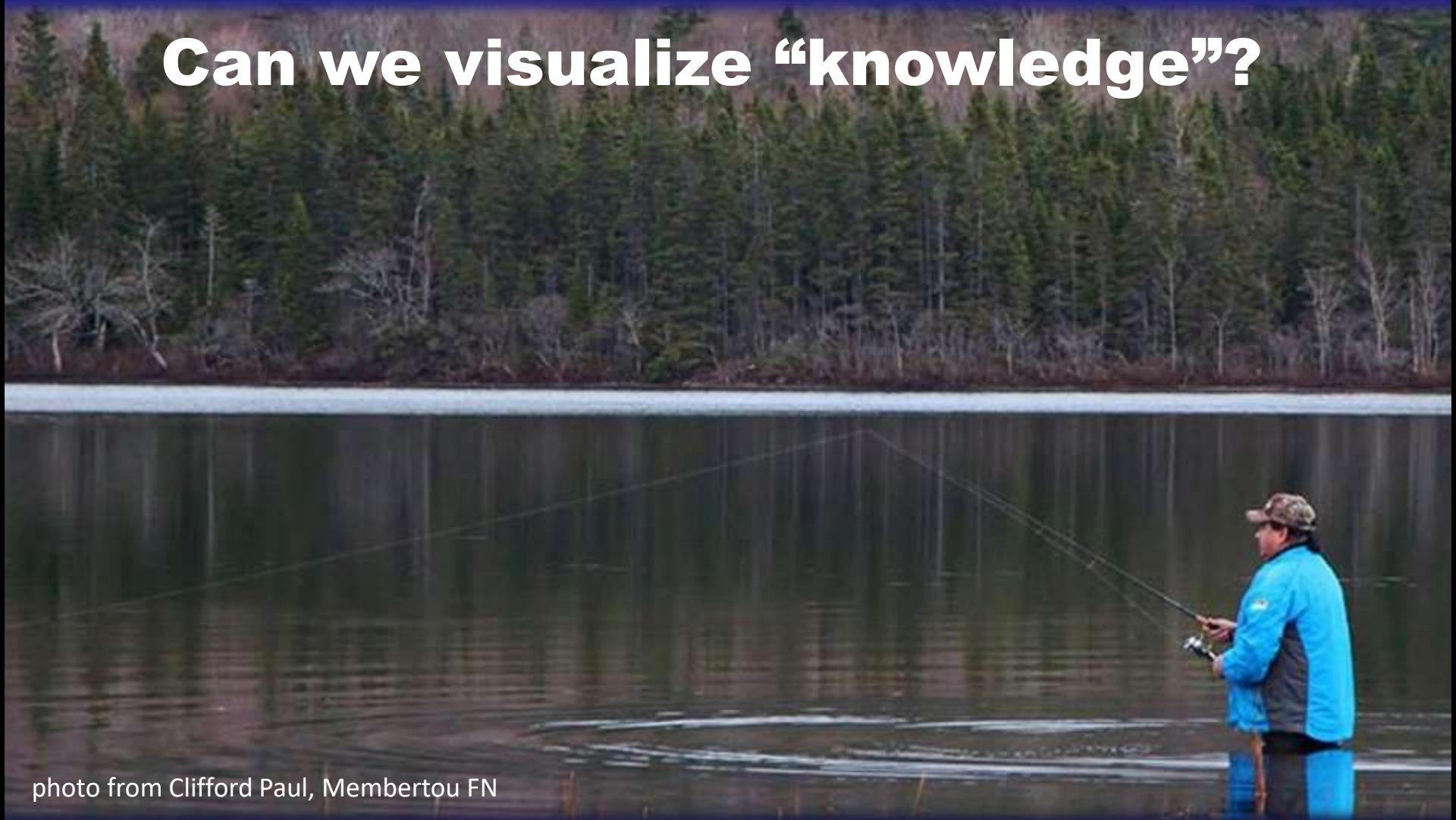
**Assistant Prof, Mi'kmaq Studies
Univ College of Cape Breton**



Integrative Science – MSIT courses

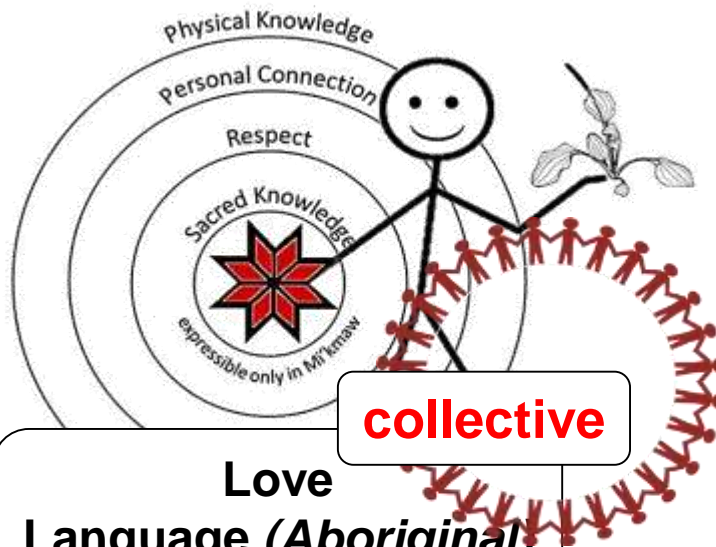
Can we visualize “knowledge”?

photo from Clifford Paul, Membertou FN

A photograph of a person fishing in a lake. The person is wearing a bright blue jacket and a hat, and is standing in the water, holding a fishing rod. The lake is calm, and the background is a dense forest of evergreen trees. The sky is overcast.

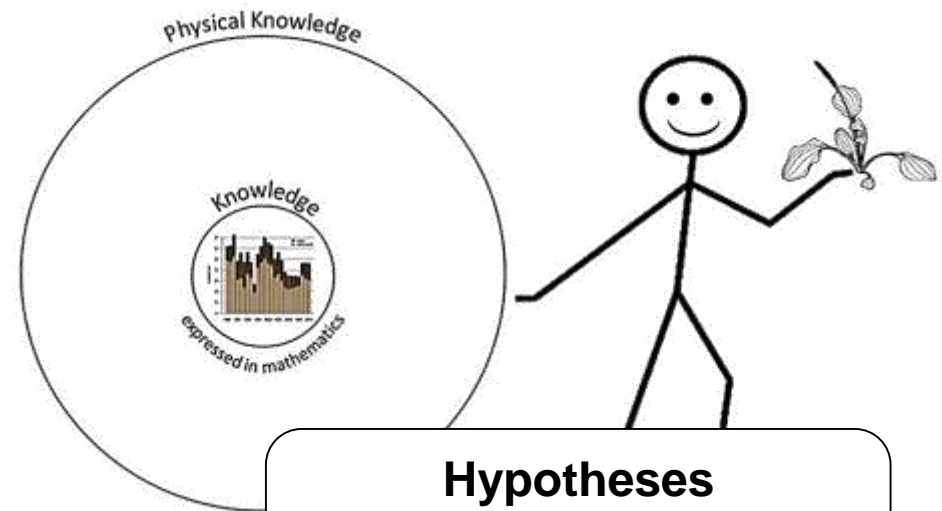
Integrative Science – MSIT courses

We can visualize “knowledge”!



Love
Language (*Aboriginal*)
Life & Land

Indigenous



Hypotheses
Language (*Mathematics*)
Theories & Models

Western

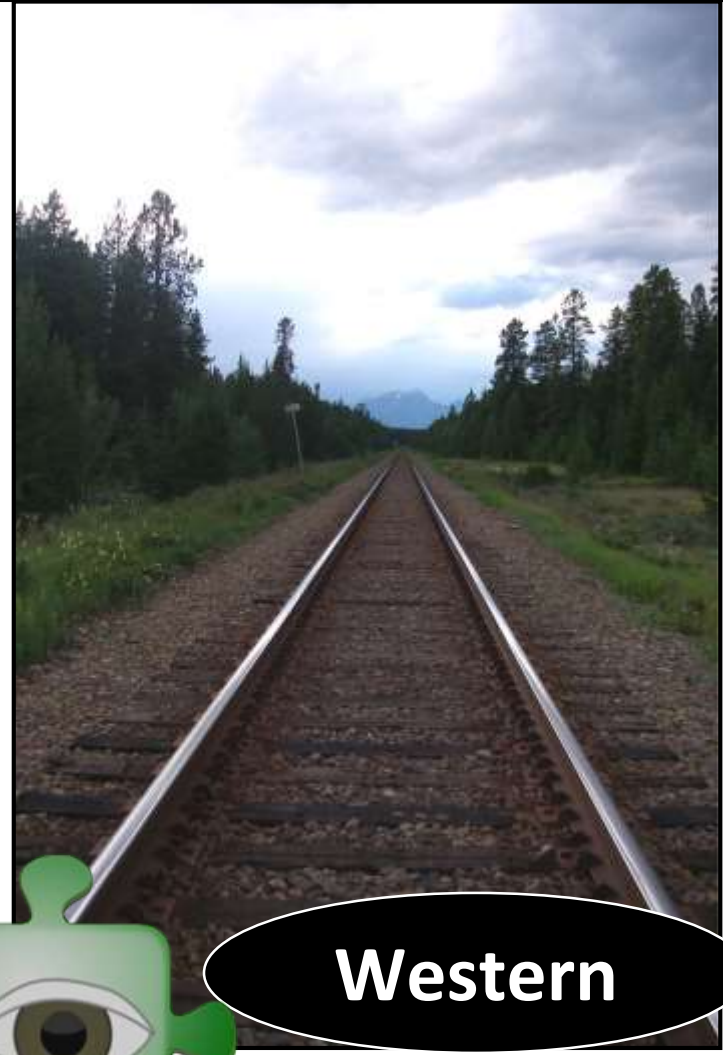
**Knowledge System Models
adapted from Elder Murdena Marshall**

Integrative Science – MSIT courses



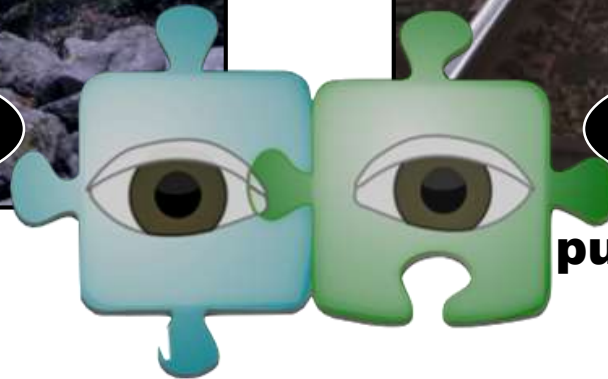
Indigenous

living knowledge
“vigour”



Western

published knowledge
“rigour”

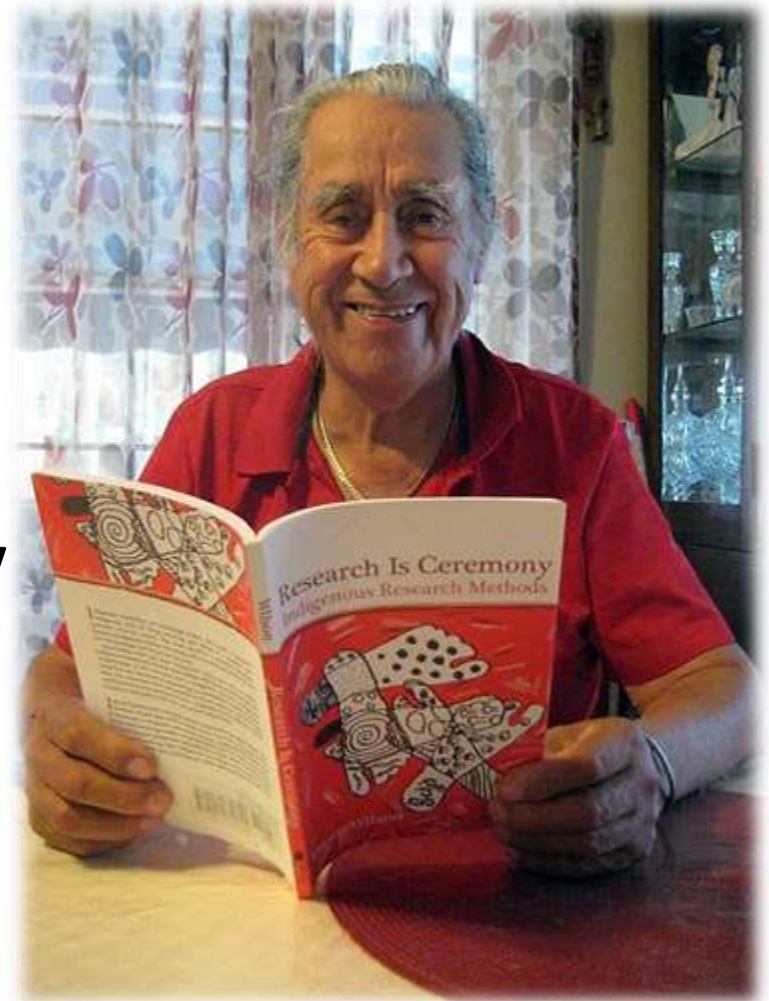


Integrative Science – MSIT courses

italicized text = Albert's thoughts for Mi'kmaq Knowledge

KNOWLEDGE SYSTEMS

- *nature of thinking or thought:*
wsitqamu'kewe'l ankitasuaqnn
(worldly thoughts or knowledge gained throughout your life) ≈ epistemology
- *worth of reality; real world; real life:*
wsitqamu'kewe'l penawsinn ≈ ontology
- *how knowledge is gained: ta'n tel mnsnmen kjiji'taqn ≈ methodology*
- *worth of knowledge that will be used:*
kjijitaqn ta'n tel wie'wasitew ≈ axiology



Integrative Science – MSIT courses

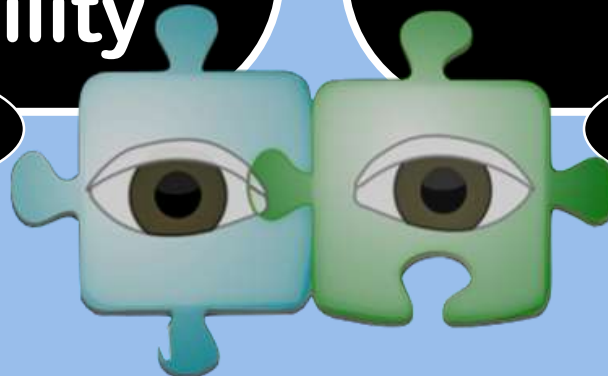
KEY CONCEPTS and ACTIONS (epistemologies)

- respect
- relationship
- reverence
- reciprocity
- ritual (ceremony)
- repetition
- responsibility

Indigenous

- hypotheses
(making & testing)
- data collection
- data analysis
- model & theory
construction

Western



Integrative Science – MSIT courses

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)3-5

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
ending within environment

towards construction of
understanding of environment

CO-LEARNING for Two-Eyed Seeing

learning our strengths and learning

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**

un-weaving 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**

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

Integrative Science – MSIT courses

**Good Beginnings: colourful vision
and big picture understandings**

**Next:
pedagogy and curriculum**

Integrative Science – MSIT courses

KEY: early conceptual input via Dialogues

- local community
- local university
- experts from away
 - Dr. Marie Battiste
 - Dr. Sakej Henderson
 - Dr. Leroy Little Bear
 - Amethyst First Rider
 - Stephen Augustine
 - Dr. Gregory Cajete
 - Dr. Jeffrey Kane



Integrative Science – MSIT courses

KEY: **Common Ground**



Dr. Marie Battiste
Dept of Educational Foundations
Univ. of Saskatchewan

*** Indigenous Knowledge and Pedagogy in First Nations Education; a 2002 literature review with recommendations:**

“... focussing on the similarities between the two systems of knowledge rather than on their differences may be a more useful place to start when considering how best to introduce educational reform.”

* paper prepared for
National Working Group on Education and
the Minister of Indian Affairs

Integrative Science – MSIT courses

KEY: **Middle Ground**



Stephen Augustine
Unama'ki College
Cape Breton University

... a learning environment that would combine mainstream educational subjects with traditional knowledge components and would also accommodate teaching and learning styles that would stimulate young students' abilities and creativity.

These teaching methods would have a more holistic approach to learning ... [including] artistic means of expression.

from MA thesis 1998:

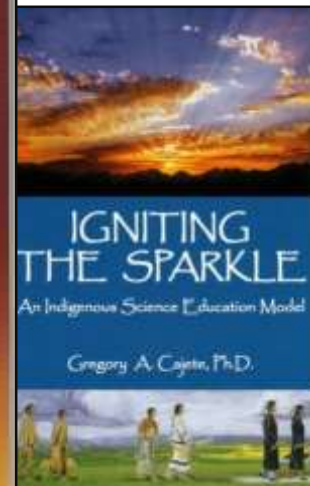
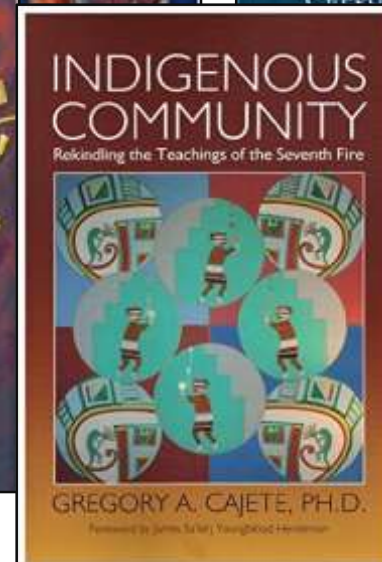
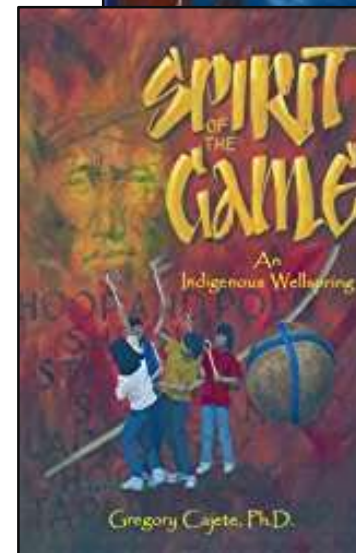
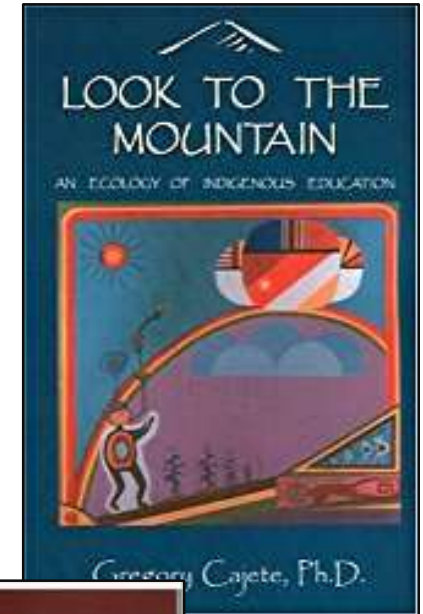
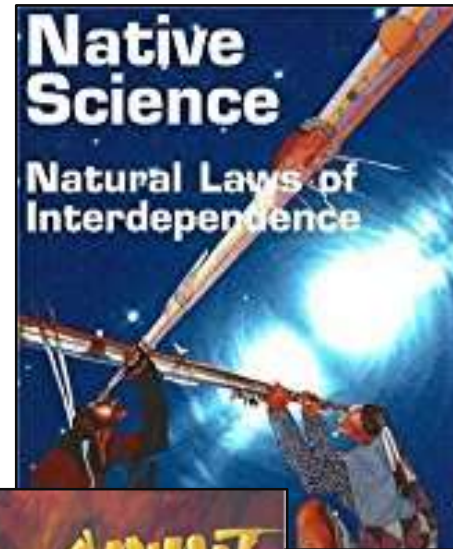
<http://www.nlc-bnc.ca/obj/s4/f2/dsk2/ftp01/MQ36858.pdf>

Integrative Science – MSIT courses

KEY:
**Reawaken Sense
of Creativity**




Dr. Gregory Cajete
Director of Native Studies
Univ of New Mexico

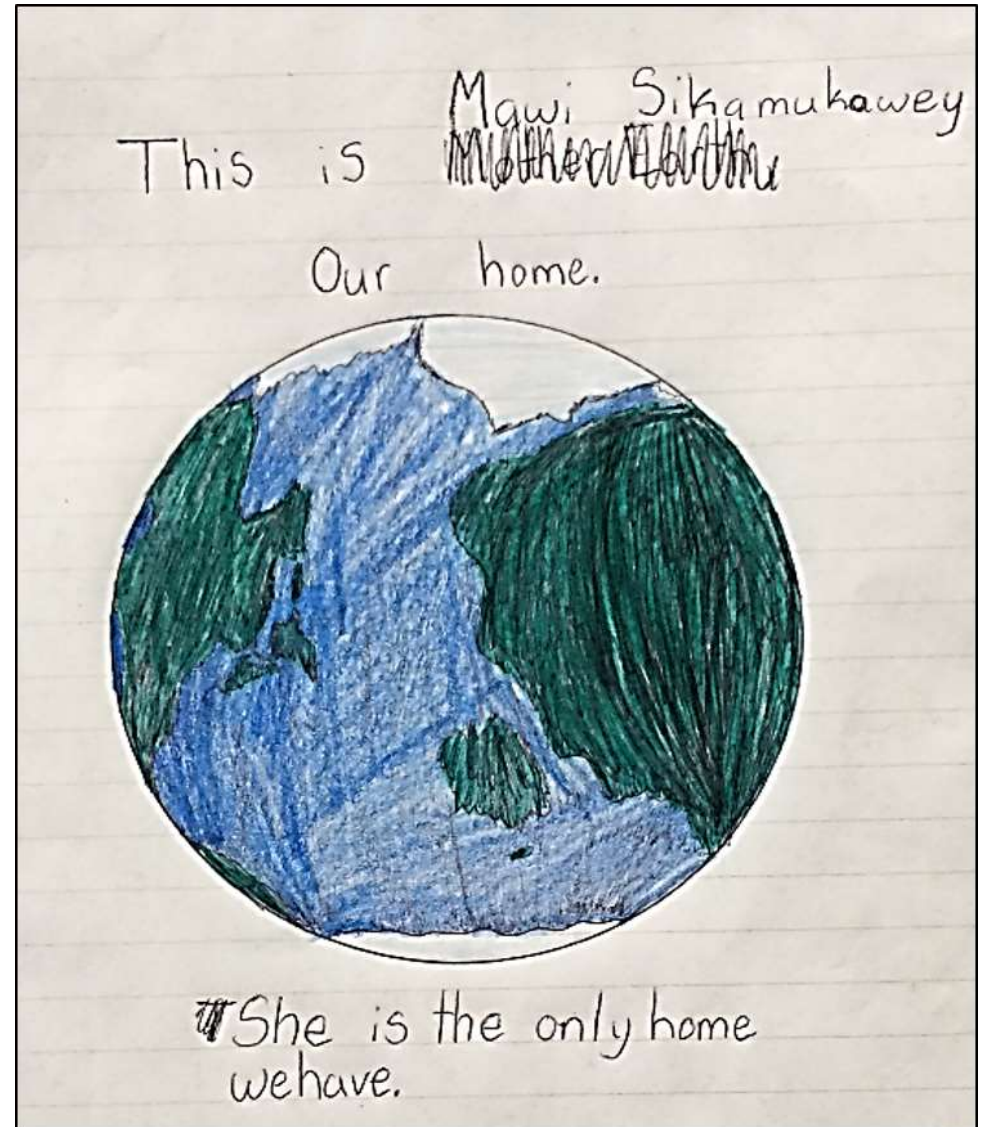


Integrative Science – MSIT courses

KEY:
**Know We Have
Only One Home**

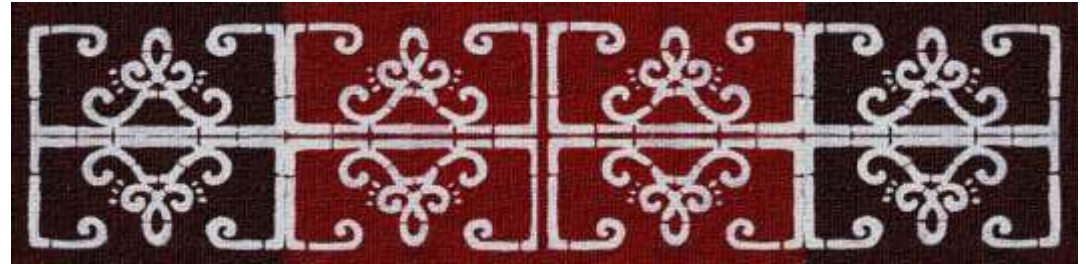
Q Doodi Knockwood 
07/12/16

Doodi Knockwood
(young person)
resonating with
Elder Albert Marshall



Integrative Science – MSIT courses

KEY:
**Exchange
of Stories**



The foundational basis
for any relationship
is an
exchange of stories.

Elder Albert Marshall, LLD
Mi'kmaq Nation

Integrative Science – MSIT courses



Integrative Science – MSIT courses

KEY:
View Science
Inclusively



work of Dr. Cheryl Bartlett
Tier 1 Canada Research Chair
and team with Elders & Educators

INTEGRATIVE SCIENCE: What is “science”?



How to view science inclusively?

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 natural world

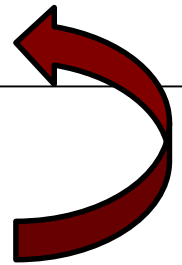
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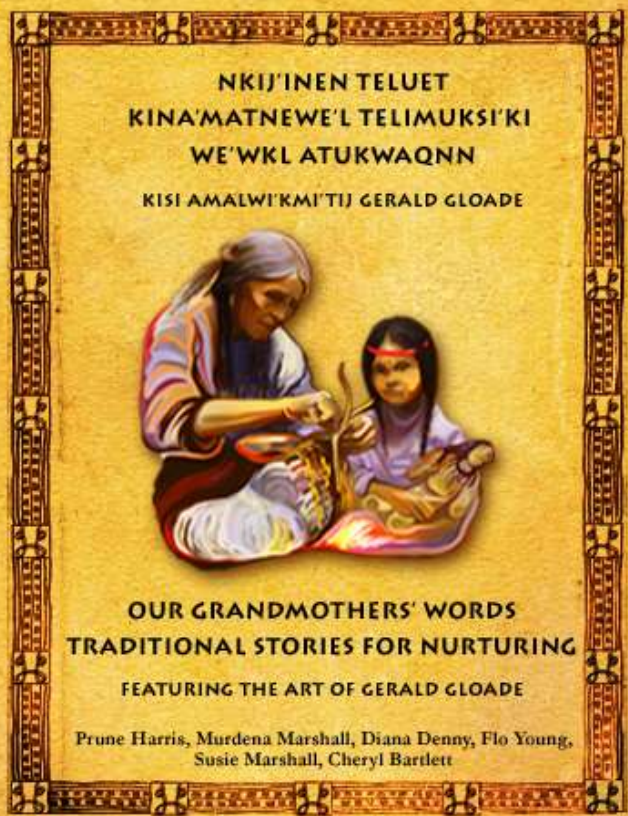


Gerald Gloade, Millbrook First Nation
pattern recognition
within Mi'kmaq Traditional Knowledge



**Gerald Gloade, Millbrook First Nation
pattern recognition
within Mi'kmaq Traditional Knowledge
interview by the Weather Network on "Groundhog Day" 2017**

<https://www.theweathernetwork.com/ca/videos/gallery/first-nations-predicted-atlantic-canada-storm/sharevideo/5318908771001>



Mi'kmawey Debert
Cultural Centre: artist plus
culture, natural resources,
and MTK educator/officer

Gerald Gloade, Millbrook First Nation
pattern recognition
within Mi'kmaq Traditional Knowledge
provided all the artwork for the 2013 Elders' book
featuring traditional stories for nurturing children



Mi'kmawey Debert
Cultural Centre: artist plus
culture, natural resources,
and MTK educator/officer

Gerald Gloade, Millbrook First Nation

**pattern recognition
within Mi'kmaq Traditional Knowledge**

designed the beaver for the new 2017 Canadian nickel

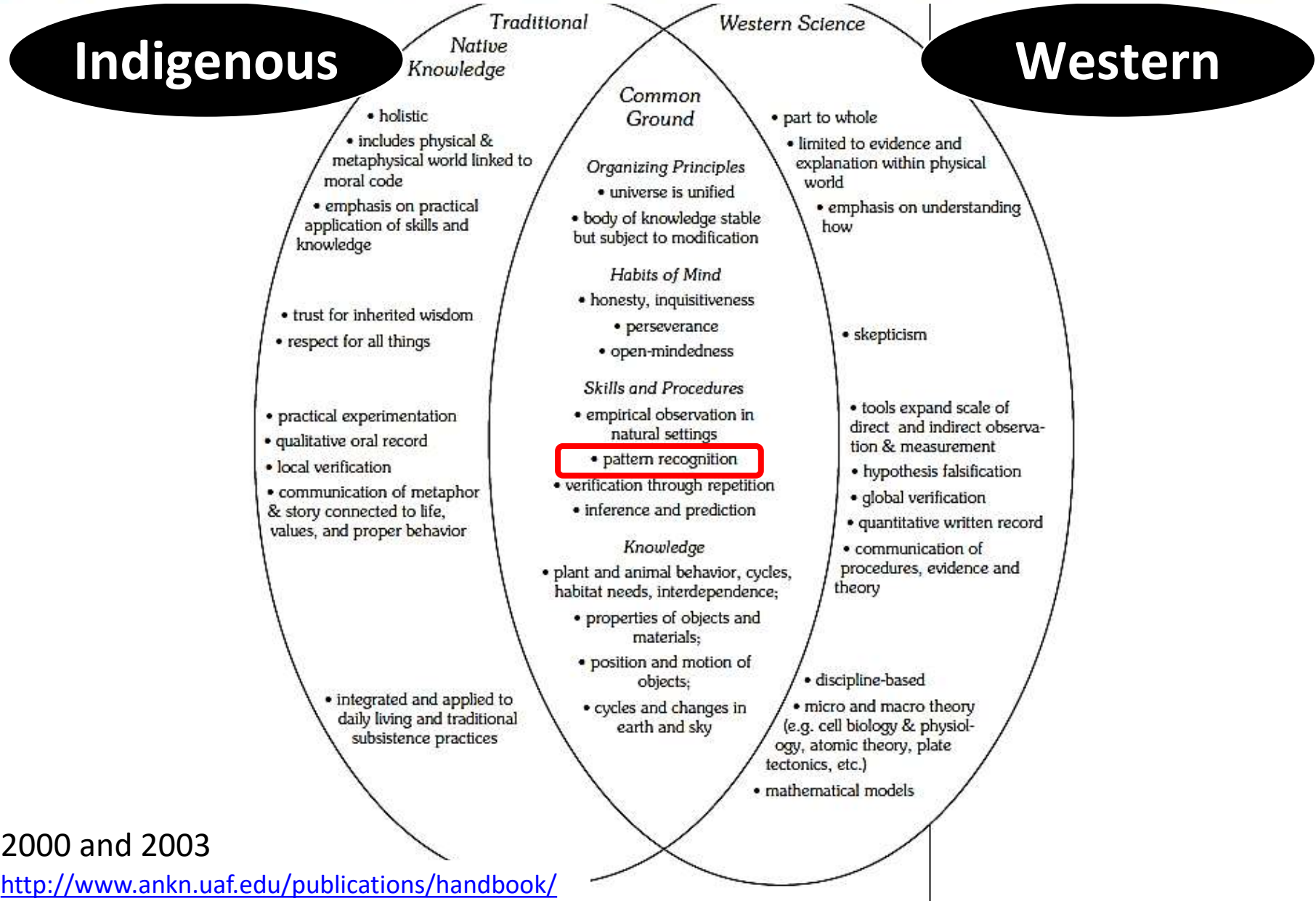


Douglas J. Cardinal, world renown architect

**Indigenous peoples, living in intimate
interconnectivity with the land,
embedded pattern awareness in
their traditional day-to-day activities
and their knowledge systems as
reflected in their languages.**

The journey of being human frequently requires a cognitive leap from the “territory of the known” to the “territory of the unknown” ... but, unfortunately, fear frequently emerges as a barrier. We humans, as pattern-learners and pattern-users, can look to our eco-kin in the natural environment for help in nurturing new patterned understandings and abilities towards successfully crossing the barrier of fear. This is what Indigenous peoples traditionally did, as they successfully met the many survival challenges in their lives.

paraphrased from: Doyle, RI, 2001, pp 38-47: Innovative Architect Says We Must Confront Our Fears as Enlightened “Spiritual Warriors”, in book “Renaissance II: Canadian Creativity and Innovation in the New Millennium” from “Millennial Conferences in the Arts and Sciences” 1999-2000, Ottawa & Edmonton



2000 and 2003

<http://www.ankn.uaf.edu/publications/handbook/>

Indigenous

al experimentation
ive oral record
erification
unication of metaphor
connected to life,
and proper behavior

• integrated and applied to
daily living and traditional
subsistence practices

2000 and 2003

<http://www.ankn.uaf.edu/publications/handbook/>

Skills and Procedures

- empirical observation in natural settings
- pattern recognition
- verification through repetition
- inference and prediction

Knowledge

- plant and animal behavior, cycles, habitat needs, interdependence;
 - properties of objects and materials;
 - position and motion of objects;
 - cycles and changes in earth and sky

Western

and scal
direct and indirect
tion & measureme
• hypothesis falsific
• global verification
• quantitative writte
• communication of
procedures, evidence
theory

- discipline-based
- micro and macro theory (e.g. cell biology & physiology, atomic theory, plate tectonics etc.)

INTEGRATIVE SCIENCE – MSIT: What kinds of “patterns”?



REPEAT a PREVIOUS SLIDE

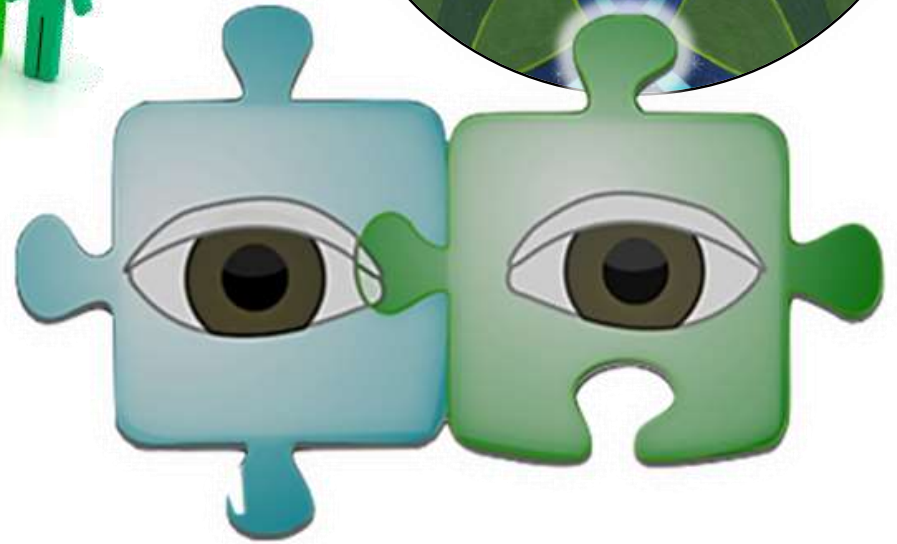


patterns essential to human survival
that also reflect practical engagement
with the natural world

**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 – MSIT: “Stories” in science?

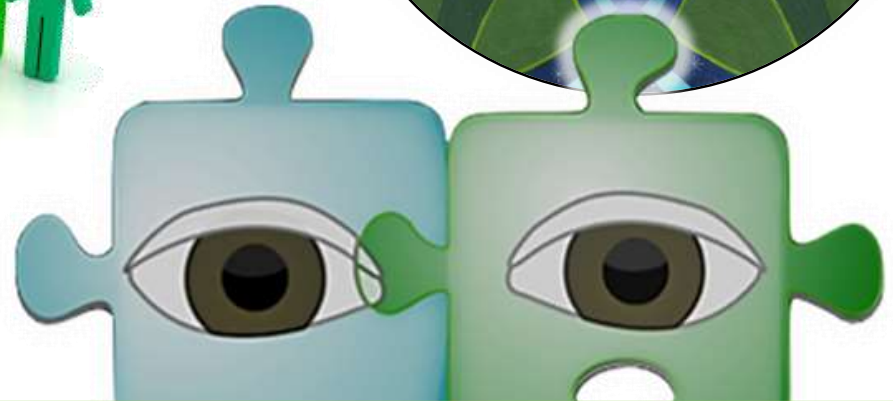


Science stories are pattern knowledge!



INTEGRATIVE SCIENCE – MSIT:

How to do, to teach, such science?



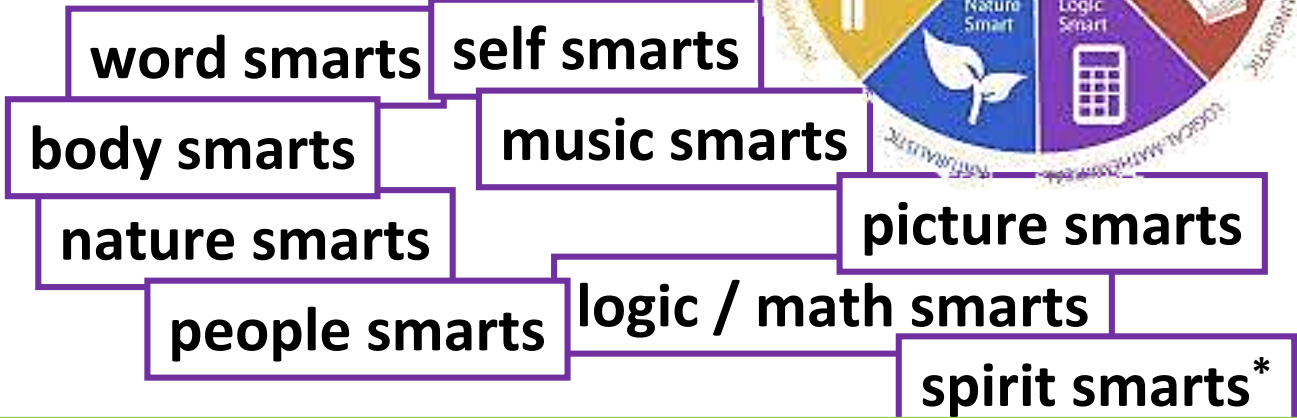
What “ways of knowing” can we use to learn patterns?

Science stories are pattern knowledge!

Howard Gardener's Multiple Intelligences Theory

the brain is a pattern recognition organ
... different "pattern smarts"
for recognizing different kinds of patterns

Western



What "ways of knowing" can we use to learn patterns?

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

Science stories are pattern knowledge!



Indigenous

Douglas J. Cardinal:

Indigenous peoples, living in intimate interconnectivity with the land, embedded *pattern awareness* in their traditional day-to-day activities and their knowledge systems as reflected in their languages.

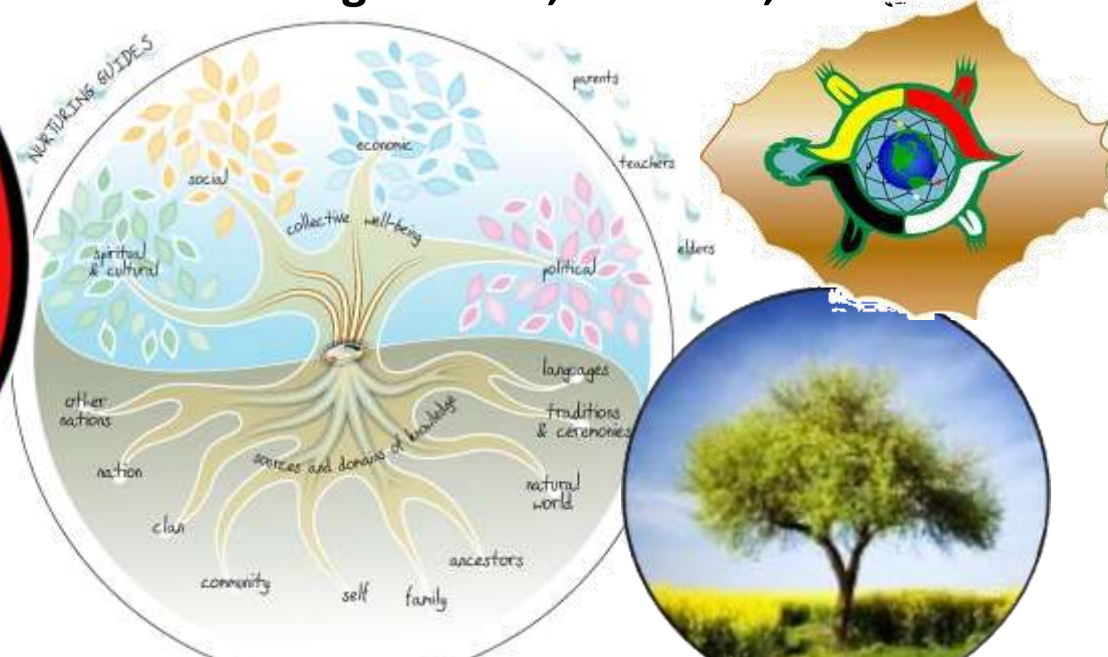
*

First Nations Holistic Lifelong Learning Model

Indigenous



... many and diverse knowledge and learning sources, domains, and guides



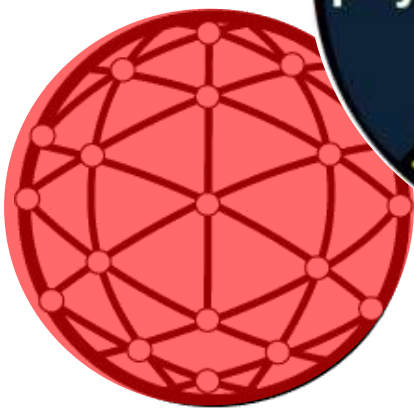
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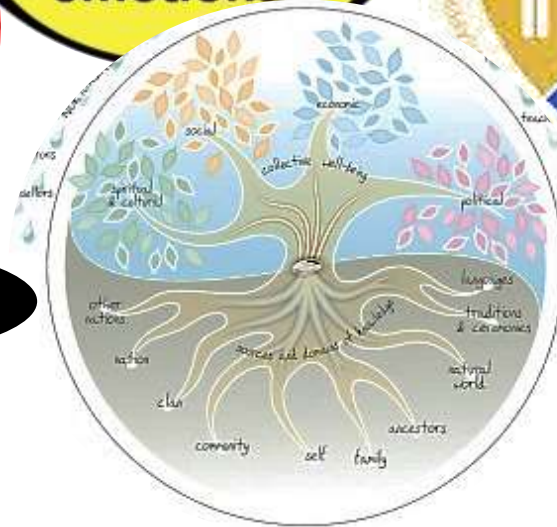
* 2007 http://www.afn.ca/uploads/files/events/fact_sheet-cco-4.pdf

Science stories are pattern knowledge!

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



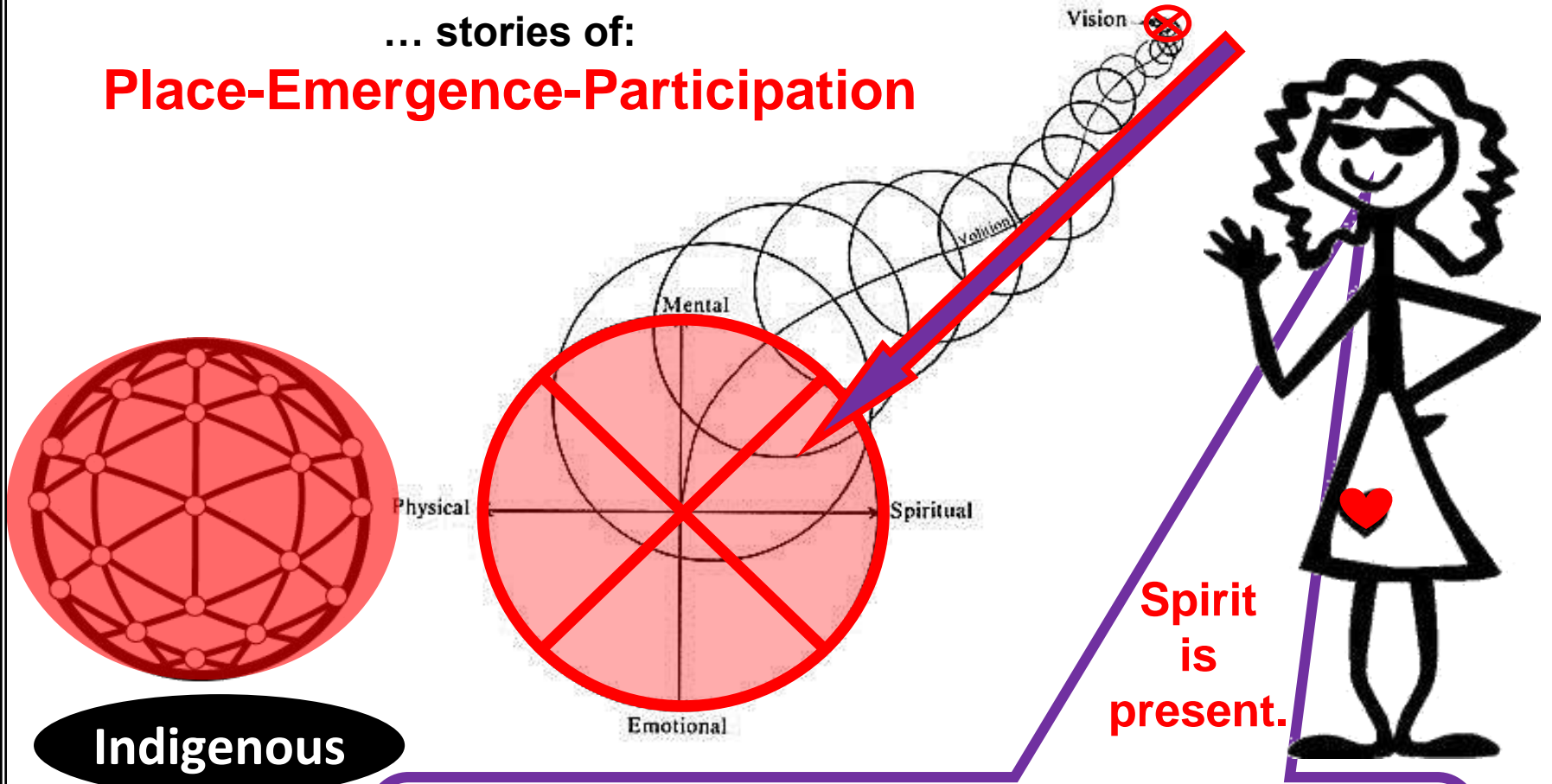
Indigenous



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

My ^ Science stories are stories of interconnectiveness

... stories of: Place-Emergence-Participation



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



TATAPN



Klo'qwejk ila'lukupjik

“the stars know their places” (pattern)
... in the story



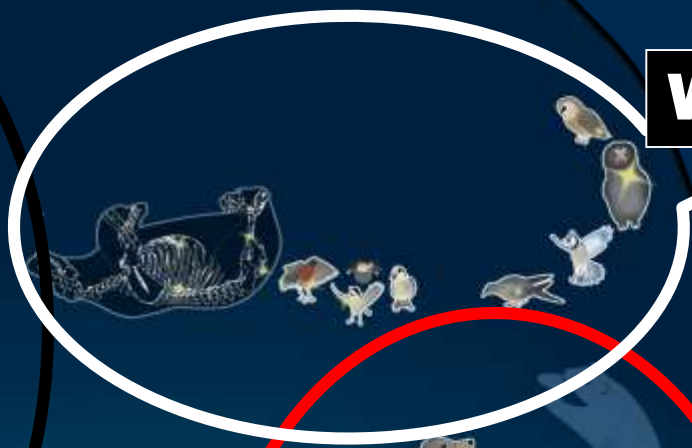


AN ORAL CALENDAR

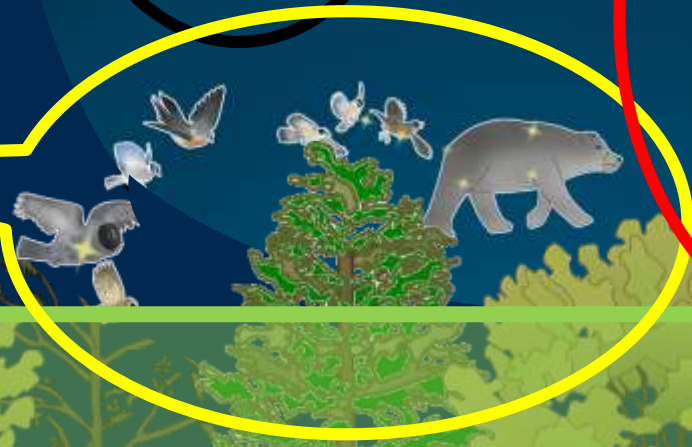
SPRING



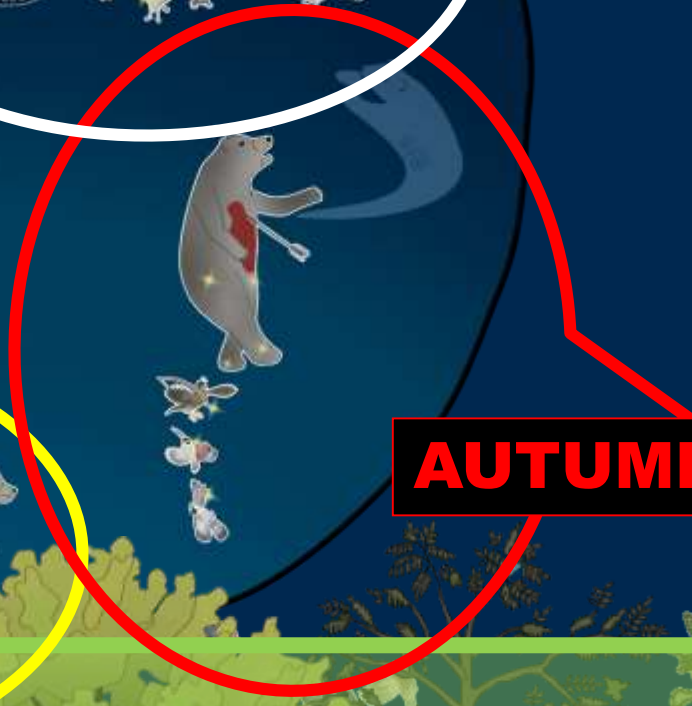
WINTER



SUMMER



AUTUMN



reference positions of stars about two hours before dawn in different seasons

SPRING

A constellation diagram for Spring, featuring a large bear-like figure (Ursa Major) with several stars, and a group of birds and other animals above it. A black line connects this diagram to the 'SPRING' label.

WINTER

A constellation diagram for Winter, featuring a large bear-like figure (Ursa Minor) with several stars, and a group of birds and other animals above it. A white line connects this diagram to the 'WINTER' label.

SUMMER

A constellation diagram for Summer, featuring a large bear-like figure (Ursa Major) with several stars, and a group of birds and other animals above it. A yellow line connects this diagram to the 'SUMMER' label.

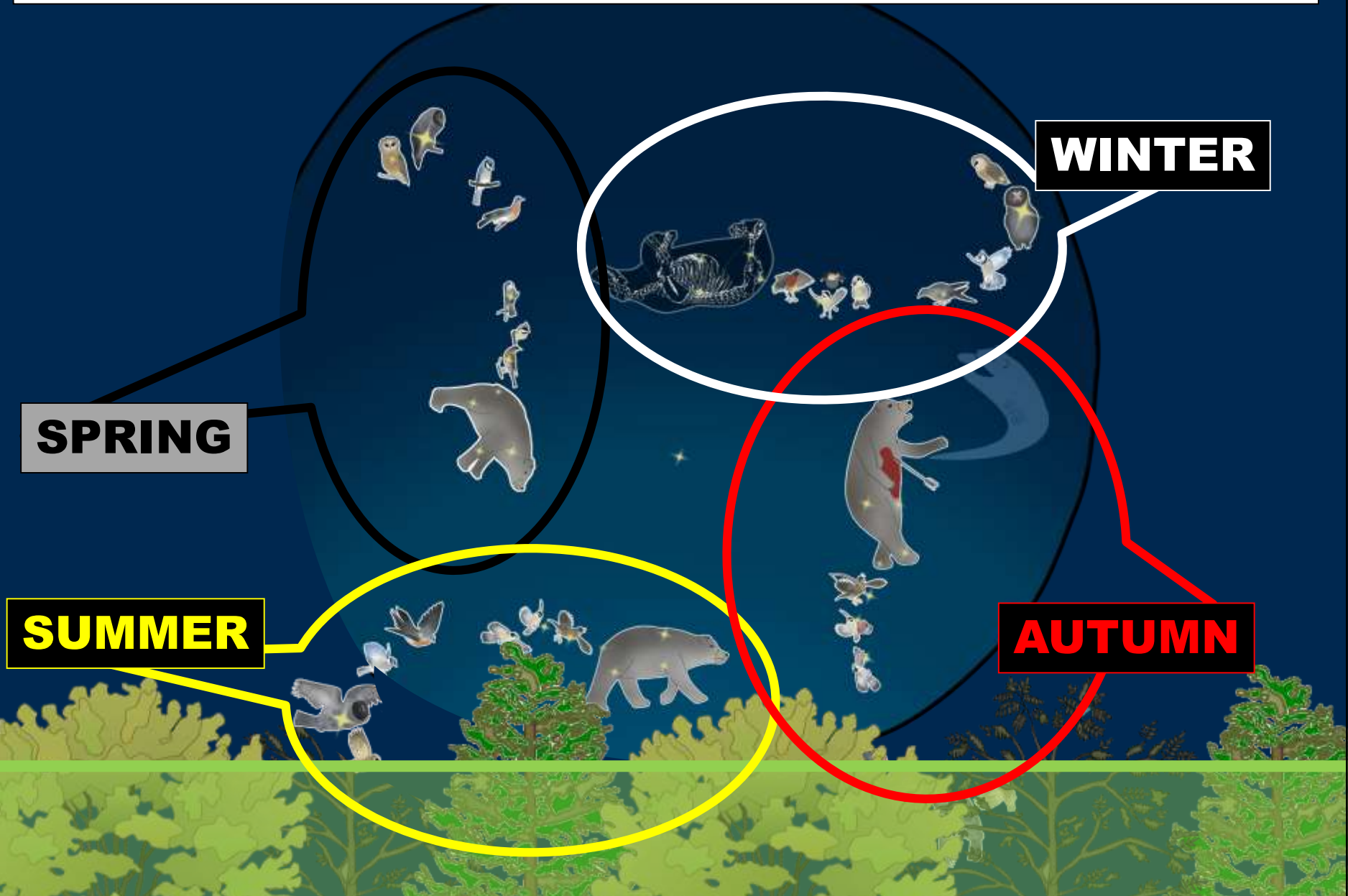
AUTUMN

A constellation diagram for Autumn, featuring a large bear-like figure (Ursa Major) with several stars, and a group of birds and other animals above it. A red line connects this diagram to the 'AUTUMN' label.



BELOW HORIZON

NOTE: in Summer four birds start to lag behind; in Autumn four birds lost. These "lost" stars are below the horizon and cannot be seen in Autumn.



The Stars in this Story



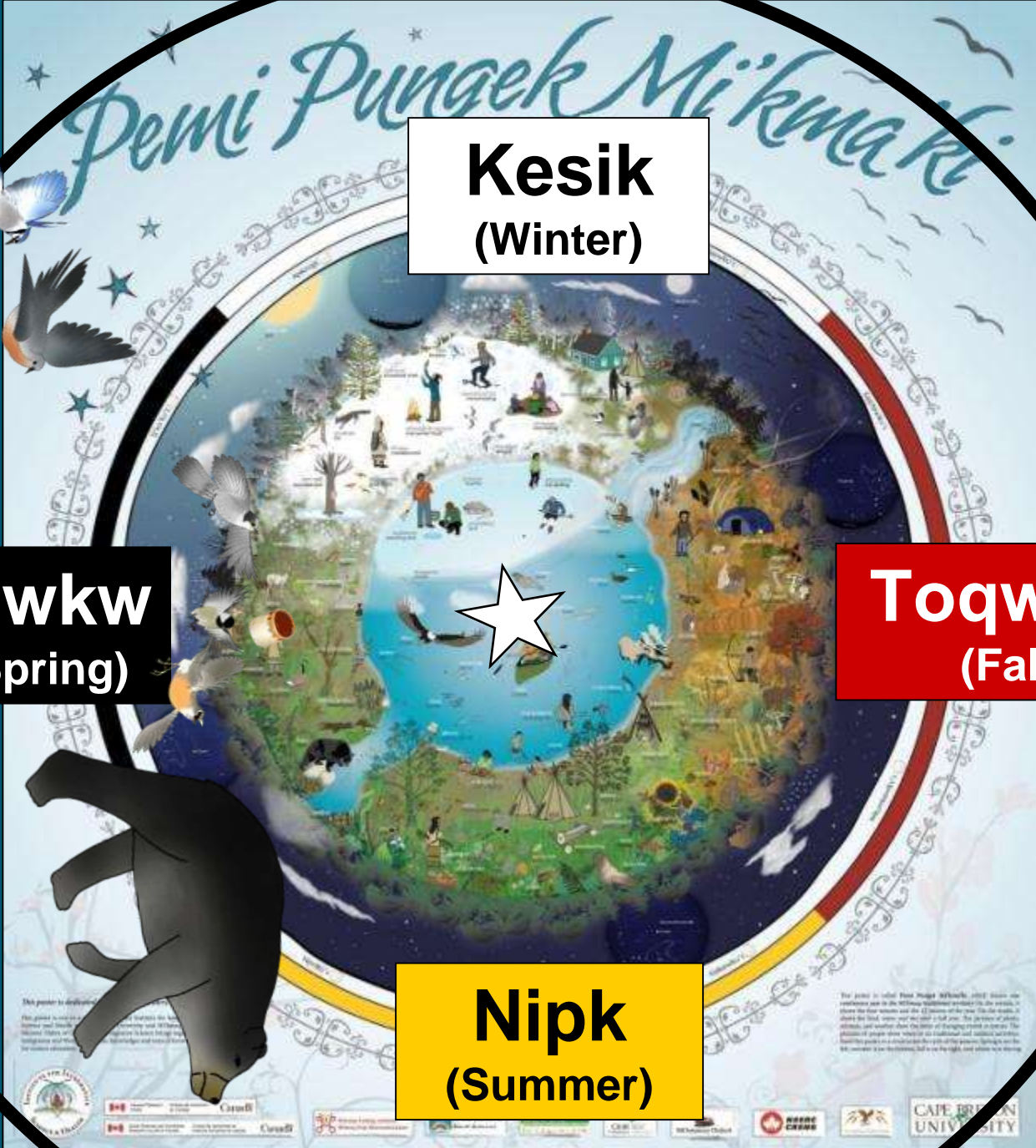
Pemi Pungek Mi'kmaq

Kesik
(Winter)

Siwkw
(Spring)

Toqwa'q
(Fall)

Nipk
(Summer)



CAPE BRETON UNIVERSITY

Pemi Pungek Mi'kmaq

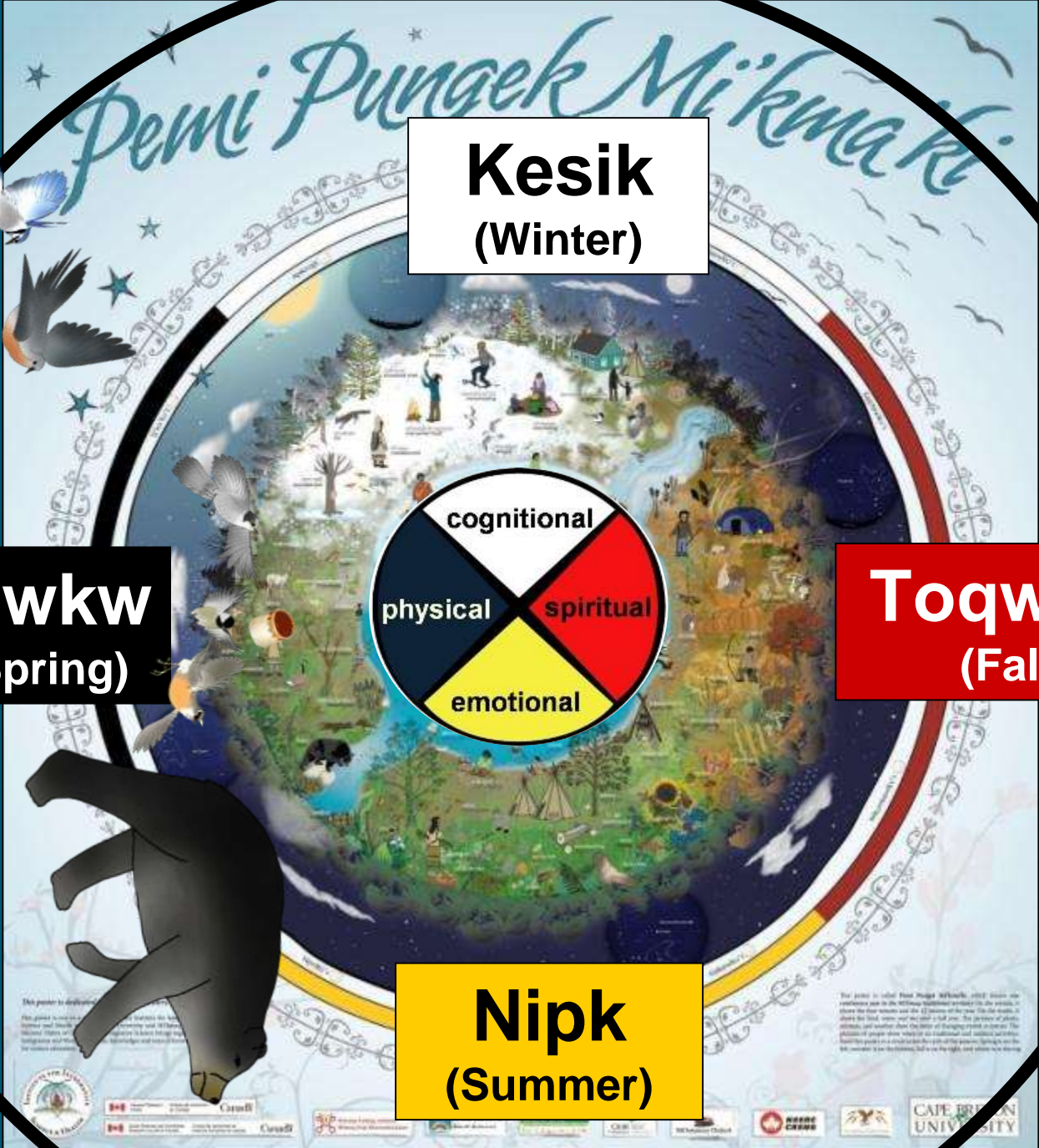
Kesik
(Winter)

Siwkw
(Spring)

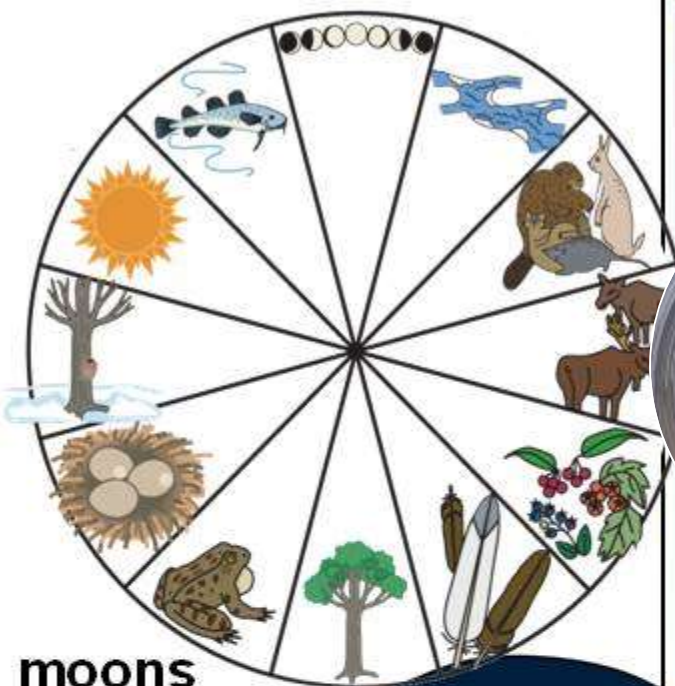
Toqwa'q
(Fall)



Nipk
(Summer)



patterns woven within patterns – Mi'kma'ki



moons



seasons



days
(nights)

generations

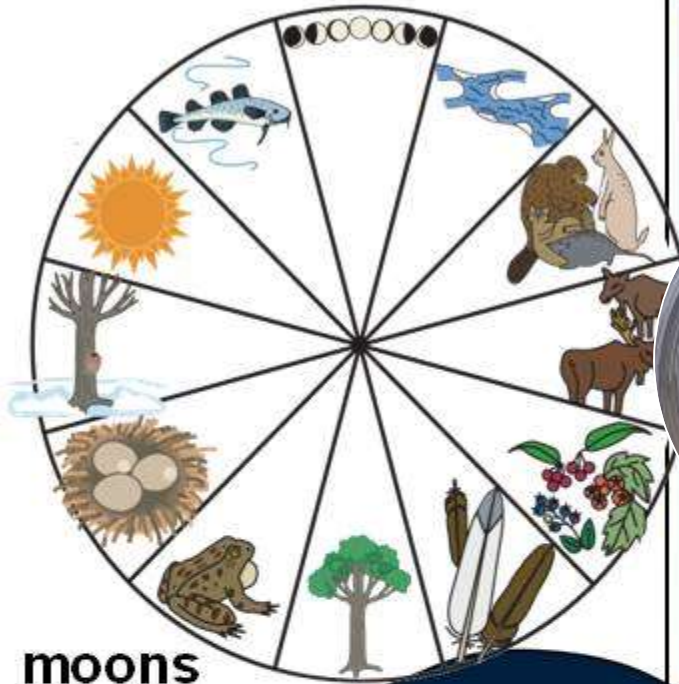
years

Msit No'kmaq
All My Relations

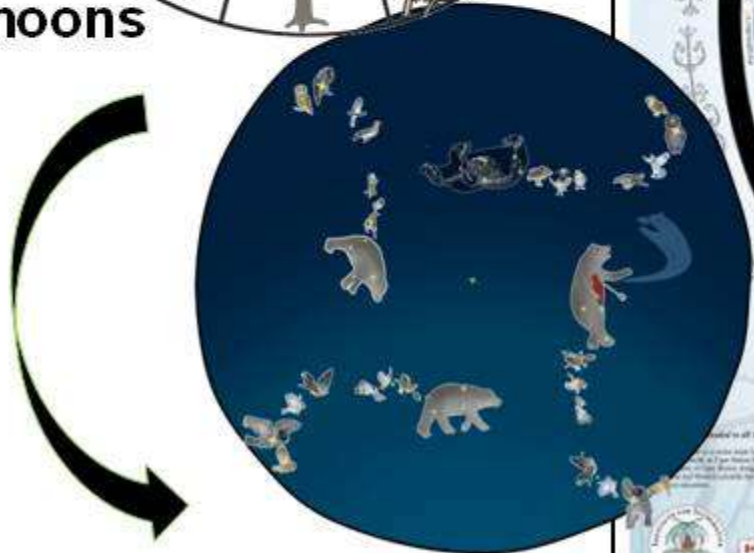
Mawisikamukawey



patterns woven within patterns – Mi'kma'ki



moons



seasons



days
(nights)

generations

years

Msit No'kmaq
All My Relations

Mawisikamukawey



**Knowledge
is spirit.
It is a gift,
passed on
through
many people.
As Elders,
we must
pass it on.**

words of
Elder Albert Marshall



Stories

FROM LESLIE MARMON SILKO:

I will tell you something about stories ...
They aren't just entertainment.
Don't be fooled.
They are all we have, you see,
all we have to fight off
illness and death.

You don't have anything
if you don't have the stories.

in: Ceremony (1997) by: Leslie Marmon Silko ...

STORYTELLER with mixed ancestry,
by her own description: Laguna Pueblo, Mexican, and white



Knowledge
is spirit.

It is a gift,
passed on
through
many people

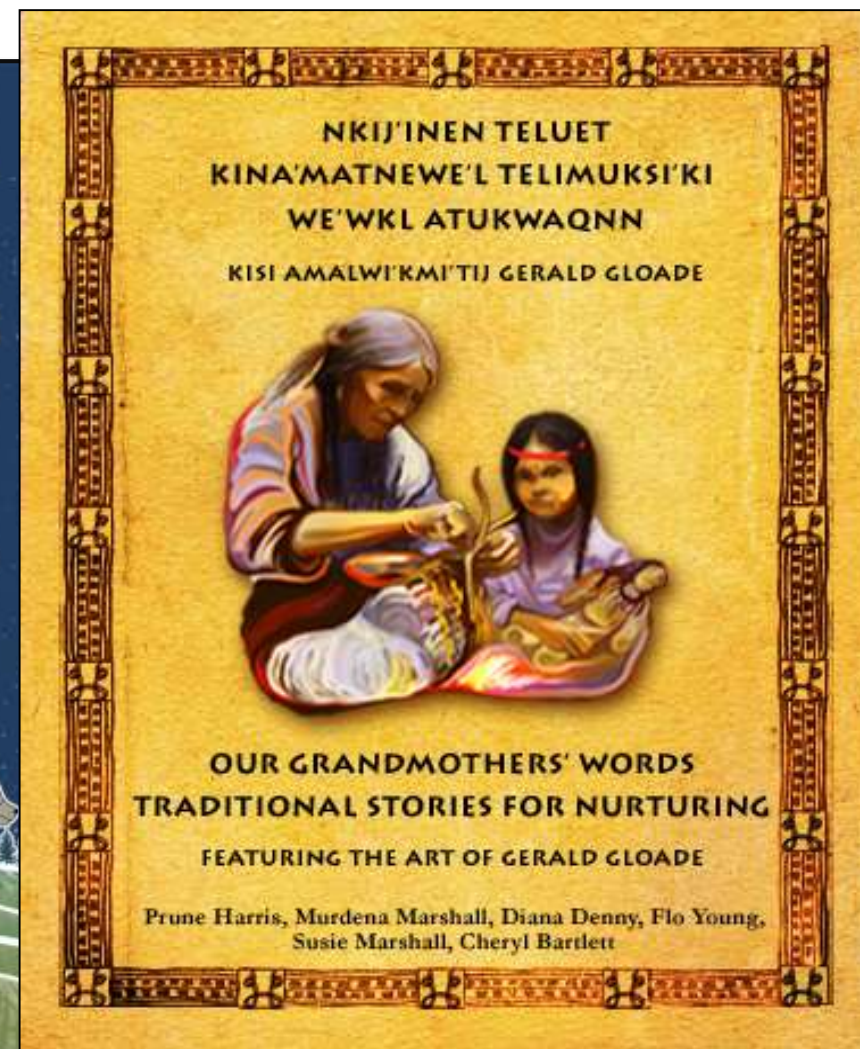
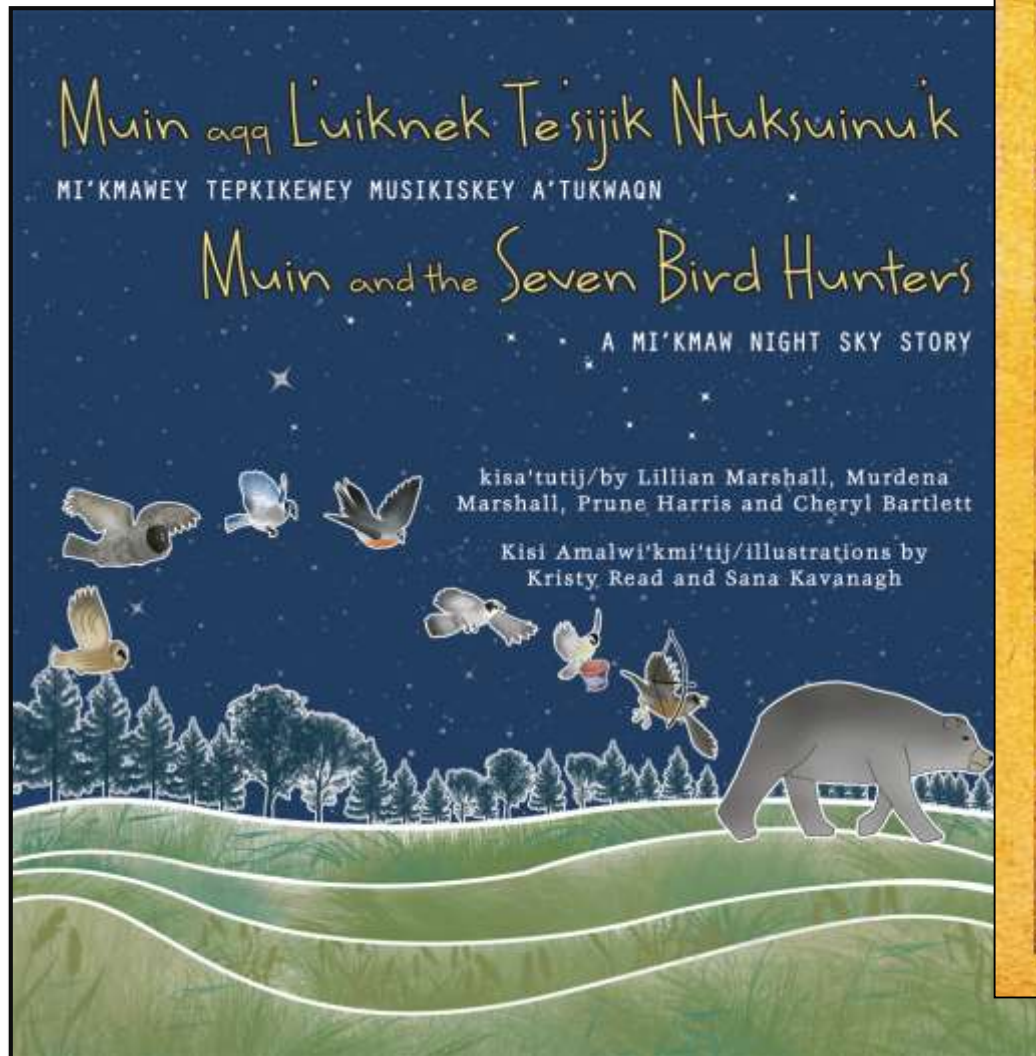
As Elders,
we must
pass it on.

words of
Elder Albert Marshall

Knowledge is alive, and thus both physical and spiritual.

KNOWLEDGE lives in STORIES

Elders' wholistic science stories – Mi'kma'ki



Science stories are pattern knowledge!

IF: I acknowledge few **pattern smarts** ...

word smarts

logic / math smarts

nature smarts

*Howard Gardner's
"multiple
intelligences
theory"*



Science stories are pattern knowledge!

IF: I acknowledge few pattern smarts ...

[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.

word smarts

logic / math smarts

nature smarts

*Howard Gardner's
"multiple
intelligences
theory"*



Science stories are pattern knowledge!

IF: I acknowledge few **pattern smarts** ...



My

Science stories are

stories of

parts & wholes

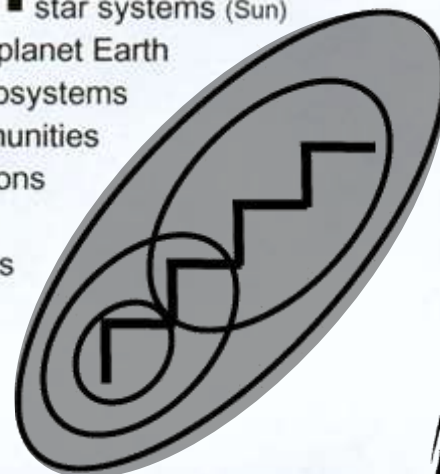
Universe: Visible Matter (levels of organization - biology)

... stories of:

MATTER & ENERGY



- [-] Universe
- [-] super clusters (Local)
- [-] clusters (Local Group)
- [-] galaxies (Milky Way)
- [-] star systems (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)



Western

**Spirit does not exist.
Even consciousness is "problematic".**

My world is many "its" (objects).

My ^

Science stories are

stories of

parts & wholes

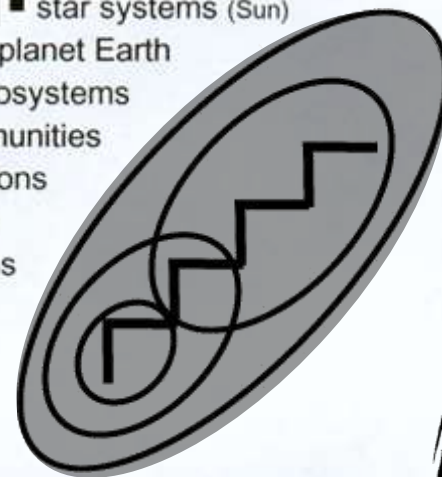
Universe: Visible Matter (levels of organization - biology)

... stories of:

MATTER & ENERGY



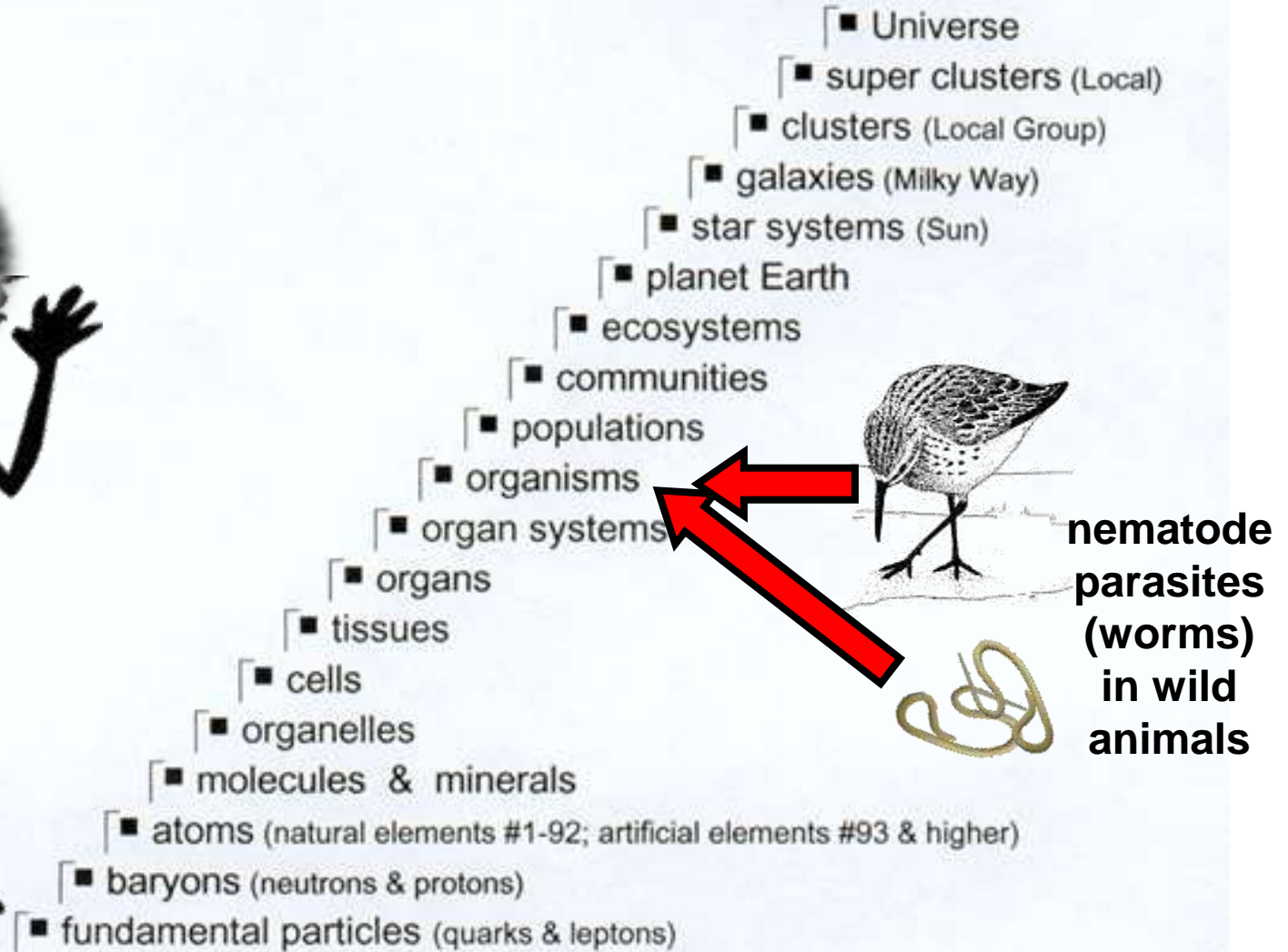
- ▣ Universe
- ▣ super clusters (Local)
- ▣ clusters (Local Group)
- ▣ galaxies (Milky Way)
- ▣ star systems (Sun)
- ▣ planet Earth
- ▣ ecosystems
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- ▣ populations
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- ▣ organelles
- ▣ molecules & minerals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



Lots of technical words for these objects and the categories into which we organize them.

my science research

Universe: Visible Matter (levels of organization - biology)



my science research

GENES / DNA

at the level of macromolecules

DISEASE

response at the level of (multi-cellular) organism

EPIDEMIOLOGY

at the level of populations

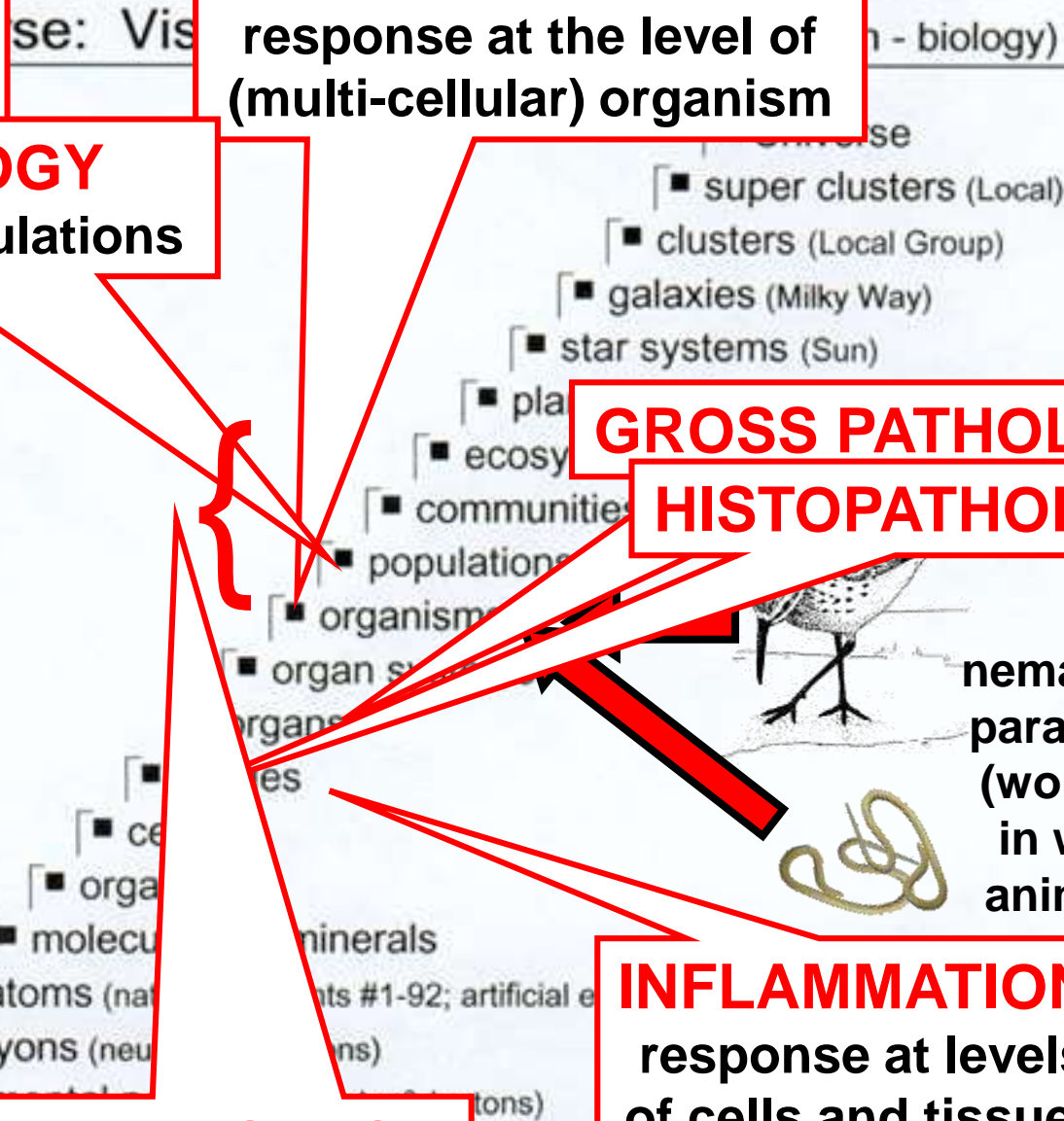
GROSS PATHOLOGY

HISTOPATHOLOGY

INFLAMMATION

response at levels of cells and tissues

ECOLOGY OF DISEASE



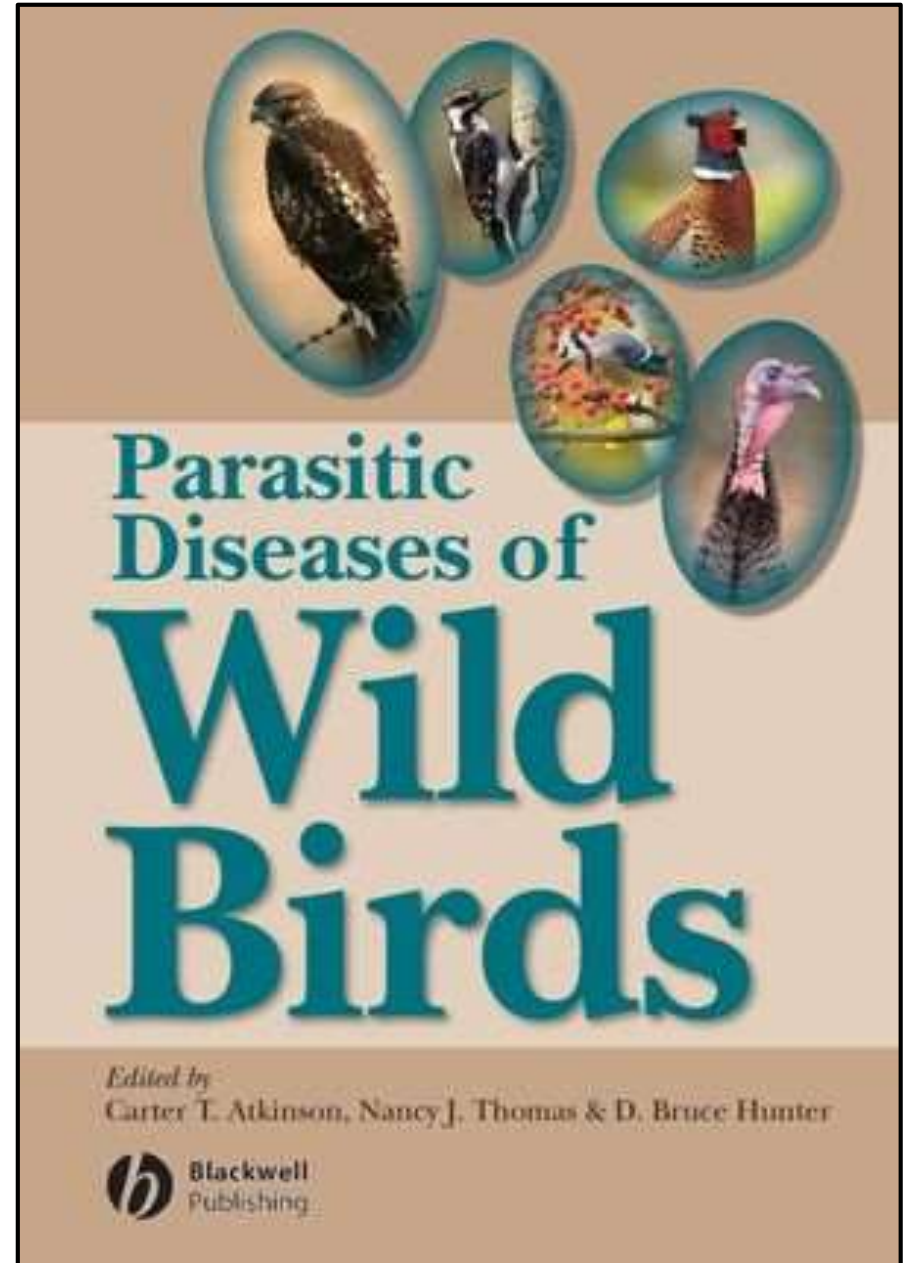
nematode
parasites
(worms)
in wild
animals

my science research

Western science stories



**patterns taken apart
to gain understanding
... re-assembled
within explanatory
professional
publications**





more information: integrativescience.ca



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[Activities](#)

Bringing together Indigenous ways of knowing and Western scientific knowledge



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.

The team at the Institute for Integrative Science & Health (IISH) defines "Integrative Science" as bringing together Indigenous and Western scientific knowledges and ways of knowing. And, we **view science in a broadened and culturally inclusive way** which is: science = dynamic, pattern-based knowledge shared through stories about our interactions with and within nature.

The Guiding Principle for our co-learning journey of different knowledges and cultures working together is **Two-Eyed Seeing**. Lots of other people across Canada and internationally have heard about Two-Eyed Seeing and are using it!

Read about **who we are**, **how we got started**, and what **themes** and other **guiding principles** we use in our work. Explore our numerous **presentations** in which

Activities

Two-Eyed Seeing



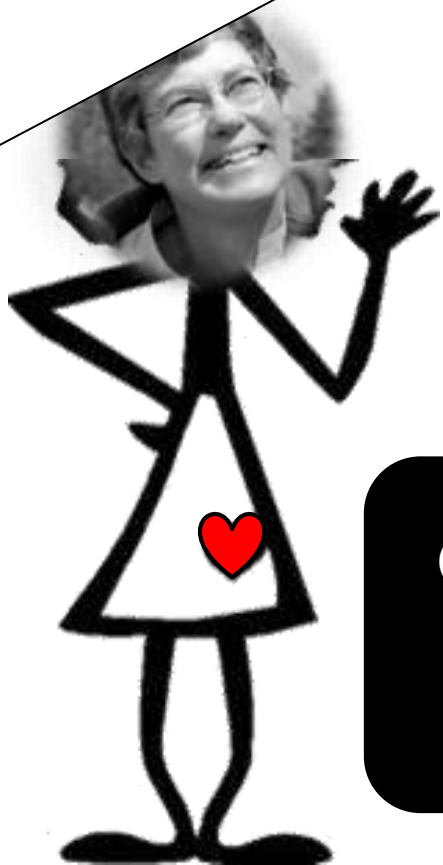
Two-Eyed Seeing is the main Guiding Principle for Integrative Science. It was brought forward by Mi'kmaw Elder *Albert Marshall*. *Read more about Two-Eyed Seeing and our other Guiding Principles.*

Our Vision



Our vision for Integrative Science is depicted in a painting by artist *Easma Kavanagh*. *Read more about our vision and Easma's painting.*

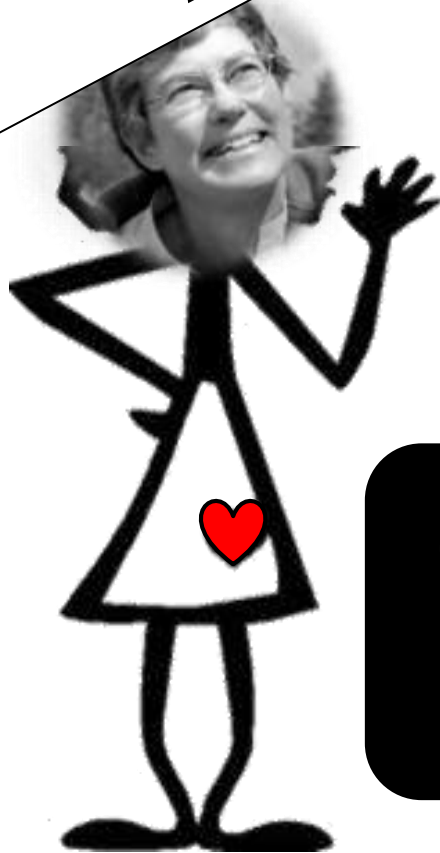
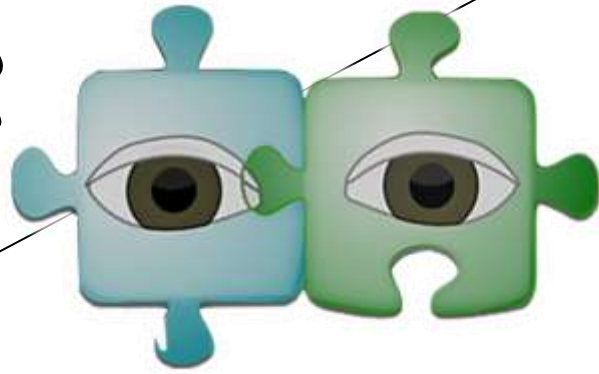
**MY
SCIENCE EDUCATION
WAS
GREAT!**



**♥ I LOVE
WESTERN
SCIENCE!**

hypotheses
(making & testing)
data collection
data analysis
model & theory
construction

**INDIGENOUS
ELDERS HAVE HELPED
ME "TWO-EYED SEE"
A LOT MORE!**



**♥ I LOVE
WESTERN
SCIENCE!**

hypotheses
(making & testing)
data collection
data analysis
model & theory
construction

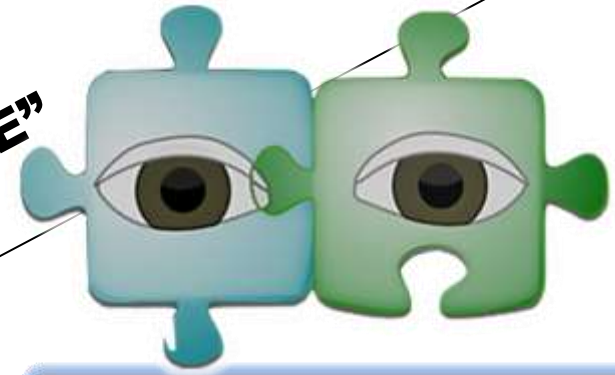
**INDIGENOUS
SCIENCE**

love ♥
language
land
All My Relations

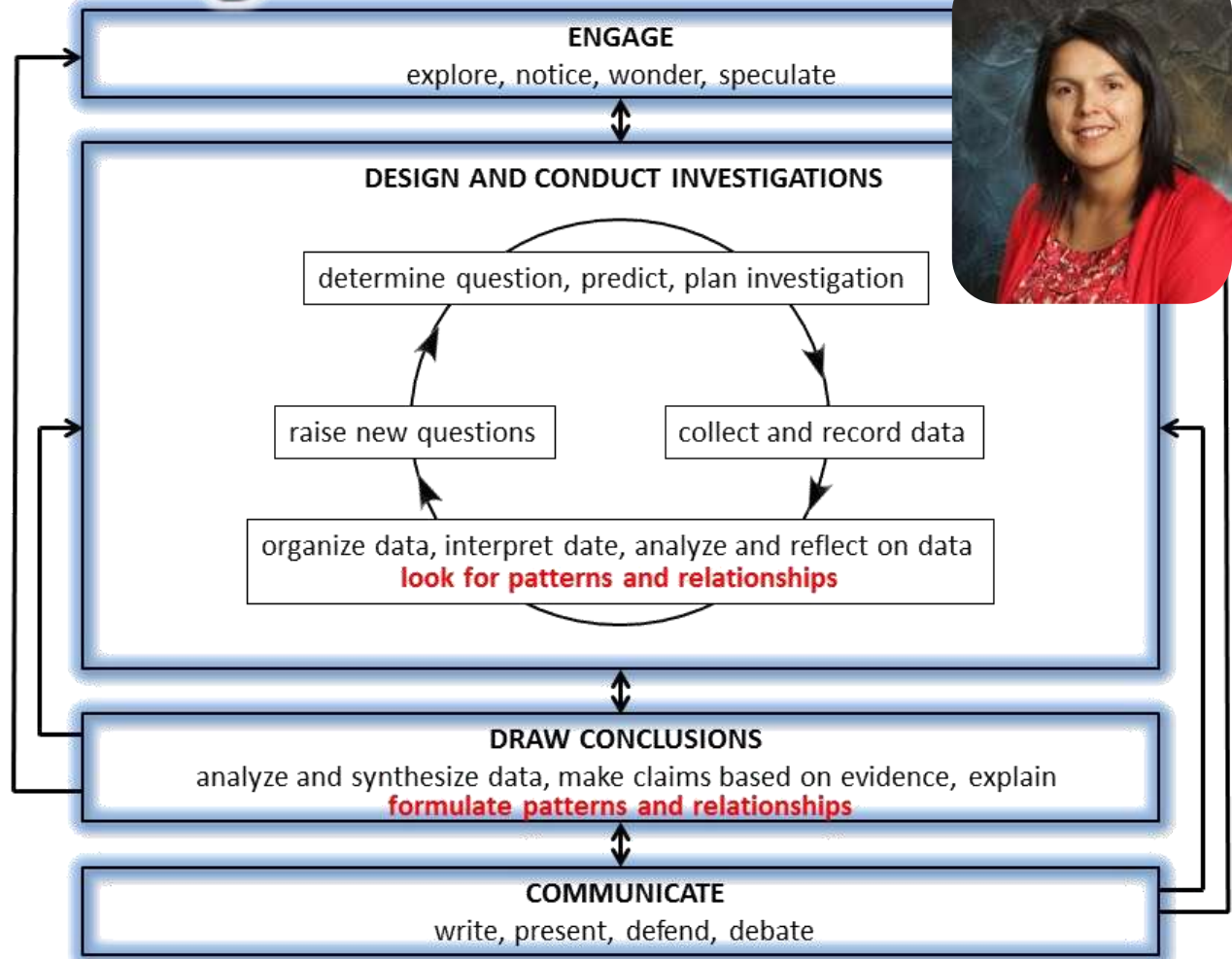
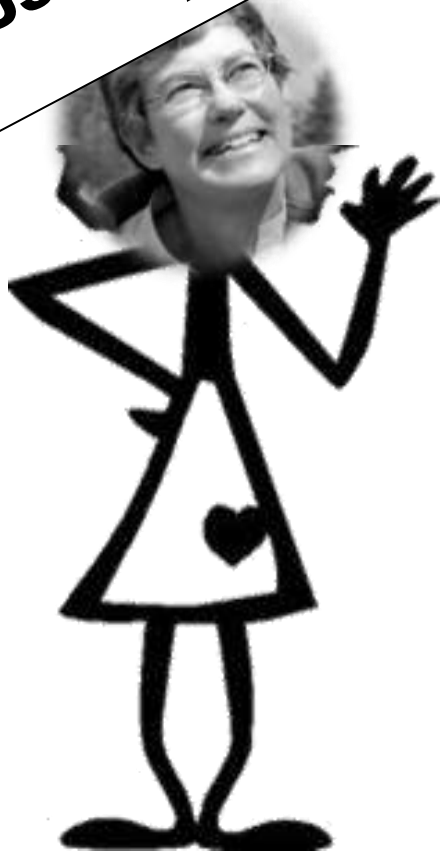
respect
relationship
reverence
reciprocity
ritual (ceremony)
repetition
responsibility



**INDIGENOUS
ELDERS CAN HELP
US ALL “TWO-EYED SEE”
A LOT MORE!**

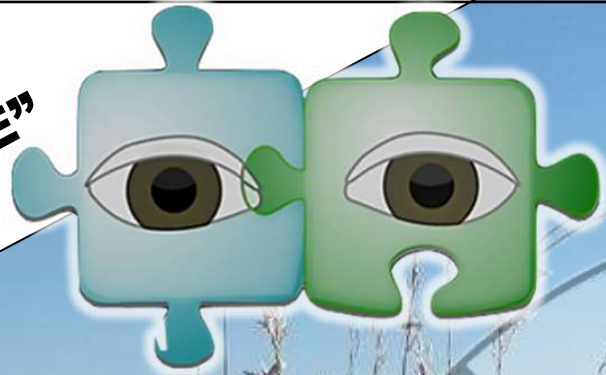


Two-Eyed Seeing
new research envisioned by
Carola Knockwood
Mi'kmaw Kina'matneway
(NS Mi'kmaw education authority)



model by Karen Worth, Wheelock College (with red added)

**INDIGENOUS
ELDERS CAN HELP
US ALL "TWO-EYED SEE"
A LOT MORE!**



We, Together

Learning & Practising → Cultural Humility

from our work: **CO-LEARNING**
from health care arena: **CULTURAL HUMILITY**

Elder Albert Marshall:

SOMETIMES IT'S LIKE A HEAVY SLEDGE

This work of Co-Learning guided by Two-Eyed Seeing is not easy and so we need to understand that sometimes our most important job is to plant seeds for the future, for the youth, knowing seeds germinate when the time is right. This job of today requires that we do it as **We, Together**



Wela'lin / Thank you

Cheryl_Bartlett@cbu.ca
www.integrativescience.ca