

# Teaching Mathematics in Relationship with Indigenous Ways of Knowing

Our Special Guest is:

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Presented by

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Webinar begins at:

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7pm EST

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Consultant & Coach  
Listen & Learn  
[www.angelanardozi.com](http://www.angelanardozi.com)

# Welcome to the Kikinoo'amaagoowin Webinar Series

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# Teaching Mathematics In Relationship with Indigenous — Ways of Knowing —

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# The Impact of Worldviews

Indigenous Worldview (generalizations)	Western Worldview (generalizations)
<p>One main encompassing characteristic: The establishment and maintenance of relationships with all of creation (including people, the earth, the spirit world and the cosmos) is the key to the creating, gaining, and sharing of knowledge worth knowing emerges.</p>	<p>Knowledge is linear, singular, and static in nature, resulting in the valuing of one correct answer to any problem or question</p>
<p>Alternate answers or strategies valued for their wisdom</p>	<p>Valuing of establishing hierarchies within knowledge</p>
<p>Sharing of knowledge is important as is giving back and building relationships through sharing of knowledge</p>	<p>Absolute belief in scientific method</p>
<p>Knowledge is connected to the place from which it came</p>	<p>Valuing of compartmentalisation and categorisation of knowledge into small components</p>
<p>Valuing the diversity of ways different people will know/understand and use knowledge</p>	<p>Valuing of written and abstract (symbolic) forms</p>

[The marginalisation of Indigenous students within school mathematics and the math wars: seeking resolutions within ethical spaces](#)

# PRINCIPLES OF LEARNING

Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.



Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

Learning involves recognizing the consequences of one's actions.

Learning involves generational roles and responsibilities.

Learning recognizes the role of indigenous knowledge.

Learning is embedded in memory, history, and story.

Learning involves patience and time.

Learning requires exploration of one's identity.

Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.



# My Responsibility

I believe it is my responsibility as a Canadian and an educator to:

- Learn the true history of our country and how the intergenerational trauma is still prevalent today
- Understand different worldviews and colonialism and how they impact how I teach, what I teach and what I value (assess)
- Work towards using pedagogy that makes math accessible for all learners and that re-humanizes what was erased/stolen/lost
- This FREE course is great (next session starts April 1):  
<http://pdce.educ.ubc.ca/reconciliation/>
- Learn about and engage in community activities with local First Nations, Metis and Inuit organizations
- Start with small steps towards these goals - we need to act.
- I HIGHLY recommend taking this post-graduate certificate program:  
<https://ethnomath.coe.hawaii.edu/>

# Integrating Indigenous Ways of Knowing

- Build strong relationships with your students - get to know them
- Collaborative Learning = building relationships
- Hands on/experiential learning with contexts
- Explore different strategies and different ways of looking at problems
- Utilize reflective and reflexive thinking
- Utilize holistic learning
- Use story
- Learn on and from the land
- Honouring and valuing contributions from many cultures

# Collaborative Learning

Collaborative Learning - This allows for relational learning (learning from each other).

- Thinking Classrooms - using random groupings and vertical non-permanent surfaces

<https://www.youtube.com/watch?v=HHTwr1jsB80>

<http://peterlijedahl.com/wp-content/uploads/Building-Thinking-Classrooms-Feb-14-20151.pdf>

<https://www.youtube.com/watch?v=hc0hp0d15-4>



# Collaborative Learning

- Complex Instruction (misnomer) - use specific roles within groups and was designed to create equity in classrooms

<http://cgi.stanford.edu/group/pci/cgi-bin/site.cgi>

<https://complexinstruction.stanford.edu/>



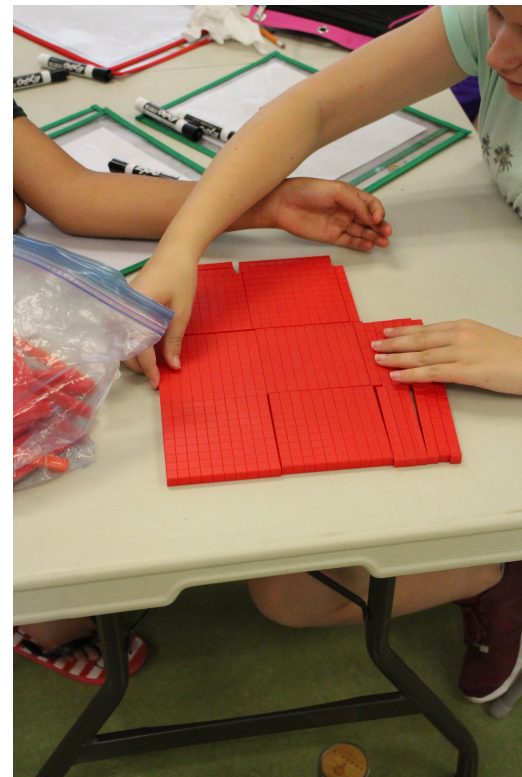
# Hands-On and Experiential Learning

- Use manipulatives and models to delve into WHY the math works
- Example: Using Cuisenaire Rods to explore:
  - Patterns found in the pairs of numbers that add to make 10 (friends of 10)
  - Subtraction as difference
  - Multiplication and how it relates to division
  - Proportional reasoning
  - Fractions as a linear measurement, mixed numbers and improper fractions, why we need a common denominator to add/subtract fractions, multiplying and dividing fractions



# Explore Different Strategies

- All of our brains are different and to understand different strategies is to understand more deeply
- Example: area models for multiplication
  - Visual tool
  - Connected to area/building
  - Can be used with all types of numbers (decimal, fraction, algebraic)
  - Can be connected to all other symbolic strategies for multiplication
  - Related to division
- There are many strategies for performing operations with all types of numbers that often make a lot more sense to students than traditional algorithms



# Holistic Learning

**Holistic Learning:** An approach that seeks to fully activate all aspects of the learner's personality (intellect, emotions, imagination, body) for more effective and comprehensive learning.

(<http://www.ibe.unesco.org/en/glossary-curriculum-terminology/h/holistic-learning-approach>)

Example: Exercise and its effects on our health (could incorporate Science, History, Language Arts, PE)

Math related content:

Adding and Time: keep track of the minutes (or hours) we spend playing sports, playing outside, anything active and then determine the amount of time in a week, month, etc.

Rates - measuring heart rate before, during and after exercising

# Story

Use story books or stories related to land, culture, history to introduce or explore math concepts.

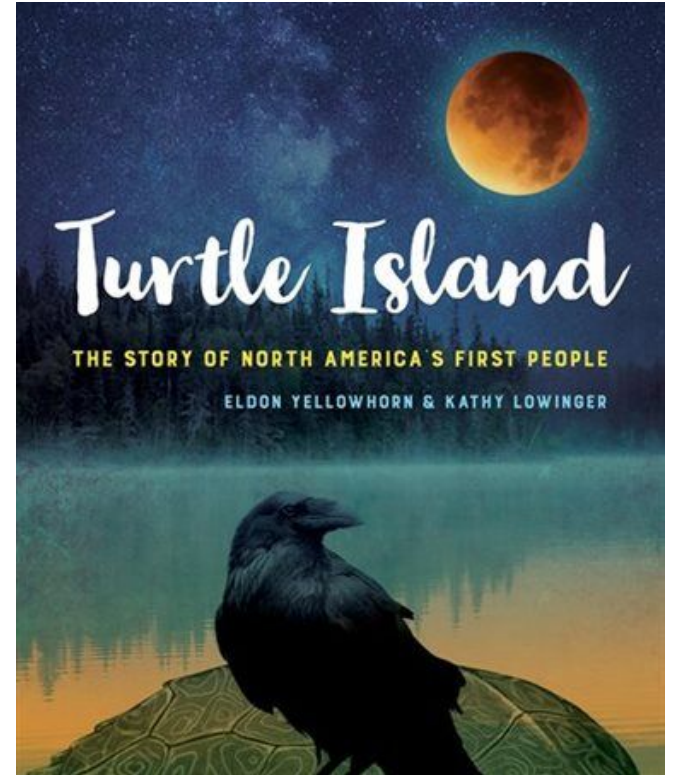
Invite an Elder or knowledge keeper to join you to tell a story (and you can listen for the math that can be found within)

<http://mathcatcher.irmacs.sfu.ca/>

[https://www.strongnations.com/store/item\\_display.php?i=6602](https://www.strongnations.com/store/item_display.php?i=6602)

<https://www.strongnations.com/search/?s=math>

<https://www.the-best-childrens-books.org/math-for-kids.html>





# Using Stories in Math Class

- Story can be modeled, acted out and solved by students:
  - Fractions in Disguise
  - Equal Schmequal
  - Spaghetti and Meatballs for All
  - Greedy Triangle
- Story can be the jumping off point:
  - 'The Cedar Tree - The Heart of Our People'
  - 'Turtle Island' (ex: page 63)
- Story can be history of the math; the people who used/invented the math:
  - The Egyptian history of fractions - they were used to compare whole numbers (proportion)
  - Drum making using 3 diameters and a hand



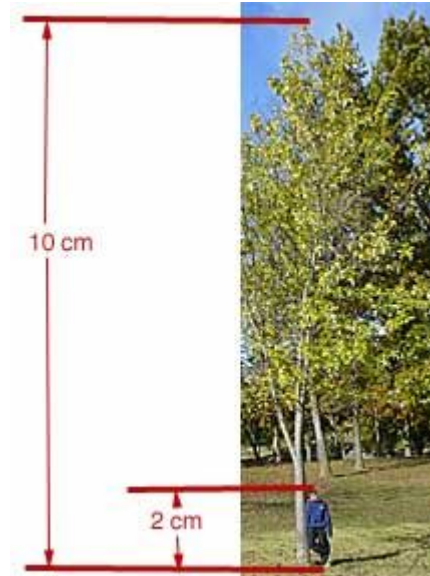
# Exploring Trees

Read the 'The Cedar Tree - The Heart of Our People' by Celestine Aleck and watch:

[https://www.ted.com/talks/suzanne\\_simard\\_how\\_trees\\_talk\\_to\\_each\\_other?language=en](https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other?language=en)

Then move into activities involving trees:

- Using ratios to estimate heights
- Estimating the age of a tree
- Estimating volume of a tree



<http://warrensburg.k12.mo.us/conundrums/treeht/help.html>

# Learning On and From the Land

- Estimating and measuring length, perimeter and area
- Estimating tree heights, ages, volumes
- Using data to measure the health of waterways, oceans, lakes (use data on salinity, temperature, toxins, fish counts, etc.)  
<https://www.sciencefriday.com/educational-resources/illustrated-graphs-using-art-enliven-scientific-data/>
- ratio/proportion to explore: the amount of green space versus developed space, trees per area, native plants versus non-native species





# Place Based Learning

- Patterns found within nature (pine cones, flowers, etc.) - fibonacci, fractals
- Using Desmos to find and compare linear equations around the school and outdoors and/or plot the school grounds on a cartesian plane - find locations using coordinate points
- Estimating large numbers - what does a million blades of grass look like? - connect to exploring very small numbers (the field is 1, each blade of grass is \_\_\_?)
- Drawing what we see (drawing uses all sorts of geometry and proportion)
- Use geometric shapes and symmetry to create drawings of nature, buildings, hands, etc.
- Ask local businesses what problems they that we could work on as a math class (profits, loss, percent)
- Data analysis of anything that is of interest to them or connected to another project/topic/concept you are exploring (math is one way of making sense of the world)
- Beach clean up - ratios of marine debris and microplastics and length of time to clean them up

# Sun Shadows

Using a pencil, or any stick measure sun shadows each hour (tip: you need to be in the same location and orientation so use chalk to mark where your paper lies):

- Explore when the shadows are shortest and longest (and how that relates to solar noon)
- Measure angles at each hour and look for patterns and connections



# Cultural Connections

- Co-creating resources within your community would be ideal
- Start with the cultural context and its importance and then explore how the math may **be useful** in understanding, building, drawing, etc:
  - Art - symmetry, transformations, using body ratios, estimating, scale
  - Housing - Longhouses, pit houses, tipis (depending on your location) - area, perimeter, scale, volume, capacity
  - Drumming - the math in music, beats, making drums
  - Artifact sharing - can be math and culture or just culture related
  - Planning for a cultural celebration
  - When learning on and from the land incorporate traditional ecological knowledges, landmarks, significances of the land

# Resources

Math in a cultural context (Yup'ik):

<https://www.brushededucation.ca/catalog/math-in-a-cultural-context>

Show Me Your Math (Mi'kmaw):

<http://showmeyourmath.ca/>

Collection of resources:

[https://www.oise.utoronto.ca/deepeningknowledge/Teacher\\_Resources/Curriculum\\_Resources\\_%28by\\_subjects%29/Math/index.html](https://www.oise.utoronto.ca/deepeningknowledge/Teacher_Resources/Curriculum_Resources_%28by_subjects%29/Math/index.html)

Video Series and resources from Ontario:

<http://mkn-rcm.ca/indigenousknowledge/>

Grade 8/9 resource from FNEsc (BC):

<http://www.fnesc.ca/math-first-peoples/>

Math Catcher Series of stories/videos:

<http://mathcatcher.irmacs.sfu.ca/>

Ethnomathematics Lessons:

<https://ethnomath.coe.hawaii.edu/resources.php>

Culture-Related math:

<https://csdt.rpi.edu/culture/legacy/index2.htm>

# Final Notes

- Collaborating with community members, students and their families, Elders and knowledge keepers is the best way to create authentic resources that will be relevant to your learning community
- Connect with your Indigenous Education department for resources local to you
- Start small if you're feeling overwhelmed...try one new strategy:)

Please feel free to email me:  
Nikki @educatingnow.com