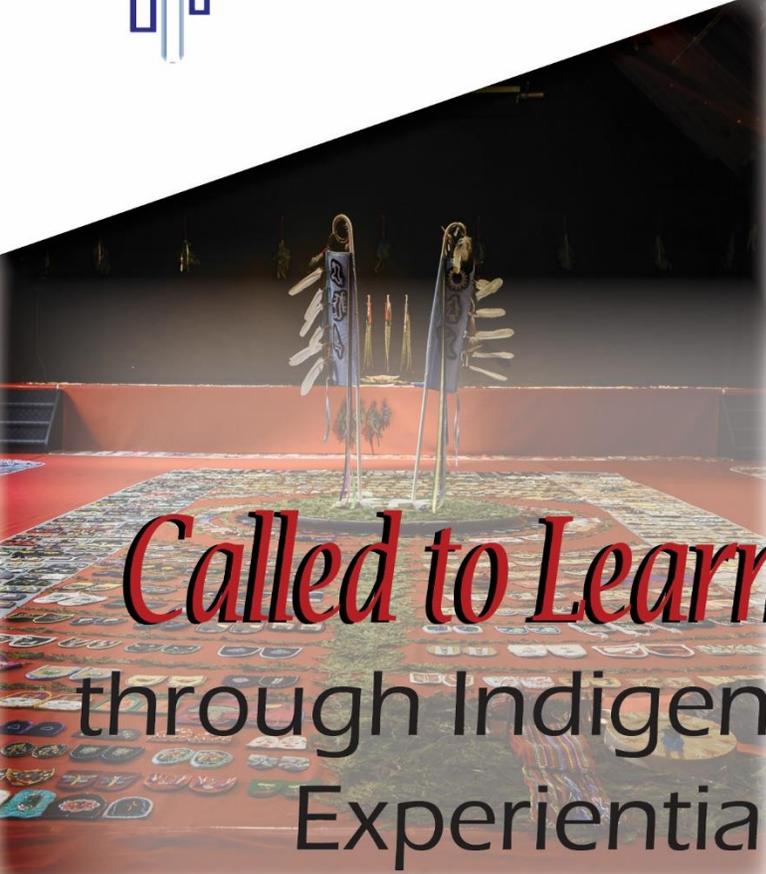
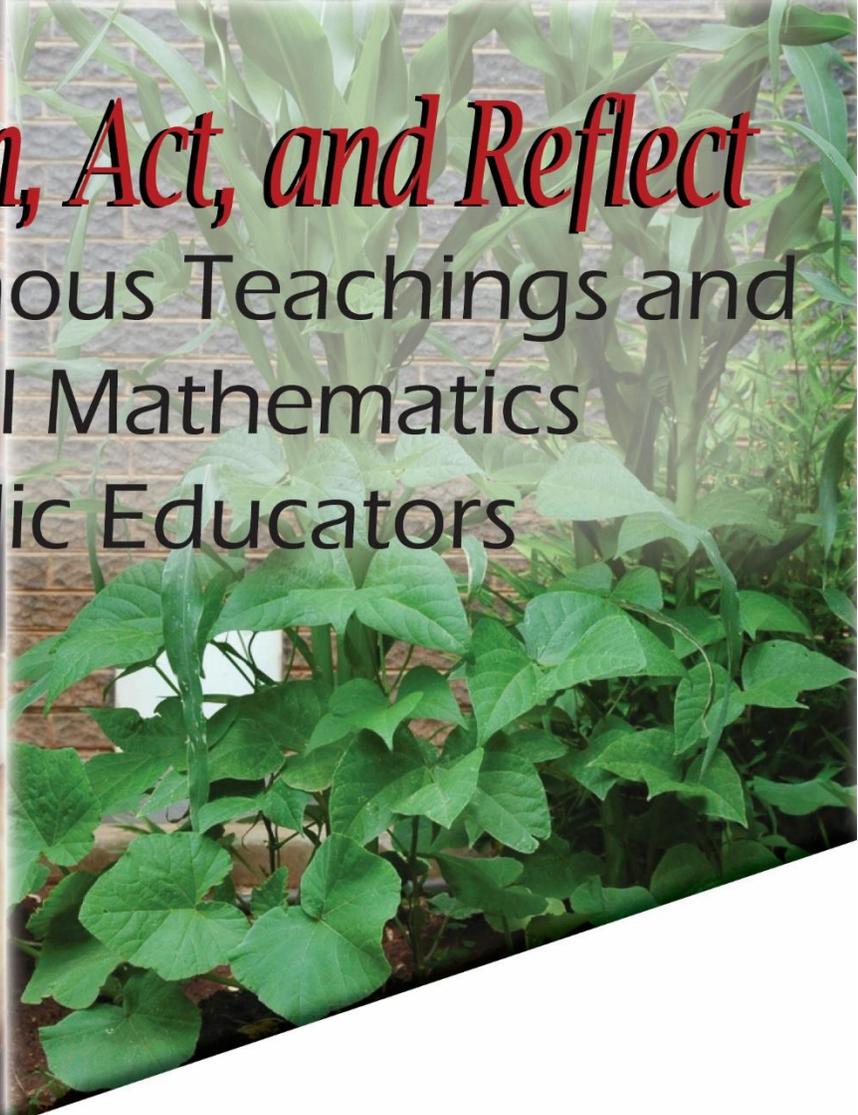
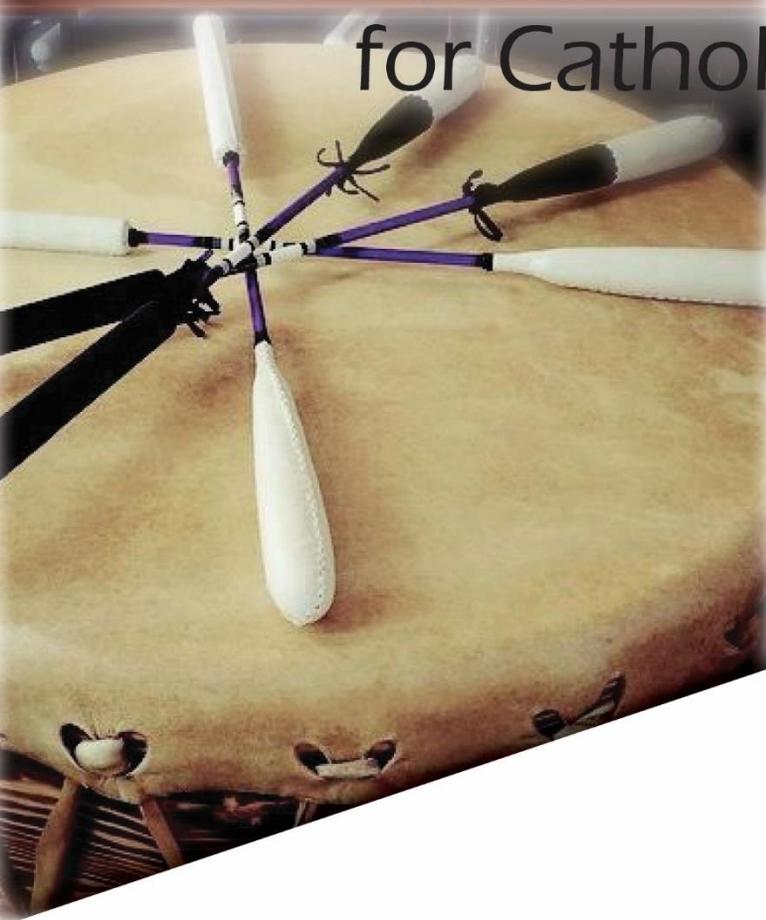


Eastern Ontario  
**CATHOLIC**  
CURRICULUM CORPORATION



*Called to Learn, Act, and Reflect*  
through Indigenous Teachings and  
Experiential Mathematics  
for Catholic Educators



Working Together for Catholic Education

[www.eoccc.org](http://www.eoccc.org)

September 2016

## Cover Art

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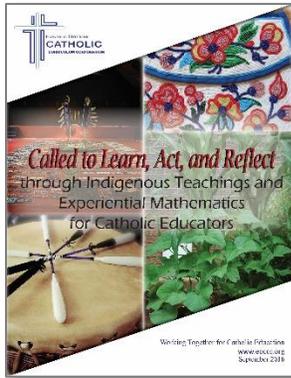
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## EOCCC Releases Resource for Catholic Educators to Learn, Act and Reflect on Mathematics through an Indigenous Lens

September 2016—Across Canada, Calls to Action are getting louder. From the Truth and Reconciliation Commission, to the National Inquiry into Missing and Murdered Indigenous Women and Girls, to the heartfelt appeal to a national audience from Gord Downie to not only care about Indigenous people but to make a difference, Canadians are called to act.

The EOCCC's new Math project then, is a very timely one which integrates Indigenous stories, music, beading and current issues with experiential mathematical learning and connections to Catholic values. It provides educators with an opportunity to hear our call to action and to therefore make a difference in the minds and hearts of our students, in our Indigenous peoples, which will ultimately impact the future of our country.

The project, *Called to Learn, Act, and Reflect, through Indigenous Teachings and Experiential Mathematics for Catholic Educators*, targets mathematics teachers in Junior and Intermediate grades. Through the guidance of David Finkle and Laura Leonard, the project highlights traditional Indigenous knowledge, stories, art, music, and current issues while making connections to mathematical concepts and processes in real ways. Each learning experience is also reflective of how these ideas are connected to Catholic values, virtues, and teachings.

“The project is important because educators would often like to integrate Indigenous teachings into the curriculum, but are sometimes unsure of how to begin or they may be wary of inadvertently causing harm. These learning experiences provide the appropriate background and links necessary to assure educators that the information they are sharing with students is accurate and authentic”, says project lead, Marian Lawson MacDonald.

This resource responds to the following inquiry questions:

- How might understanding of Indigenous worldview be deepened by harvesting mathematical concepts embedded within Indigenous traditions?
- How might the lens of Catholicity be used to discern a deeper understanding of each?

The learning experiences within this resource allow students to use critical thinking and the inquiry process to discover mathematics in relatable, interesting, and experiential ways. These investigations could also lead the student on an inquiry into storytelling, art, music, and perhaps even inspire a call to action within their own school community or across this country to support Indigenous people.

Each experience explains the rationale, sets the Indigenous context, and connects to the big ideas of mathematics, Catholic Graduate expectations, and possible cross-curricular possibilities.

Our goal is to investigate how Indigenous pedagogy might support a renewed vision for teaching and learning mathematics. We know though, that these experiences will go beyond the mathematics curriculum to reveal great truths and even greater opportunities for our youth to discover themselves. As an Indigenous leader said, “In our culture, we believe that every child is born with gifts. What will our schools do to uncover and develop the gifts of our children?” This document will help educators to continue the learning journey within all of our classrooms through intentional and respectful steps.

Hear the call: learn, act and reflect.

***Called to Learn, Act, and Reflect, through Indigenous Teachings and Experiential Mathematics for Catholic Educators*** is now available to EOCCC’s member Boards and will be available electronically to all, in early fall, with the launch of EOCCC’s new website.

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*As Catholic educators, we have our mission. Education is a life-long experience leading us forth from where we are, to where God would have us be, in the example of Jesus. We ask God to help us to deepen our knowledge and understanding, our awareness and sensitivity, and our discipleship and our serving others in God’s name.*

## Called to Learn, Act, and Reflect, through Indigenous Teachings and Experiential Mathematics for Catholic Educators

### Acknowledgements

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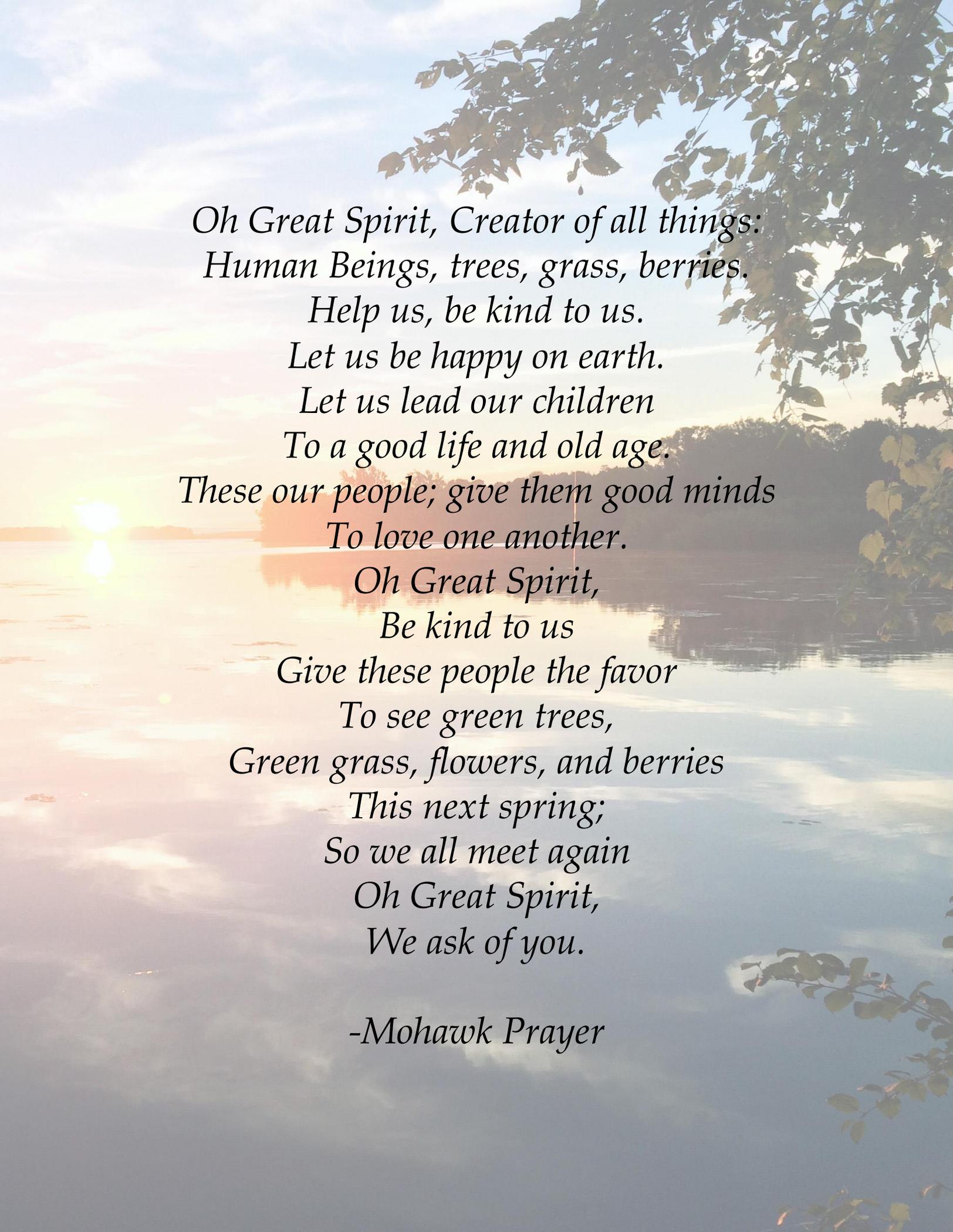
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*Oh Great Spirit, Creator of all things:  
Human Beings, trees, grass, berries.  
Help us, be kind to us.  
Let us be happy on earth.  
Let us lead our children  
To a good life and old age.  
These our people; give them good minds  
To love one another.  
Oh Great Spirit,  
Be kind to us  
Give these people the favor  
To see green trees,  
Green grass, flowers, and berries  
This next spring;  
So we all meet again  
Oh Great Spirit,  
We ask of you.*

*-Mohawk Prayer*

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## **Called to Learn, Act, and Reflect through Indigenous Teachings and Experiential Mathematics for Catholic Educators**

*“I believe we can change the world if we start listening to one another again. Not mediation, negotiation, problem-solving, debate, or public meetings. Simple, truthful conversation where we each have a chance to speak, we each feel heard, and we each listen well...The only way the world will change is if many more of us step forward, let go of our judgments, become curious about each other, and take the risk to begin a conversation.” Margaret Wheatley,*

**Turning to One Another: Simple Conversations to Restore Hope to the Future, 2009.**

### **Calls to Action:**

What does it mean to truly listen deeply, then respond through action? In Aboriginal culture, it is believed that the Creator gave us two ears and one mouth to emphasize the need to listen twice as much as we speak. Catholic educators are called to walk alongside children, their parents, their parish and community partners to witness the learning journey of children entrusted to an educator’s care. The Prayer of St. Francis calls upon us to be a ‘channel for peace’ by seeking more to understand than to be understood. Canadians are called to action by the Truth and Reconciliation Commission of Canada (TRC), (summer, 2015) to honour the past in order to reconcile the future. Specifically the education community is called to “build student capacity for intercultural understanding, empathy, and mutual respect” (Article 63-iii). Educators have also been called by the Ontario Ministry of Education to ‘renew’ an understanding of the teaching and learning of mathematics. How might educators respond to these multiple calls to action by weaving these different perspectives together to strengthen understanding of each?

The futurist, Alvin Toffler, in his book, *Future Shock* (1970), stated, “The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.” In order to honour the past and reconcile for the future, it is time to open our hearts and minds. Educators are called to interrogate structures and processes; to challenge assumptions; to unlearn and relearn. We are ready to listen and respond!

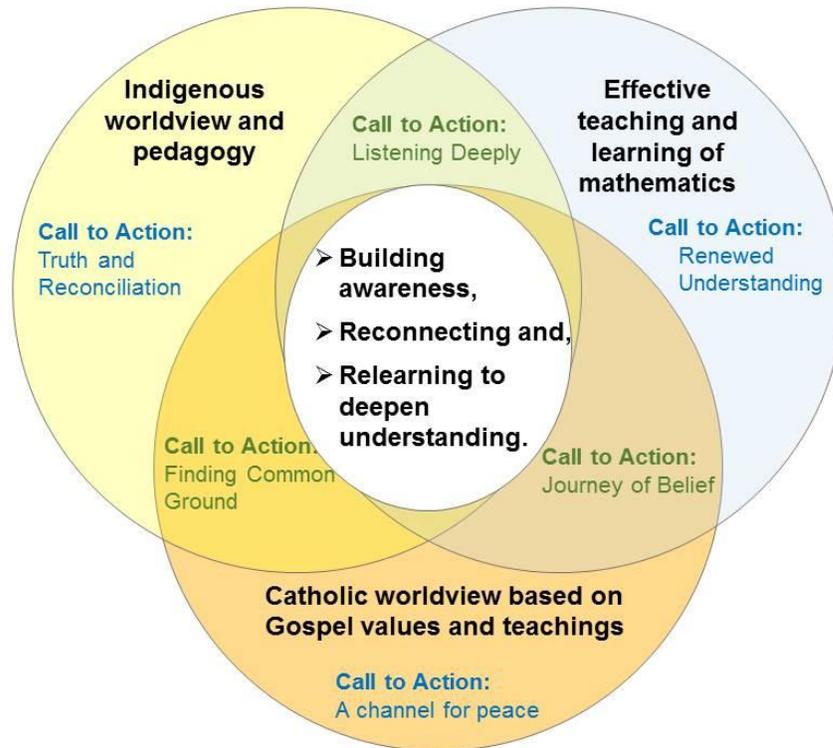
### **Setting the Context:**

This resource investigates the connections between three domains of understanding:

- Indigenous worldview and pedagogy,
- Eurocentric teaching and learning of mathematics, and
- Catholic traditions and perspective.

Educators will examine the context in which many Aboriginal students learn mathematics thereby increasing awareness of Indigenous ways of knowing and potentially affecting changes in classroom practices that positively impact all students. In a research article entitled, *Reconsidering Approaches to Aboriginal Science and Mathematics Education*, Sterenberg and Hogue (2011) present the term *cultural infusion* as “the process of integrating Aboriginal and Western knowledges... this intertwined approach of dialogical interaction where each knowledge system encircles the other as they embrace, twist or wrap around each other. This implies that each knowledge system is preserved, and the twisting together adds tensile strength to the learning” (p. 11). In a similar way, at the Ottawa Region Equity and Inclusion Education Network Conference in Ottawa, May 16, 2016, Albert Dumont shared the same concept through an image

of four trees on a rocky crag. The crag forces the trees to have shallow roots. They survive their harsh environment by entwining their roots and supporting one another. This integration responds to the call of the TRC to build the capacity for respecting diversity. No one domain should exert control or dominance over the other. The graphic below illustrates the intersection of these domains and highlights the necessity for deep listening and responsiveness, building awareness and reconnecting, resulting in relearning to deepen our understanding of all three domains.



This resource responds to the following inquiry questions:

- How might understanding of Indigenous worldview be deepened by harvesting mathematical concepts embedded within Indigenous traditions?
- How might the lens of Catholicity be used to discern a deeper understanding of each?

### **Making Connections:**

#### **Indigenous Worldview and Catholic Teachings**

What commonalities exist between Indigenous teachings and Catholic teachings?

#### **Indigenous Teaching/Belief - Catholic Teaching/Belief**

Finding common ground stems from listening and exploring ideas from different perspectives. Strong connections exist between Indigenous teachings and Catholicism. In an article entitled *Crossing the Borders of Catholicity, FNMI Teachings and Technology*, (Principal Connections,

Winter 2015), Rose Burton Spohn, Superintendent for Huron-Superior CDSB, highlights three examples to spark conversations of discovery and understanding.<sup>1</sup>

Indigenous Teaching/Belief	Catholic Teaching/Belief
Many First Nation, Métis and Inuit (FNMI) people believe important decisions must be made not only on the impact they will have today, but also on those who live seven generations from now.	Morality [and discernment] play a key role in the decisions we make (i.e. we must do what is right, not merely what is convenient).
Many FNMI prayers honour the Creator that sustains humanity (e.g. animals, plants and water). Many FNMI ceremonies (e.g. sweat lodges, healing circles, smudges) aim to heal, purify or provide spiritual insight.	There are many different forms of prayer, types of liturgies and reasons to pray (e.g. praise, gratitude and healing).
Many FNMI people honour the Seven Grandfather Teachings, which include wisdom, love, respect, bravery, honesty, humility and truth.	The Ten Commandments, the Beatitudes and many Scriptural passages refer to desirable behaviours and virtues

After reflecting on the ideas listed in the chart above, consider a summary of the Seven Grandfather Teachings - foundational to Indigenous spirituality:

To cherish knowledge is to know **wisdom**,  
 To know **love** is to know peace,  
 To honour all the creation is to have **respect**,  
 To face life with courage is to know **bravery**.  
 To walk through life with integrity is to know **honesty**,  
**Humility** is to know yourself as a sacred part of creation.  
**Truth** is to know all of these things.

*Traditional Teachings Handbook.*  
 Aboriginal Healing and Outreach Program

In juxtaposition, a focus on the Gospel values shows the possible connections between the Grandfather Teachings (also known as Grandmother Teachings) and Catholic teachings. [Gospel values](#) have informed individual and interpersonal relationships since the beginning of Christianity. Stemming from the Documents of the Second Vatican Council in 1962, gospel values provided the foundation for Catholic Social Teaching, extending these to apply to modern systems and social structures. Derived from Jesus' commandment of love (John 13: 34): "A new command I give you: Love one another. As I have loved you, so you must love one another". The gospel values include: respect for the life and dignity of each individual, trust in God, honesty, compassion, forgiveness, mercy, community, servant leadership, equality, simplicity, justice, and peace.<sup>2</sup> In comparing the two sets of teaching, direct links to love, respect and honesty exist.

<sup>1</sup> Burton Spohn, R. "Crossing the Borders of Catholicity, FNMI Teachings and Technology". *Principal Connections: Aboriginal Education*. Pg. 36-37.

<sup>2</sup> Gospel Values: Extracted on July 14, 2016 from [http://www.lovingjustwise.com/gospel\\_values2.htm](http://www.lovingjustwise.com/gospel_values2.htm)

Connections between the remaining teachings can be explored giving rise to deeper appreciation between the two systems.

Reinforced in both the *Ontario Catholic Elementary Curriculum Policy Document for Religious Education, 2012* and the *Ontario Catholic Elementary Curriculum Policy Document, Grades 1-8: Family Life Education, 2012*, is the following big idea: “To be human is to be a member of society... from the perspective of the responsibilities we have as members of small communities, brothers and sisters within the whole human family, and caretakers of the earth.” (Family Life Education, p. 16). We are all called to action to become fully human and live in solidarity with each other.

### **The Metaphor of the Circle:**

The symbolism of the circle remains an important concept for both Indigenous culture and Catholic teachings. The circle has been used in the oldest cultures as a metaphor to represent the cycle of life. Catholic teachings represent Christ “as the Alpha and Omega, meaning He is the first and the last; the beginning and the end of all creation. [The] liturgical year follows a cyclical pattern... The most revered of [Catholic] beliefs, the Resurrection cycle and the Paschal Mystery, connect to the cycle of dying and rising above earthly suffering”<sup>3</sup>

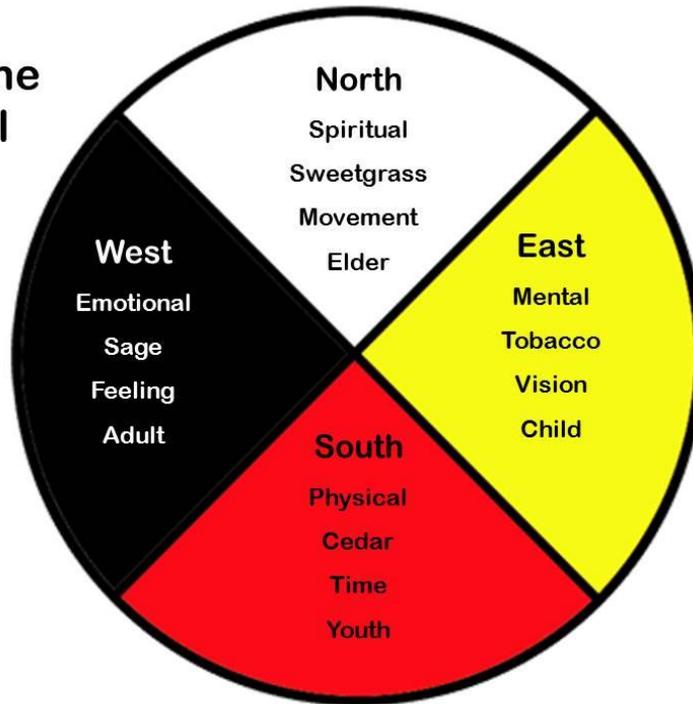
In many Indigenous cultures the circular medicine<sup>4</sup> wheel is essential in representing the teachings related to humanity, the cardinal directions, states of being, sacred medicines, phases of life as well as care of the land and relationships. The image below offers a glimpse into these connections, for example, the colours represent the four great nations on Earth, suggesting that all people should live in harmony. (Please note that in some Indigenous cultures the placement of elements and colours may vary.)

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<sup>3</sup> Garbutt & Webster. “*The Metaphor of the Circle*”. *Principal Connections: Aboriginal Education*. pg. 13-15.

<sup>4</sup> Aboriginal Healing and Outreach Program. (2008). *Traditional Teachings and Handbook*, p. 2.

## Medicine Wheel



### In Relation with the Natural World:

To highlight another major precept of Indigenous worldview, explore the idea of being 'in relation', and being a connected component, with the natural world. When addressing the Native Peoples of the Americas (Phoenix, Sept. 1987), St. John Paul II affirmed that Indigenous people knew the Creator long before Christian missionaries 'discovered' America.

"I was able to see you as the noble descendants of countless generations of inhabitants of this land, whose ways were marked by great respect for the natural resources of land and rivers, of forest and desert. Here your forefathers cherished and sought to pass on to each new generation their customs and traditions, their history and way of life. Here they worshipped the Creator and thanked him for his gifts."

In this message, the responsibility of being stewards of the earth and in relation to every natural form permeates a way of being that impacts all aspects of life - water, food, medicines, shelter and clothing. "We take only what we need [from Mother Earth] to survive to respect the harmony of the Creator."<sup>5</sup> There is a different way of thinking about the earth when one considers changing the Eurocentric messaging from 'our children will inherit the earth from us' to an Indigenous stance of 'today, we borrowed the earth from our grandchildren.' In recent years, Pope Francis' encyclical '[Laudato Si'](#)' - On Care for Our Common Home<sup>6</sup> affirms the concerns for the care of the environment and its impact on humanity and all creation. Pope Francis highlights the reciprocal relationship between nature and humanity and challenges all of us to set the relationship right. Coming together in open dialogue revolving on current environmental issues, specifically related to Indigenous communities, would be a response to Pope Francis' provocation to 'set it right'.

<sup>5</sup> Elder Sagassige. (2015). "Native Spirituality and Catholic Praxis". *Principal Connections: Aboriginal Education*. p.22.

<sup>6</sup> Encyclical Letter *Laudato Si'* of the Holy Father Francis - On Care for Our Common Home. p. 5

The educator should keep these commonalities between Indigenous worldview and Catholic teachings (i.e. beliefs, the metaphor of the circle and living in relation with the natural world) as planted seeds of understanding while exploring additional aspects of this resource to nourish and grow complexity of thinking.

### **Making Connections:**

#### **Indigenous Worldview and Eurocentric View of Teaching and Learning Mathematics**

How might Indigenous pedagogy support and enhance the effective teaching and learning of mathematics?

#### **What are the tenets of Indigenous pedagogy?<sup>7</sup>**

Deeply engrained in the Indigenous way of knowing is **storytelling**. An oral tradition as a means of gathering knowledge and sharing wisdom to assist others is foundational. **Listening** deeply and **respectfully** are essential to gaining understanding. At its very core, storytelling is **relational**. “How does this story help me in seeing my part in the natural world - connected to others and in relation to Mother earth?” Social tribal structures, such as, reverence to elders and adherence to traditional ceremony and protocol are seen as ways to transmit values and knowledge to younger members of the community.

A strong connection can be made in Catholic ways of knowing when considering how Jesus taught using parables. Disciples needed to reflect on the meaning of Jesus’ stories to gain insight. Jesus rarely told people directly what should be done. He modelled through his actions. **Modelling** is a vital strategy in Indigenous pedagogy. Elders who stayed with young children when the hunters or gatherers were away modelled what needed to be done and to be learned. As a result, **experiential learning** and **collaboration** are key to indigenous pedagogy. ‘Doing’ is intricately related to knowing. **Relevance** or making meaningful personal connections is related to this style of learning. “What do I personally need to know? How is this important to my context or my survival?”

#### **How might Indigenous pedagogy support a renewed vision for teaching and learning mathematics?**

In the forefront of collaborative inquiry in Ontario is a discussion related to what constitutes effective teaching and learning in mathematics. The overarching Eurocentric big ideas of mathematics could be stated as, ‘math is a study of patterns’ and ‘math is all around us’. Seen through an Indigenous lens, the big ideas may be altered slightly to ‘math is about relationships’ and ‘math is found all around us in the natural world’. Subtle differences show the Indigenous teachings embedded in these statements. Recent research names this as the process of ‘verbification’. In other words, seeing mathematics as a process - an act of doing- rather than seeing a concept as a noun, for example, a pattern, a thing or an object. Relationships are dynamic concepts that evoke connections to personal meaning-making. Seeing math in every aspect of the natural world elevates the importance and necessity of mathematics in our everyday lives. These nuances may allow Indigenous students to more readily see themselves in the curriculum being taught as well as allowing non-Indigenous students to consider mathematics from a different perspective. In an article entitled, *Decolonizing Aboriginal Education in the 21st Century*, researchers Munroe et al (2013) report a parent’s wish for “two-eyed seeing, a concept

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<sup>7</sup> Kovach, M. “Conversational Method in Indigenous Research”, 40-44. (Supported through conversations with David Finkle - Indigenous musician, community partner with EOCCC)

that she and Mi'kmaw Elder Albert Marshall have made known. A notion that encourages learning to see from one eye with the best in the Indigenous ways of knowing and from the other eye with the best in the mainstream ways of knowing, and most importantly, learning to see with both eyes together - for the benefit of all." (p. 327)

The Eurocentric vision of the mathematics learner revolves around the interplay of the following elements:

- understanding mathematical concepts with proficiency and confidence,
- displaying a natural curiosity and enjoyment in mathematics,
- engaging in the mathematical processes of problem-solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating, and
- demonstrating social-emotional learning of self-regulation and independent thinking.

Renewing our understanding of acquiring complex mathematical skills and concepts calls on educators to reflect on assessment and instructional strategies that are **student-centred and collaborative in nature**. The following intentional strategies are considered to be highly effective:

- Harvest from students what they already know. This is a respectful consideration of students' ability rather than assuming students are 'a blank slate',
- Create a learning environment where:
  - mistakes are seen as opportunities for learning and promote a sense of well-being,
  - resources reflect the diversity in the classroom,
  - all voices are heard and respected,
- Provide opportunities for students to:
  - engage in relevant tasks that are connected to students' interests and way of life,
  - 'play' with mathematical ideas through oral discourse and forming conjectures,
  - experience the learning by moving from the concrete to the abstract,
  - explain their thinking and consolidate their learning through multiple attempts and by various modalities if needed (i.e. observations/demonstrations, conversations and a variety of products),
  - connect mathematical ideas by making cross-curricular connections,
- Create a transparent learning environment where learning goals are presented and success criteria are co-constructed so that students can reflect and set personal goals by asking, "What am I learning? Where am I now? Where to next?"

This list of intentional educator moves exemplifies 'two-eyed seeing'. Ways of knowing in this vision see the student as a listener, a doer, an explorer of ideas, a meaning-maker, a collaborative team member, a critical thinker and an effective communicator. Perhaps this set of competencies can be viewed as a weaving of ideas taken from both Indigenous and Eurocentric worldviews that supports the realities of 21st century learner.

A 21st century approach to education recognizes the value of knowing multiple languages, including Indigenous languages, and holds respect for diverse cultures, acknowledging the need for culture preservation. We see this as being in harmony with calls for education originating in an Aboriginal perspective that enable Aboriginal students and others to value their own cultures and come to respect the world around them...This means that all students should be learning to understand multiple points of view, exploring phenomena from a variety of cultural worldviews and engaging in intercultural dialogue.

Munroe, Lunney Borden, Orr, Toney, Meader.

*Decolonizing Aboriginal Education in the 21st Century*, 2013

Catholic educators connect this 21st century approach through the Ontario Catholic School Graduate Expectations (ICE, 2011). The vision of the learner is expected to be **a responsible**

**citizen** who respects and affirms the diversity and interdependence of the world's peoples and cultures (7f) as well as who respects and understands the history, cultural heritage and pluralism of today's contemporary society (7g).

### **Research Reveals:**

How might recent research provide further insight specifically to the learning needs of Indigenous students in mathematics?

In an article entitled, *The 'Verbification' of Mathematics: Using the Grammatical Structures of Mi'Kmaq to Support Student Learning*<sup>8</sup>, (2011), Lisa Lunney Borden presents a model that emphasizes the complexities of teaching and learning mathematics as well as providing further clarification of Indigenous worldview. Four important concepts, centred on establishing meaningful personal connections to mathematics, provide insight in supporting Indigenous students in the teaching and learning of mathematics. These include:

- The importance of cultural connections and context,
- Providing hands-on experiences with a focus on visual-spatial learning,
- Learning from language structures unique to each Indigenous culture helps to understand how mathematics is described through verbs rather than nouns,
- Acknowledging how values impact mathematical ideas. (E.g. the concept of estimation as a need for survival connects the concept of equity and fairness grounded in necessity and experience.)

In another article written for *Principal Connections*<sup>9</sup>, Dr. Borden continues to summarize the implications of her research for classroom educators by offering practical strategies to support Indigenous students:

- Know your students:
  - Listen deeply to their ideas. Watch what they are doing and listen to the connections they are making to their way of life.
  - Notice and name misconceptions in order to pinpoint gaps in understanding,
  - Align explanations of concepts with how they are talking about ideas.
- Know their communities:
  - Explore indigenous knowledge inherent in what is at the centre of the learning,
  - Focus on indigenous knowledge and issues that affect indigenous communities.
- Believe they can learn:
  - Consider the gifts of each student using an asset-based mindset. Care for them and have high expectations. This fosters a sense of well-being through relationships.

To supplement these three practical strategies Dr. Borden shares insights, in a recent series of video clips ([Learn Teach Lead: Coming Together to Learn Together](#)), to deepen educators' understanding of meeting the needs of Indigenous students by pointing out possible misconceptions or assumptions. Awareness of these assumptions change instructional decisions. Consider this advice from Dr. Borden:

- Understand the diversity of indigenous cultures. "The term Indigenous knowledge is used so as not to imply that one should see indigenous peoples as 'all the same' or make the false assumption that what is true of one Indigenous community is also true of

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<sup>8</sup> Borden, L., *The 'Verbification' of Mathematics: Using the Grammatical Structures of Mi'Kmaq to Support Student Learning*, 2011, p. 10.

<sup>9</sup> Borden, L. "3 Good Ideas". *Principal Connections: Aboriginal Education*. Pg. 24-26.

another. Communities do have a shared history of colonization and shared values with respect to their relationship with the natural world.”<sup>10</sup>

- “It is false to assume that many Aboriginal children who come to school speaking English also think in English [or Eurocentric] ways.”<sup>11</sup>
- “Understanding the structure of languages can gain insight into ways to support mathematical understanding.”<sup>12</sup> Probe for the meaning of words and concepts.
- Learning experiences should not be viewed as an event but as an opportunity for reflection of self and awareness of others. Understanding is deepened through the ‘doing’.
- Highlight the integrated nature of the learning so students can see connections to their cultural teachings.
- Promote curiosity. Show a variety of perspectives.

Another practical resource, *What Works? Research into Practice - Integrating Aboriginal Teaching and Values into the Classroom*, written by Dr. Pamela Rose Toulouse, uses the anchor of the Ojibwe Good Life Teachings to summarize additional practical suggestions for educators. View this chart on the following page.

### Supporting Indigenous Students:

Ojibwe Teaching	Implications for Education
Respect	Have high expectations for the Aboriginal student and honouring their culture, language and worldview in our schools.
Love	Demonstrate our belief (as educators) that all Aboriginal students can and will succeed through our own commitment to their learning/teaching styles.
Bravery	Commit to change our school curriculum through including the contributions, innovations and inventions of Aboriginal people.
Wisdom	Share effective practices in Aboriginal education through ongoing professional learning and research that focuses on embedding equity.
Humility	Acknowledging that we need to learn more about the diversity of Aboriginal people and accessing key First Nation resources to enhance that state.
Honesty	Accept that we have much to learn from one another and review the factors involved to encourage change in the education system (i.e. increased parental-guardian involvement, teacher education)
Truth	Develop measurable outcomes for Aboriginal student success and use these as key indicators of how inclusive our curriculum and pedagogy really are.

<sup>10</sup> Munroe, et al. (2013), “Decolonizing Aboriginal Education in the 21st Century”. p. 320.

<sup>11</sup> Ibid. p. 321.

<sup>12</sup> Lunney Borden. Extracted from Video Series: Coming Together to Learn Together.

## **Consolidation:**

### **Called to Learn, Act, and Reflect through Indigenous Teachings and Experiential Mathematics for Catholic Educators**

*Without dissonance learning does not exist.* This is a bold statement that either affirms or challenges every educator to act. Are educators ready to consider tough questions and engage in collaborative inquiries to interrogate structures and processes in order to move learning forward?

Turning to scripture, we are asked in Corinthians to consider the implications of these statements, “There are different kinds of spiritual gifts but the same Spirit. There are different workings but the same God who produces all of them in everyone. To each individual, the manifestation of the Spirit is given for the same benefit.” (1 Corinthians 12: 4-7). A similar message is reiterated by Peter, “As each has received a gift, use it to serve one another, as good stewards of God’s varied grace” (1 Peter 4:10).

How do we view our students and those of all ages who walk with educators in a common learning journey? Are students viewed through an asset-based lens, as curious, capable thinkers and doers? Are students perceived as having God-given talents and strengths?

In the Ministry monograph entitled, *Pedagogical Documentation Revisited: Looking at Assessment and Learning in New Ways*, an Aboriginal leader reveals his thinking, “In our culture, we believe that every child is born with gifts. What will our schools do to uncover and develop the gifts of our children?” A tough question followed by an even tougher one from a child. “Are you confident you can design a curriculum which will equip me to live in my world? I am five years old and I am sitting in one of your classrooms today.” (Beare, 2002, “I Am the Future’s Child.”<sup>13</sup>) Are educators ready to prepare students for the 21st century that will be uncertain, volatile and ambiguous?

### **Challenges are Set: the Need is Great**

At the fourth Annual Aboriginal Lecture Series hosted by the Màmawi Together Community Initiative (Rideau High School, May 25th, 2016), Justice Murray Sinclair challenged the audience, “Schools have a duty to help students answer these four questions:

- Where do I come from? (What is my creation story? my history?)
- Why am I here? (What is our shared purpose? Creator has a purpose for you.)
- Where am I going? (Now? In the future? After death?)
- Who am I? (Only at the moment of death will you know that answer)”

How will Catholic schools respond to this challenge?

Calls to action have been issued throughout this resource and summarized below:

- What does it mean to truly listen deeply, then respond through action?
- How might Catholic educators be ‘channels of peace’?
- How will the educational community build student capacity for intercultural understanding, empathy, and mutual respect? (Article 63-iii, TRC)
- How will educators ‘renew’ an understanding of the teaching and learning of mathematics?
- How will we unlearn to relearn?

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<sup>13</sup> Munroe, et al. (2013). Decolonizing Aboriginal Education in the 21st Century. p. 322.

The most important question, above all of these, is...

**“What do you perceive as the next intentional and respectful step in this learning journey?”**

**How could this resource be used for professional learning within a Catholic Professional Learning Cycle (CPLC)?**

- Read the introduction section using a thinking protocol, for example:
  - **What?** (What key ideas can we harvest from the introduction?)
  - **So what?** (How do these ideas affirm or challenge our thinking?)
  - **Now what?** (How will we respond? What are our next steps?)
- From the resource, choose one sample learning experience to explore with a colleague. How might you revise or adapt this experience based on your context? Co-plan and co-teach with a colleague.
  - Gather evidence of learning based on co-constructed success criteria and anticipated student responses. Bring observations, notes of conversations and samples of student work to discuss at a subsequent meeting of the CPLC.
  - What is the documentation telling you? Where to next for both student and educator learning?
- Deepen understanding by exploring suggested resources.
- Intentionally look for connections in Indigenous stories to mathematical concepts.
- Infuse indigenous learning experiences and resources into other content areas (i.e. Religion, Family Life, Social Studies, Science, Language, Arts, Health and Physical Education)

**Additional Considerations:**

- Do you know the traditional Indigenous territory upon which your school resides?
- How might you honour this territory and highlight Indigenous traditions from your community within your school community?
- Do you know the Aboriginal Lead in your school board? Possible resources, partnerships and professional learning may be available.
- Have you established partnerships with Indigenous community leaders?
- Are students aware of how to self-identify? Note: Parents may be apprehensive of the self-identification process due to the effects of intergenerational trauma caused by the misguided policies of residential schools. They may have concerns of a hidden agenda. Provide parents with contact information of the Board Aboriginal Lead to address concerns.
- The terms Aboriginal and Indigenous are used synonymously throughout this document. “Aboriginal”, is a term that was first used by the Government of Canada to refer to all three Indigenous groups: First Nations, Métis, and Inuit peoples. Some of our First Nations, Métis, and Inuit people, prefer the term Indigenous, meaning our first peoples who occupied Canada before contact with colonial powers. When possible, the term, *Indigenous*, has been used. Both terms are used with great respect.

### **The Sample Learning Experiences:**

Consider the sample learning experiences as a spark to kindle a learning journey - both personal and for students. The hope of the writers is to foster curiosity and interest in pursuing the inquiry questions:

- “How might understanding of Indigenous worldview be deepened by harvesting mathematical concepts embedded within Indigenous traditions?”
- How might the lens of Catholicity be used to discern a deeper understanding of each?”

Embrace the concept of one of the learning experiences. Change the suggested steps to suit your classroom needs. Ask a colleague to walk this journey with you. Invite a community partner to support the learning. Be willing to learn alongside students and community partners. Listen deeply and respond to the calls for action!

## Learning Experience 1: Three Sisters Mathematics

**Learning Destination:** How might exploring Indigenous cultural traditions and practices foster a greater understanding of mathematical concepts?

**Rationale:** These learning experiences will help students to understand how deeply Canada's Indigenous people understand and respect nature. Through the study of the Iroquois traditional ways of gardening, keeping calendars, and trading, students will participate in mathematical problem solving which will also grow insight into traditional ways of life, which, to some degree, continue to be practiced even today. In experiencing mathematics within an Indigenous context, all students will be provided the opportunity to grow their knowledge and appreciation of First Nation, Métis, and Inuit traditions, culture, and perspectives, which is the vision of the Ontario First Nations, Métis, Inuit Education Policy Framework<sup>14</sup>.

### Setting the Context:

The Iroquois (Haudenosaunee) lived in areas along the eastern shore of Lake Ontario in Canada, and in the northern part of New York State located south of the St. Lawrence River. The Iroquois Nation includes the peoples from the Mohawk, Seneca (with the Tuscarora), Cayuga, Onondaga, and Oneida tribes. They lived an agricultural life, growing crops in order to support a healthy diet and to survive the long winter season during which harsh weather conditions made hunting more difficult. Large areas of land would be cleared by the tribes so that seeds could be planted and grown into vegetables like corn, beans, and squash. It was the women who were responsible for planting and caring for the crops. They would plant the seeds in an interesting way, inspired by an Indigenous legend known as "The Three Sisters". In exploring this method of planting, several mathematical ideas and concepts come to life. Additionally, in exploring traditional Indigenous teachings, we expand our knowledge and understanding of Indigenous cultures, thereby growing our ability to answer the call to action.

**Division:** As such, the following learning experience presents several math tasks that might be considered in the Junior Division setting.

### Big Ideas:

#### ❖ Mathematics:

- **Number Sense and Numeration**
  - Quantity
    - Numbers tell how much or how many
    - By classifying numbers, conclusions can be drawn about them
  - Operational Sense
    - It is important to recognize when each operation (addition, subtraction, multiplication, division) is appropriate to use

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<sup>14</sup><http://www.edu.gov.on.ca/eng/aboriginal/fnmiFramework.pdf>

- There are many ways to add, subtract, multiply or divide numbers
  - Proportional Reasoning
    - There are many representations of a given shape
- **Geometry and Spatial Sense**
  - Properties of 2D Shapes
    - There are many representations of a given shape
    - New shapes can be created by either composing or decomposing existing shapes
- **Measurement**
  - Attributes, Units and Measurement Sense
    - The same object can be described by using different measurements
    - The numerical value attached to a measurement is relative to the measurement unit
    - Units of different sizes and tools of different types allow us to measure with different levels of precision
    - The use of standard measurement units simplifies communication about the size of objects
    - Knowledge of the size of benchmarks assists in measuring
- **Patterning and Algebra**
  - Patterns and Relationships
    - Any pattern, algebraic expression, relationship, or equation can be represented in many ways
    - A group of items form a pattern only if there is an element of repetition, or regularity, that can be described with a pattern rule
  - Variables, Expressions, and Equations
    - Variables can be used to describe relationships or unknowns

❖ **Catholic Graduate Expectations:**

- **A Discerning Believer Formed in the Catholic Faith Community**
  - Respects the faith traditions, world religions and the life-journeys of all people of good will.
- **An Effective Communicator**
  - Presents information and ideas clearly and honestly and with sensitivity to others.
- **A Reflective, Creative and Holistic Thinker**
  - Adopts a holistic approach to life by integrating learning from various subject areas and experience.
- **A Self-Directed, Responsible, Lifelong Learner**
  - Applies effective communication, decision-making, problem-solving, time and resource management skills.
- **A Collaborative Contributor**

- Achieves excellence, originality, and integrity in one’s own work and supports these qualities in the work of others.
- **A Responsible Citizen**
  - Respects and understands the history, cultural heritage and pluralism of today’s contemporary society.

**Possible Products/Cross-Curriculum Connections:**

Culminating tasks might include:

- Retelling the “Three Sisters” legend
- Dramatizing the “Three Sisters” legend
- Creating a media representation of “The Three Sisters” legend using iPad apps such as iMovie, Book Creator, Explain Everything, or Educreations
- Growing a “Three Sisters” class garden
- Cooking “Three Sisters” soup ([Sample Recipe](#))<sup>15</sup>

**Learning Experience**

**Activation**

- 1) The “Three Sisters” legend will be shared and discussed with the group (see *The Three Sisters: A Legend* handout)
- 2) The historical and scientific information will be shared and discussed with the group (see *Planting the Three Sisters* information handout, the *How the Three Sisters Work Together* handout, and the *From Seed to Table* handout)

**Actions**

**Task 1: Investigating a Three Sisters Garden**

<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>
<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use personal references to help me measure with consistency.</li> <li>▪ I can use manipulatives to help count units of measure.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use manipulatives to help count units of measure.</li> <li>▪ I can use symbolic math language to solve the area of a shape.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use symbolic math language to solve the area of a shape.</li> </ul>

<sup>15</sup> <http://www.food.com/recipe/three-sisters-soup-410371?photo=330998>

Using the diagram of a Three Sisters garden, students will calculate the amount of space needed for it given a list of conditions (see task handout provided). The task is meant to be a rich problem, in that educators are encouraged to allow students to explore and solve the problem using their own thinking and strategies, whether standard or non-standard. In doing so, educators can assess the students' knowledge and understanding of the properties of area and respond accordingly in their continued planning.

**Consolidation:**

- ✓ What strategies did the students use to determine the length and width of the space for the garden plan?
- ✓ How did the students calculate the area of the garden? Did they use an informal or formal method?
- ✓ Which conditions were most helpful in helping the students to determine the dimensions of the garden space?
- ✓ Were any of the conditions problematic for the students to work with?

**Task 2: Creating a Three Sisters Garden Plan**

<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>
<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to investigate the area of a 2D shape using a variety of strategies.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use personal references to help me measure with consistency.</li> <li>▪ I can create a shape according to given measurements.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can make a model to help solve the problem.</li> <li>▪ I can divide shapes into sections that I can work with more easily.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can make a scale drawing to help solve the problem.</li> <li>▪ I can divide shapes into sections that I can work with more easily.</li> <li>▪ I can use the formula <math>L \times W</math> to help me calculate the area of a quadrilateral.</li> </ul>

Students will create their own garden design given a required number of squash and corn/bean mounds and considering a given list of conditions (see task handout provided). The task is meant to be a rich problem, in that educators are encouraged to allow students to explore and solve the problem using their own thinking and strategies, whether standard or non-standard. In doing so, educators can assess the students' knowledge and understanding of the properties of area and respond accordingly in their continued planning. Manipulatives such as geoboards, linking cubes or Cuisenaire rods might be useful in helping the students create a model of their garden. Chart paper and various measuring tools (meter stick, centimeter rulers) will be required so that students can create their spaces to scale.

**Consolidation:**

- ✓ How are the students' garden plans similar and different?
- ✓ Are there some configurations that students consider more easily created and calculated? More difficult?
- ✓ What conversion relationships do students identify?
- ✓ What patterns or trends do students notice existing when considering all student-created garden plans (i.e. the closer the values of the dimensions, the more square the greater the space)?
- ✓ How did the students calculate the area of the garden? Did they use an informal or formal method?

**Task 3: How Much Corn: Yield Calculation**

Grade 4	Grade 5	Grade 6
<p><b>Learning Goal:</b> We are learning to solve problems involving the addition, subtraction, multiplication, and division of single and multi-digit whole numbers using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to solve problems involving the addition, subtraction, multiplication, and division of single and multi-digit whole numbers using a variety of strategies.</p>	<p><b>Learning Goal:</b> We are learning to solve problems involving the addition, subtraction, multiplication, and division of single and multi-digit whole numbers using a variety of strategies.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can estimate before solving the problem to help judge the reasonableness of my answer.</li> <li>▪ I can choose an appropriate operation to solve the question.</li> <li>▪ I can use different representations to help communicate my math thinking (diagrams, numbers, and symbols).</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can estimate before solving the problem to help judge the reasonableness of my answer.</li> <li>▪ I can choose an appropriate operation to solve the question.</li> <li>▪ I can use different representations to help communicate my math thinking (diagrams, numbers, and symbols).</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can estimate before solving the problem to help judge the reasonableness of my answer.</li> <li>▪ I can choose an appropriate and efficient operation to solve the question.</li> <li>▪ I can use symbolic math language to communicate my math thinking.</li> </ul>
<p><b>Learning Goal:</b> We are learning to describe and make predictions related to number patterns.</p>	<p><b>Learning Goal:</b> We are learning to use a table of values to describe relationships in a number pattern.</p>	<p><b>Learning Goal:</b> We are learning to use a table of values to describe relationships in a number pattern.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can recognize when a pattern is repeating, growing, or shrinking.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can recognize when a pattern is repeating, growing, or shrinking.</li> <li>▪ I can communicate a pattern using a table.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can recognize when a pattern is repeating, growing, or shrinking.</li> <li>▪ I can communicate a pattern using a table.</li> <li>▪ I can represent a pattern using algebraic expressions or symbols.</li> </ul>

Students will calculate the yield of various Three Sister garden scenarios. Corn yields will be the only amount considered since of the Three Sisters, corn is the only seed with a fairly consistent yield amount (see the **How Much Corn?** handout).

**Consolidation:**

- ✓ What strategies are students using to complete their calculations (i.e. repeated addition, multiplication, repeated subtraction, division )?
- ✓ How do students communicate operational thinking (non-traditional/student generated methods or standard algorithms)?
- ✓ Are there certain numbers that students find easier/harder to work with?
- ✓ Extension Question: What patterns and trends do students identify in comparing and discussing each other’s work?
- ✓ Can variables and algebraic representation be used to describe relationships identified by the students when calculating the answers regarding yields of various garden scenarios?

**Task 4: The Trade Meeting**

<b>Grade 4</b>	<b>Grade 5</b>	<b>Grade 6</b>
<p><b>Learning Goal:</b> We are building our understanding of proportional reasoning by investigating whole-number unit rates.</p>	<p><b>Learning Goal:</b> We are building our understanding of proportional reasoning by investigating whole-number unit rates.</p>	<p><b>Learning Goal:</b> We are building our understanding of proportional reasoning by investigating whole-number unit rates.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use a diagram or model to communicate how two values relate.</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▪ I can use a diagram or mathematical symbols and language to communicate how two values relate.</li> </ul>	<p><b>Success Criteria</b></p> <ul style="list-style-type: none"> <li>▪ I can use a diagram or mathematical symbols and language to communicate how two values relate.</li> </ul>

In learning and discussing the importance of trade within the economic system of the Iroquois nation, students will determine the economic value of items such as corn, squash and beans, furs and skins, weapons and tools while playing a trading game. Students will also be introduced to the Iroquois calendar system which will provide insight into the Indigenous way of telling time according to weather patterns and celestial bodies.

**Part A:** Read together and discuss the information provided regarding Iroquois trade and economy (see **Iroquois Trade and Economy** handout). Discuss the Iroquois calendars with the students in reference to the information provided in the handout (see **The Iroquois Calendars** handout).

**Part B:** Students will play an interactive game to re-enact trading between tribes and with Europeans. Students will determine the value of the trade items acquired by using proportional reasoning to determine the unit rate of items traded given the ratio of items traded.

### **INSTRUCTIONS:**

- 1) Provide each student with various trade cards (2-3), one role card (tribal or European roles), and one situational card (see ***The Trade Meeting Cards*** master)
- 2) Students will mingle and complete trades with each other based on the role that they have been assigned, the goods that they have, and their situational circumstances.
- 3) Students will have reflection time at the end of the game to consider the trade(s) that they made during the meeting (see ***The Trade Meeting*** handout).
- 4) Discuss the students' reflections.

N.B. Wampum beads were used to make Wampum Belts. More information on the importance of Wampum belts in peace, land agreements and friendships between nations can be found at: [http://firstpeoplesofcanada.com/fp\\_treaties/fp\\_treaties\\_earlyalliances.html](http://firstpeoplesofcanada.com/fp_treaties/fp_treaties_earlyalliances.html) or

<https://briarpatchmagazine.com/articles/view/a-short-introduction-to-the-two-row-wampum>

### **Consolidation:**

- ✓ What strategies did students use to solve for and evaluate the value of their trade?
- ✓ What understanding do the students demonstrate about ratio and rate?
- ✓ What do students consider a fair trade? What conditions need to be present?
- ✓ Discuss the impact of the trades the students made on their assigned roles.

### **Connections to other Divisions**

#### **Curriculum Connections/Possible Extensions:**

##### **❖ Social Studies:**

- **Gr. 3: Heritage and Identity: Communities in Canada, 1780-1850**
  - The different communities in early-nineteenth-century Canada influence the way we live today.
  - Social and environmental challenges were a major part of life in all communities in the early-nineteenth-century Canada.
- **Gr. 4: People and Environments: Political and Physical Regions of Canada**
  - Human activity and the environment have an impact on each other.
  - Human activities should balance environmental stewardship with human needs/wants.
- **Gr. 5: Heritage and Identity: First Nations and Europeans in New France and Early Canada**
  - Interactions between people have consequences that can be positive for some people and negative for others.

- When studying interrelationships between groups of people, it is important to be aware that each group has its own perspective on those interrelationships.
- **Gr. 6: Heritage and Identity: Communities in Canada, Past and Present**
  - Many different communities have made significant contributions to Canada's development.
- **Gr. 7: New France and British North America, 1713-1800**
  - Understanding the experiences of and challenges facing people in the past helps put our experiences and challenges into context.

❖ **Science:**

- **Understanding Life Systems**
  - Gr. 3: Growth and Changes in Plants
    - Living things, including humans, interact with soils and can cause positive or negative changes.
  - Gr. 4: Habitats and Communities
    - Society relies on plants and animals.
  - Gr. 5: Human Organ Systems
    - Choices we make affect our organ systems and, in turn, our overall health.
  - Gr. 6: Biodiversity
    - Humans make choices that can have an impact on biodiversity.
  - Gr. 7: Interactions in the Environment
    - Human activities have the potential to alter the environment. Humans must be aware of these impacts and try to control them.
- **Understanding Matter and Energy**
  - Gr. 3: Forces Causing Movement
    - Forces in nature, such as high winds or water, can have a significant impact on humans and the environment.
  - Gr. 5: The properties of materials determine their use and may have an effect on society and the environment.
- **Understanding Earth and Space Systems**
  - Gr. 3: Soils in the Environment
    - Living things, including humans, interact with soils and can cause positive or negative changes.
  - Gr. 7: Heat in the Environment
    - Heat has both positive and negative effects on the environment
  - Gr. 8: Water Systems
    - Water is crucial to life on Earth.
    - Water is an important resource that needs to be managed sustainably.

*The following story, entitled "The Three Sisters," was recorded by Lois Thomas of Cornwall Island, Canada. It is one of a collection of legends compiled by students at Centennial College, Toronto, Canada. Out of respect to native culture, we ask that you share the legend in a spirit of respect.*

## **The Three Sisters: A Legend**

Once upon a time very long ago, there were three sisters who lived together in a field. These sisters were quite different from one another in their size and also in their way of dressing. One of the three was a little sister, so young that she could only crawl at first, and she was dressed in green. The second of the three wore a frock of bright yellow, and she had a way of running off by herself when the sun shone and the soft wind blew in her face. The third was the eldest sister, standing always very straight and tall above the other sisters and trying to guard them. She wore a pale green shawl, and she had long, yellow hair that tossed about her head in the breezes.

There was only one way in which the three sisters were alike. They loved one another very dearly, and they were never separated. They were sure that they would not be able to live apart.

After a while a stranger came to the field of the three sisters, a little Indian boy. He was as straight as an arrow and as fearless as the eagle that circled the sky above his head. He knew the way of talking to the birds and the small brothers of the earth, the shrew, the chipmunk, and the young foxes. And the three sisters, the one who was just able to crawl, the one in the yellow frock, and the one with the flowing hair, were very much interested in the little Indian boy. They watched him fit his arrow in his bow, saw him carve a bowl with his stone knife, and wondered where he went at night.

Late in the summer of the first coming of the Indian boy to their field, one of the three sisters disappeared. This was the youngest sister in green, the sister who could only creep. She was scarcely able to stand alone in the field unless she had a stick to which she clung. Her sisters mourned for her until the fall, but she did not return.

Once more the Indian boy came to the field of the three sisters. He came to gather reeds at the edge of a stream nearby to make arrow shafts. The two sisters who were left watched him and gazed with wonder at the prints of his moccasins in the earth that marked his trail.

That night the second of the sisters left, the one who was dressed in yellow and who always wanted to run away. She left no mark of her going, but it may have been that she set her feet in the moccasin tracks of the little Indian boy.

Now there was but one of the sisters left. Tall and straight she stood in the field not once bowing her head with sorrow, but it seemed to her that she could not live there alone. The days grew shorter and the nights were colder. Her green shawl faded and grew thin and old. Her hair, once long and golden, was tangled by the wind. Day and night she sighed for her sisters to return to her, but they did not hear her. Her voice when she tried to call to them was low and plaintive like the wind.

But one day when it was the season of the harvest, the little Indian boy heard the crying of the third sister who had been left to mourn there in the field. He felt sorry for her, and he took her in his arms and carried her to the lodge of his father and mother. Oh what a surprise awaited here there! Her two lost sisters were there in the lodge of the little Indian boy, safe and very glad to see her. They had been curious about the Indian boy, and they had gone home with him to see how and where he lived. They had liked his warm

cave so well that they had decided now that winter was coming on to stay with him. And they were doing all they could to be useful.

The little sister in green, now quite grown up, was helping to keep the dinner pot full. The sister in yellow sat on the shelf drying herself, for she planned to fill the dinner pot later. The third sister joined them, ready to grind meal for the Indian boy. And the three were never separated again.

Every child of today knows these sisters and needs them just as much as the little Indian boy did. For the little sister in green is the bean. Her sister in yellow is the squash, and the eldest sister with the long flowing hair of yellow and the green shawl is the corn.<sup>16</sup>



Image<sup>17</sup>

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<sup>16</sup><https://www.evergreen.ca/downloads/pdfs/BeanKeepers-ThreeSisters.pdf>

<sup>17</sup><https://neechifoods.files.wordpress.com/2013/04/20130702-3-sisters-2.jpg>

## Planting the Three Sisters

According to Iroquois legend, corn, beans, and squash are three inseparable sisters who only grow and thrive together. This tradition of inter-planting corn, beans and squash in the same mounds, widespread among Native American farming societies, is a sophisticated, sustainable system that provided long-term soil fertility and a healthy diet to generations. Growing a Three Sisters garden is a wonderful way to feel more connected to the history of this land, regardless of our ancestry.

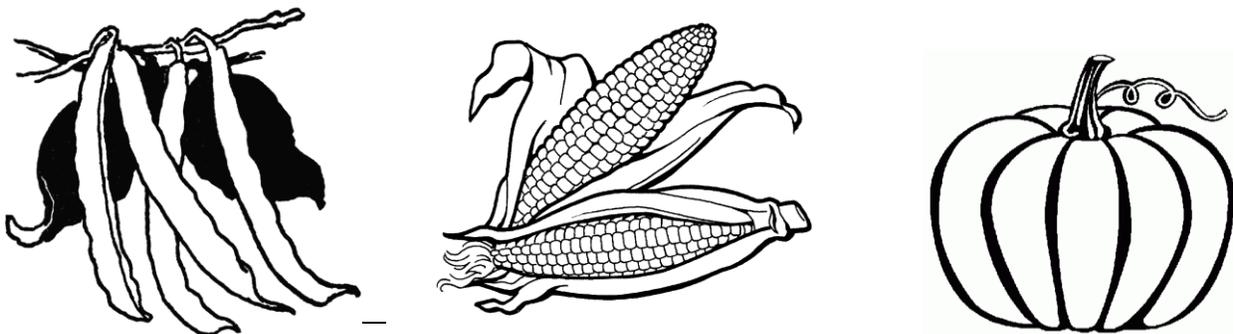
Corn, beans and squash were among the first important crops domesticated by ancient societies. Corn was a primary crop, providing more calories or energy per acre than any other. According to Three Sisters legends corn must grow in community with other crops rather than on its own - it needs the beneficial company and aide of its companions.

The Iroquois believe corn, beans and squash are precious gifts from the Great Spirit, each watched over by one of three sisters' spirits, called the De-o-ha-ko, or "Our Sustainers". The planting season is marked by ceremonies to honor them, and a festival commemorates the first harvest of green corn on the cob. By retelling the stories and performing annual rituals, Native Americans passed down the knowledge of growing, using and preserving the Three Sisters through generations.

Corn provides a natural pole for bean vines to climb. Beans fix nitrogen on their roots, improving the overall fertility of the plot by providing nitrogen to the following years' corn. Bean vines also help stabilize the corn plants, making them less vulnerable to blowing over in the wind. Shallow-rooted squash vines become a living mulch, shading emerging weeds and preventing soil moisture from evaporating, thereby improving the overall crops chances of survival in dry years. Spiny squash plants also help discourage predators from approaching the corn and beans. The large amount of crop residue from this planting combination can be incorporated back into the soil at the end of the season, to build up the organic matter and improve its structure.

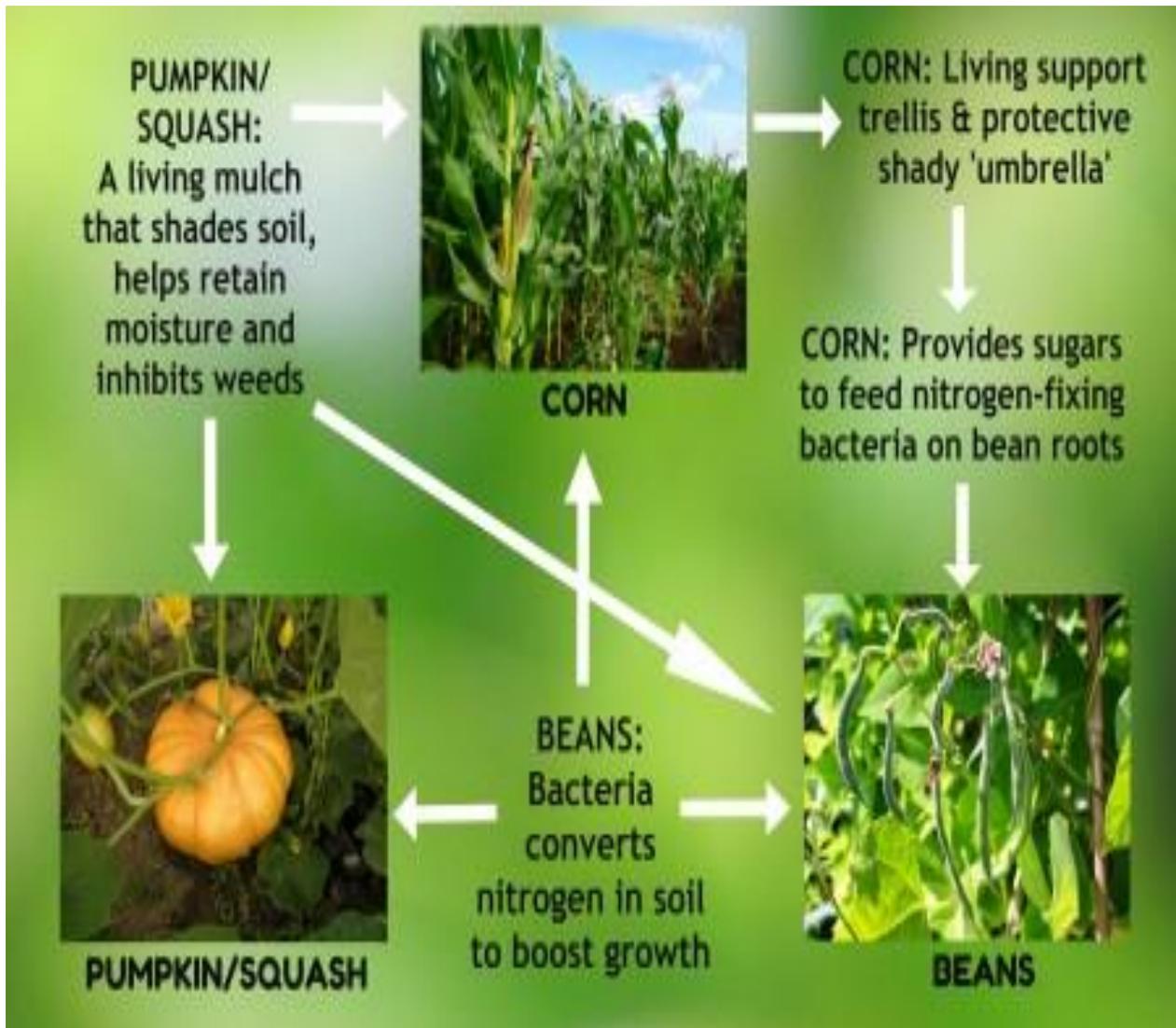
Corn, beans and squash also complement each other nutritionally. Corn provides carbohydrates, the dried beans are rich in protein, balancing the lack of necessary amino acids found in corn. Finally, squash yields both vitamins from the fruit and healthful, delicious oil from the seeds.

Native Americans kept this system in practice for centuries without the modern conceptual vocabulary we use today, i.e. soil nitrogen, vitamins, etc. They often look for signs in their environment that indicate the right soil temperature and weather for planting corn, i.e. when the Canada geese return or the dogwood leaves reach the size of a squirrels ear.<sup>18</sup>



<sup>18</sup> <http://www.reneesgarden.com/articles/3sisters.html>

## How the Three Sisters Work Together



Image<sup>19</sup>

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<sup>19</sup><http://themicrogardener.com/wp-content/uploads/2014/06/A-Mutually-Beneficial-Guild-Planting-e1402021501607.jpg>



## The Three Sisters --- From Seed to Table



<http://heritagefoodsusa.com/blog/wp-content/uploads/2013/10/1WCP-WholeCorn.jpg>



<http://heritagefoodsusa.com/blog/wp-content/uploads/2013/11/braiding.jpg>

White corn was an Iroquois staple food. It was tasteful and high in nutritional value. The Iroquois tribes would dry the cobs and store the kernels in clay pots during the winter. Corn was also ground into flour which was used as an ingredient in other foods. The husks were used to stuff and line clothing as well as to make corn-husk dolls.



[http://appalachianheritoomplantfarm.weebly.com/uploads/5/4/4/3/5443684/5418561\\_orig.jpg](http://appalachianheritoomplantfarm.weebly.com/uploads/5/4/4/3/5443684/5418561_orig.jpg)



[http://farm1.staticflickr.com/139/359864337\\_1aa6f9530\\_z.jpg](http://farm1.staticflickr.com/139/359864337_1aa6f9530_z.jpg)

The Iroquois planted a variety of beans. Beans were harvested and dried and stored in pots in order to provide food during the winter season. Beans were a good source of protein, which was important during times when hunting was difficult due to harsh winter conditions.



<http://www.waldeneffect.org/20110801squashseeds.jpg>



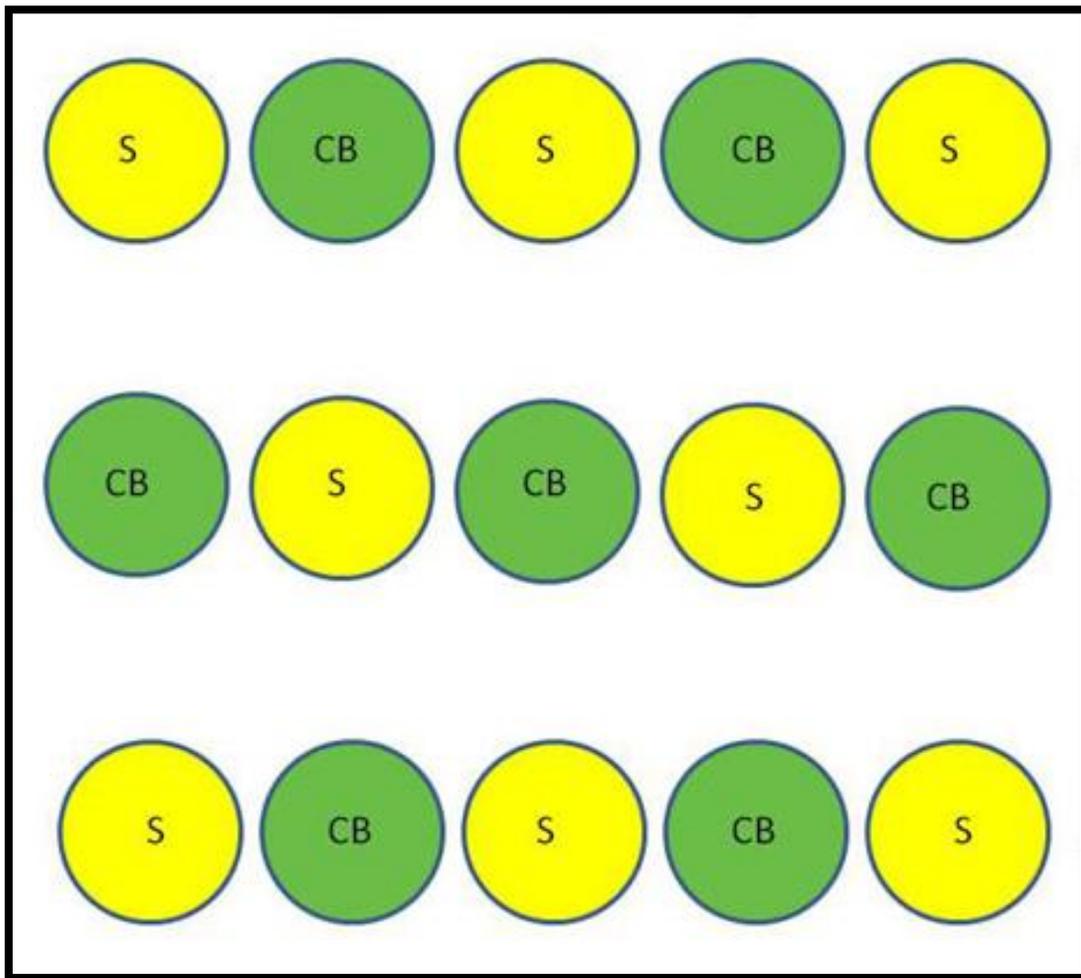
[https://www.seedparade.co.uk/710-large\\_default/summer-squash-sunburst-f1-5-seeds.jpg](https://www.seedparade.co.uk/710-large_default/summer-squash-sunburst-f1-5-seeds.jpg)

Squash provided the Iroquois with vitamins. It was dried and stored in clay pots in order to be eaten during the winter when sunshine was limited because of shortened daylight and other sources of vitamins like roots and berries were not available.

## Investigating a Three Sisters Garden

The mounds indicated with the “S” are used for planting squash. The mounds indicated with the “CB” are used for planting corn and beans. Given the following conditions, calculate the amount of space needed for the following Three Sisters garden plan:

- Mounds of the same type must be 1.5 m apart from centre to centre
- There must be 10 cm between mounds in each row
- Each mound measures 45 cm across.<sup>20</sup>



**Reflection:** The Iroquois would not have measured out their garden using meters and centimetres. How might they have measured out the spacing necessary for their garden to grow successfully?

<sup>20</sup> <http://www.reneesgarden.com/articles/3sisters.html>

## Creating a Three Sisters Garden Plan

Using “S” circles and “CB” circles, create a Three Sisters garden plan considering the following conditions:

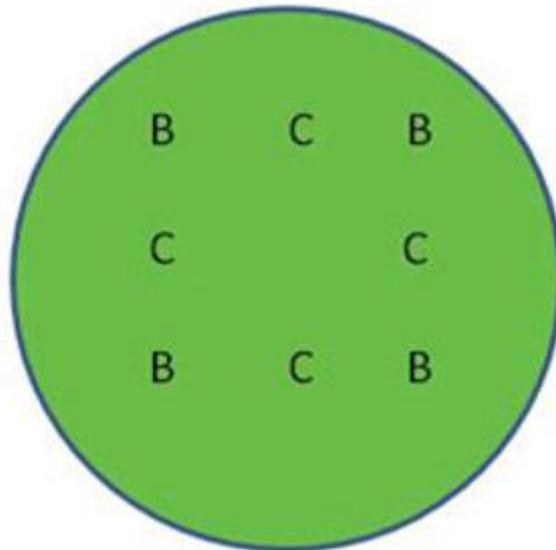
- Mounds of the same type must be 1.5 m apart from centre to centre
- There must be 10 cm between mounds in each row
- Each mound measures 45 cm in width
- You need to have 15 squash mounds and 14 corn and bean mounds.
- There is no restriction to the shape of your space or to the number of rows you use to create your garden

Be sure to indicate all of your measurements and units with clear labels. Be prepared to discuss your thinking with others.

## How Much Corn?

A typical corn plant produces one ear although multiple ears per plant can exist if resources (space, water, nutrients, etc.) are not limited. One silk is attached to each kernel allowing it to receive pollen. The average ear of corn has approximately 400 to 600 kernels arranged in 16 rows. On average, one bushel of corn contains about 90,000 kernels. (Source: <http://www.agronext.iastate.edu/corn/corn-qna.html>)

**Problem 1:** In one corn and bean mound, seeds are planted according to the following diagram:



Image<sup>21</sup>

If, according to the information above, each stalk yields one cob, then how many cobs would this mound yield?

If, according to the information above, an average cob of corn has approximately 400-600 kernels of corn, how much corn might this mound yield?

What if each stalk yielded 2 cobs? How does this change your calculated values?

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<sup>21</sup> <http://www.reneesgarden.com/articles/3sisters.html>

**Problem 2:** Create a table or chart to organize your calculations for the following garden scenarios:

- a) 8 mounds of corn and beans
- b) 13 mounds of corn and beans

Calculate the values considering your stalks yield up to 3 cobs. How many cobs of corn and how many kernels will the gardens yield?

**Problem 3:** Remembering that 1 bushel of corn typically holds 90 000 kernels, consider:

- How many cobs of corn would you need to harvest in order to produce a bushel of corn kernels?
- If your garden's stalks of corn typically yield 2 cobs of corn, how many seeds would you need to plant if you were planning to harvest 1 bushel of corn kernels?
- How many mounds would that require in your Three Sisters garden?

## Iroquois Trade and Economy

Traditionally, the Iroquois were farmers and hunters. They also fished and gathered berries, plants, and roots. Before the arrival of Europeans their primary weapons were bows and arrows, stone axes, knives, and blowguns; however, by the late 1800's European goods had almost completely replaced the weapons and tools typically traded. Their principal crops maize, beans, and squash were prominent in ceremonial activities as well as in their day-to-day diet. Surplus crops were dried and stored for future use, especially during the winter when harsh weather conditions made hunting and fishing difficult. The Iroquois people followed a consistent pattern for survival --- after the harvest of crops in the late summer, fall hunting lasted until the winter solstice, early spring fishing and hunting of passenger pigeons followed, and then spring and summer clearing and planting of fields occurred.

The Iroquois were masters of bending and shaping wood when it was green or after it was steamed. House frames, pack frames, snowshoes, toboggans, basket rims, lacrosse sticks, and other wood products were made using these techniques. Rope was made from the inner bark of hickory, basswood, and slippery elm, and straps or ties were made from the braided fibers of nettle, milkweed, and hemp plants. Pipes of fired clay were among the many types of items manufactured by the Iroquois. They are known for making ash and maple baskets.

The Iroquois were involved in an intricate trade network with other native groups, especially with those other native groups all along the east coast of North America. The Iroquois were known to be particularly aggressive in their trading behavior and this is assumed to be as a result of their goal to maintain an important role as a middleman within the European fur trade system. According to this theory, the Iroquois warred primarily to obtain the trade goods of their neighbors who were in closer contact with Europeans.<sup>22</sup>

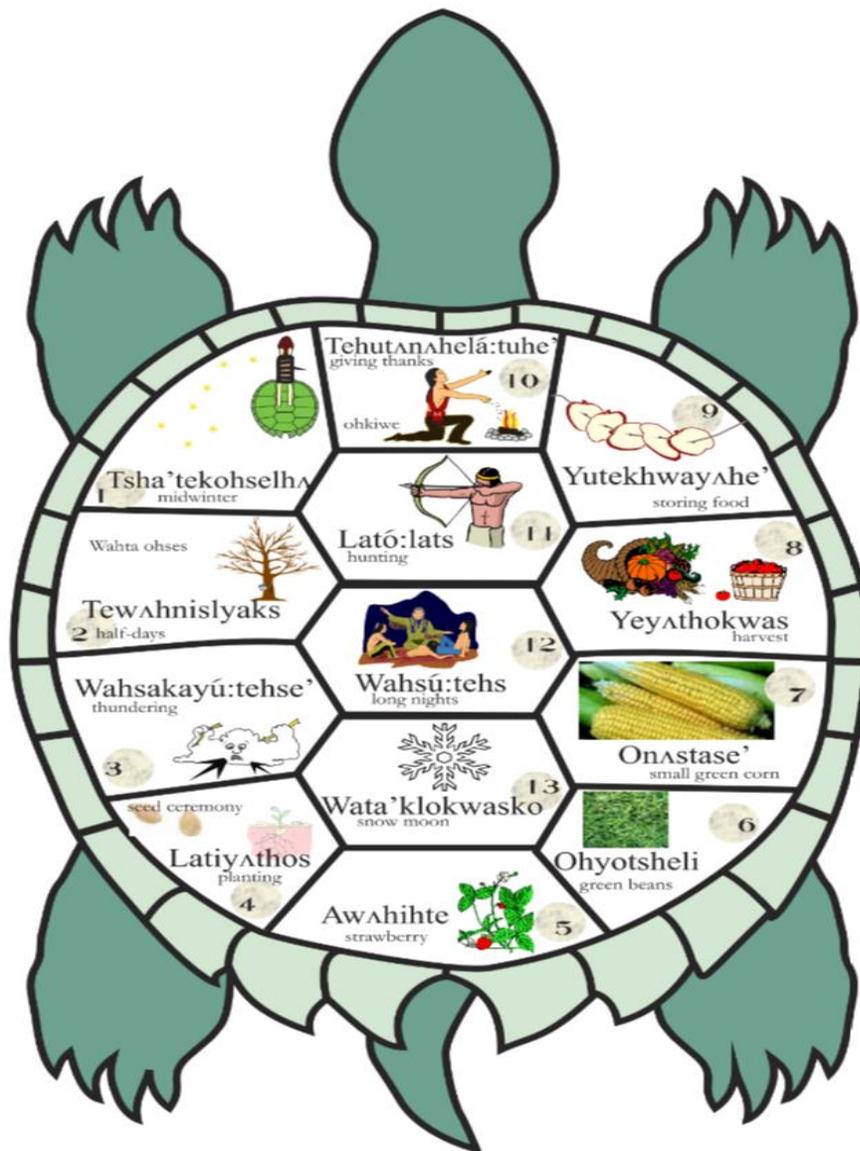
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<sup>22</sup> <http://www.encyclopedia.com/topic/Iroquoian.aspx>

## Aboriginal Calendars

Aboriginal calendars are not the same as our western calendar. They are lunar calendars that are logical to a people who are closely linked to nature. The different times of the moon are closely linked to corresponding important yearly events.

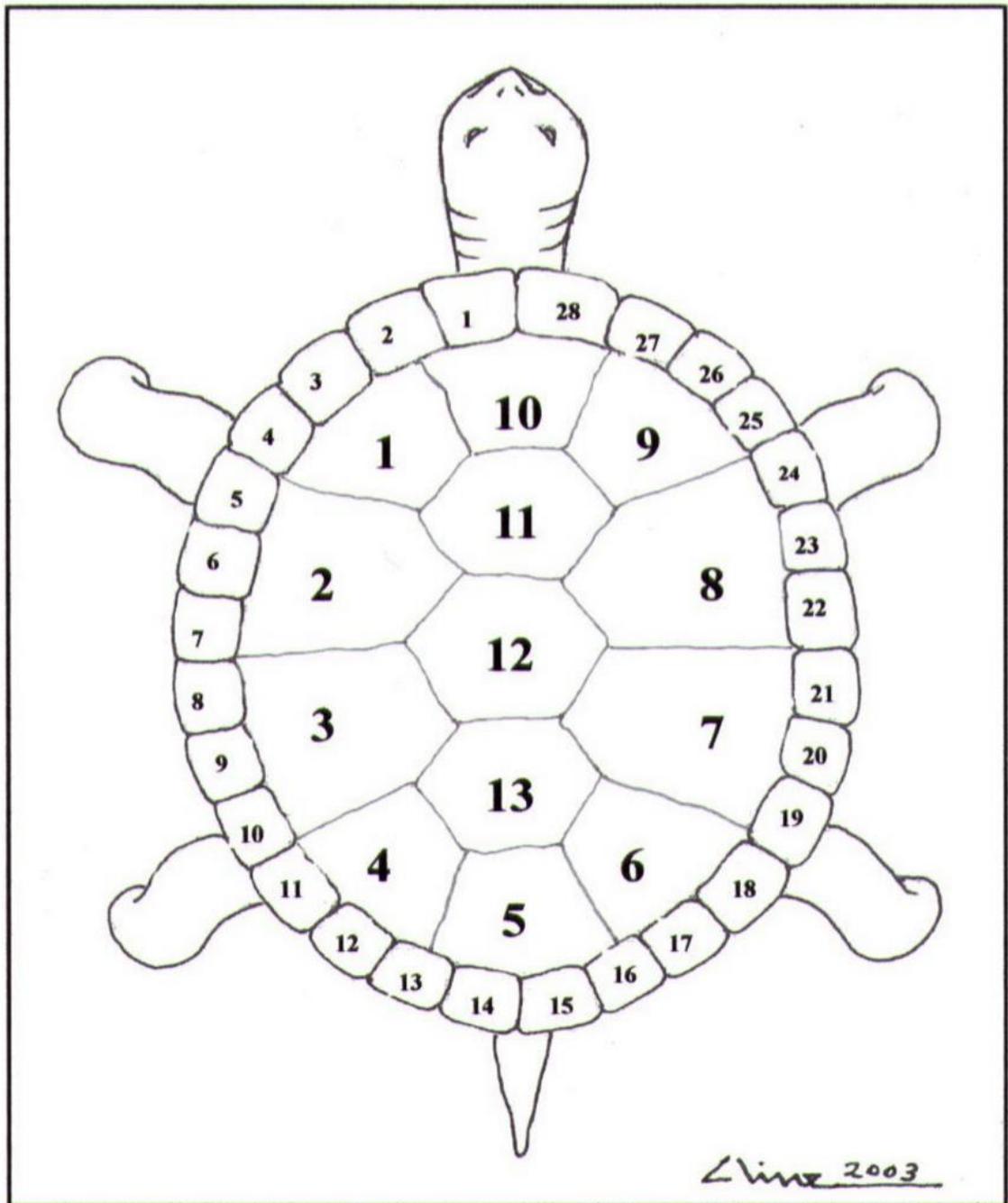
In each nation, Ojibwe, Cree, and Mohawk, there are many different names and variations of the thirteen moons. This is why these calendars do not often match up with the typical 12 month calendar. The naming of the moons also has a cultural teaching that explains the cycle of life and nature within the respective cultures. Most calendars today use the 12 month cycle even though traditionally the Ojibwe, Cree and Mohawk calendar year followed a 13 moon lunar cycle.



Image<sup>23</sup>

<sup>23</sup> [onlc.ca/wp-content/uploads/2014/06/13-Moon-curriculum2.pdf](http://onlc.ca/wp-content/uploads/2014/06/13-Moon-curriculum2.pdf)

On a turtles back the pattern of scales establishes the combination of numbers that define the lunar calendar cycle. The circle of scales that surround the edge add up to 28, the number of days that comprise the lunar cycle. (28 days from full moon to full moon). The center of the shell has a pattern of thirteen larger scales which represent the 13 moons of the lunar calendar.



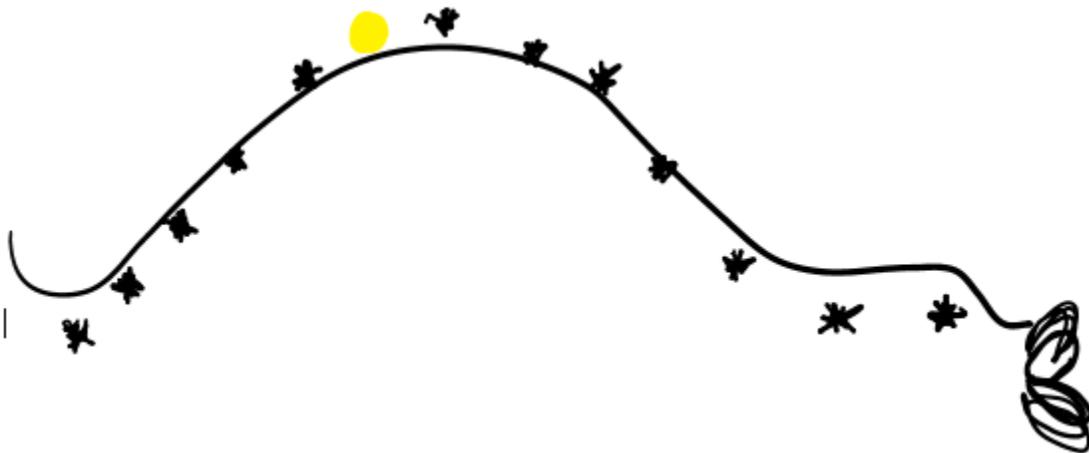
Image<sup>24</sup>

<sup>24</sup> <http://dcsymbols.com/design/13moons.jpg>

## The Aboriginal Calendar and Trading

Keeping track of the date and of appointments was done with the help of a knot rope. Small knots were tied into a string of rope to count the number of days passing and large knots or beads symbolized the new moon. If a trade meeting was organized, the knot rope would help the partners keep track of the passing days and moons until it was time to meet.

Image<sup>25</sup>



The small black star-shaped marks indicate single days.

The yellow circle (a bead or a larger knot) indicates a new moon (month) begins.

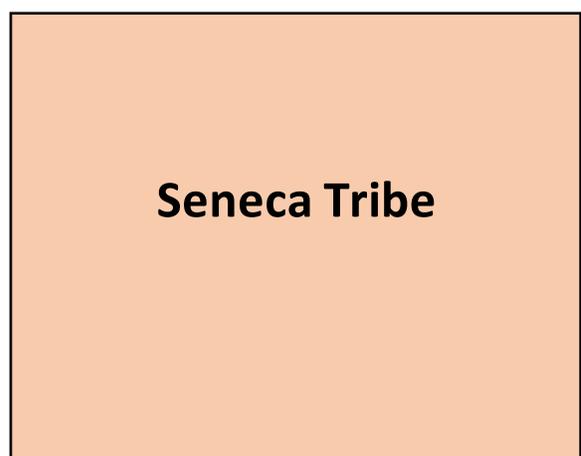
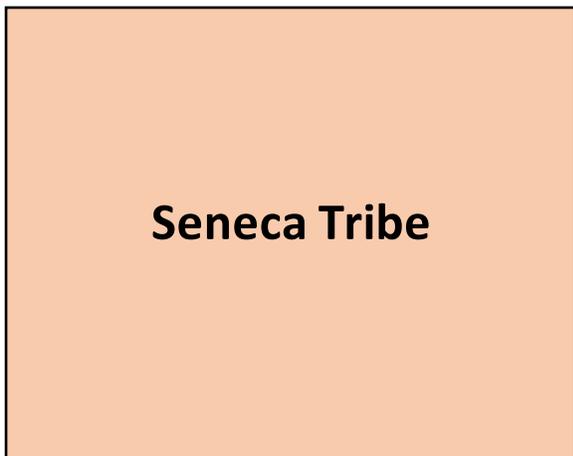
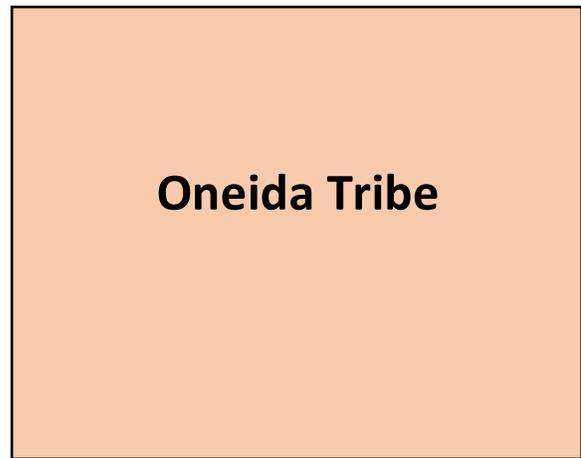
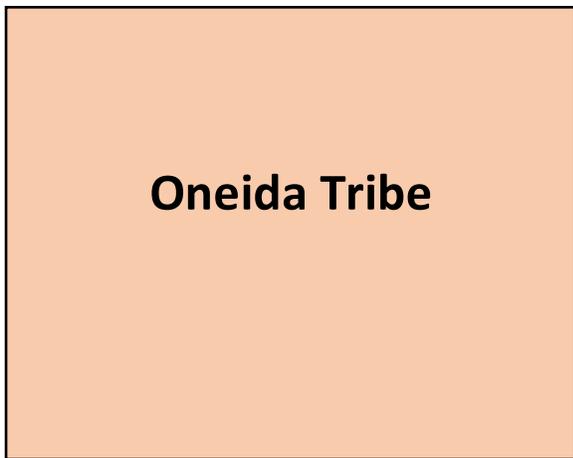
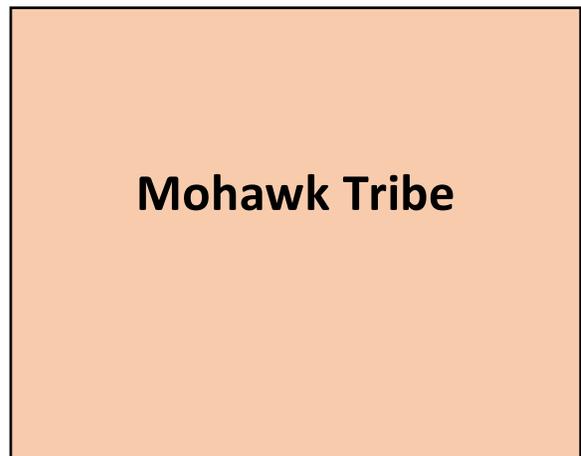
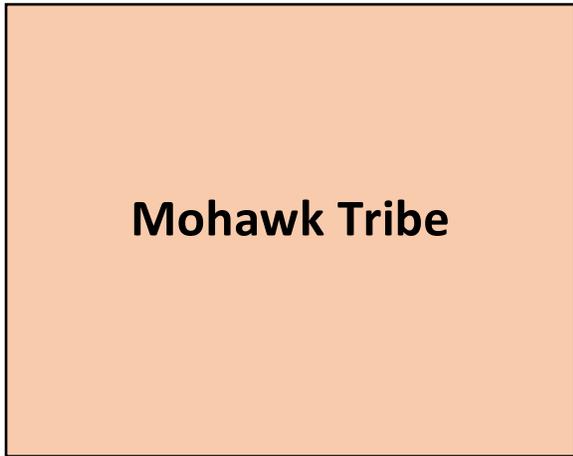
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<sup>25</sup> [http://www.crystalinks.com/inca\\_calendar2.jpg](http://www.crystalinks.com/inca_calendar2.jpg)

What would a knot rope look like if you were attending a trade meeting given the following conditions:

- 2 weeks from today?
- 2 months from today?
- 3 months and 2 days from today?

***The Trade Meeting* Playing Cards – Roles Blackline Masters**



*The Trade Meeting* Playing Cards – Roles

**Onondaga Tribe**

**Onondaga Tribe**

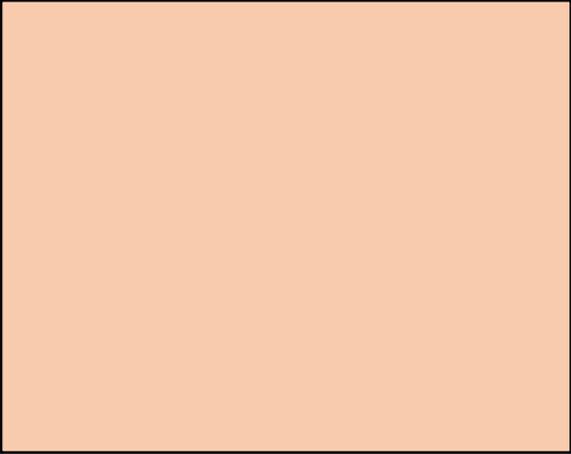
**Cayuga Tribe**

**Cayuga Tribe**

**European Trader**

**European Trader**

*The Trade Meeting* Playing Cards – Roles



*The Trade Meeting* Playing Cards – Situational Circumstances

**POOR HARVEST**

**POOR HARVEST**

**POOR HUNTING  
SEASON**

**POOR HUNTING  
SEASON**

**IN NEED OF STORAGE  
CONTAINERS**

**IN NEED OF STORAGE  
CONTAINERS**

*The Trade Meeting* Playing Cards – Situational Circumstances

**HARSH AND COLD  
WINTER PREDICTED**

**HARSH AND COLD  
WINTER PREDICTED**

**SHORTAGE OF  
WAMPUM BEADS**

**SHORTAGE OF  
WAMPUM BEADS**

**TRIBE IS ON VERGE OF  
WARRING ENEMY  
NATION**

**TRIBE IS ON VERGE OF  
WARRING ENEMY  
NATION**

*The Trade Meeting* Playing Cards – Situational Circumstances

**SPIRITUAL  
CEREMONIES ARE KEY  
TO WELLNESS**

**SPIRITUAL  
CEREMONIES ARE KEY  
TO WELLNESS**

**SHORTAGE OF ANIMAL  
SKINS FOR SEWING  
CLOTHING**

**SHORTAGE OF ANIMAL  
SKINS FOR SEWING  
CLOTHING**



*The Trade Meeting* Playing Cards – Trade Goods

**2 BUSHELS OF CORN**

**2 BUSHELS OF CORN**

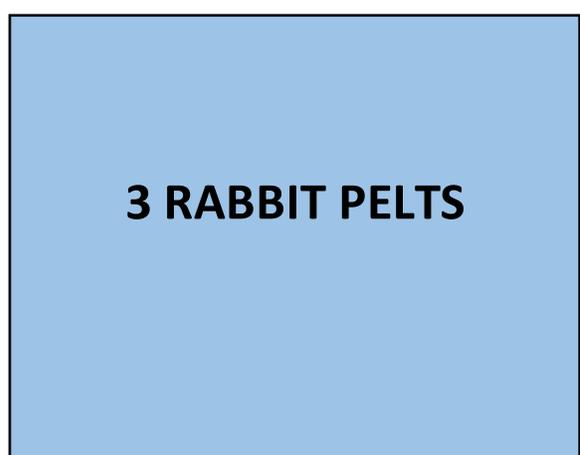
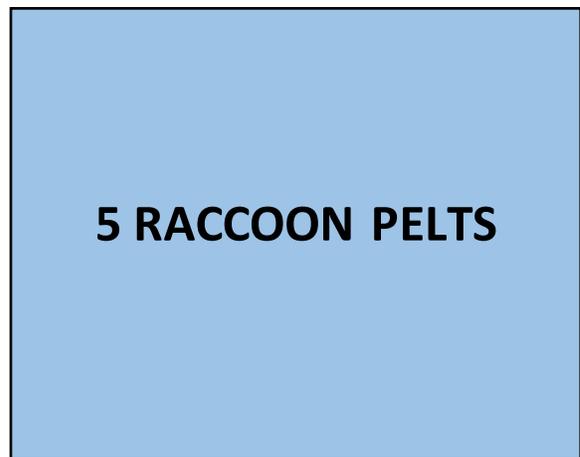
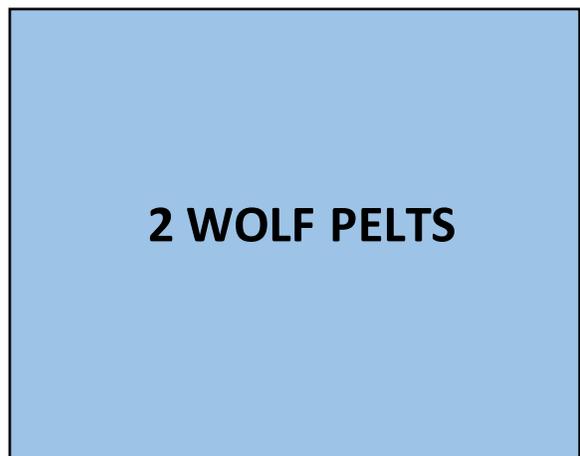
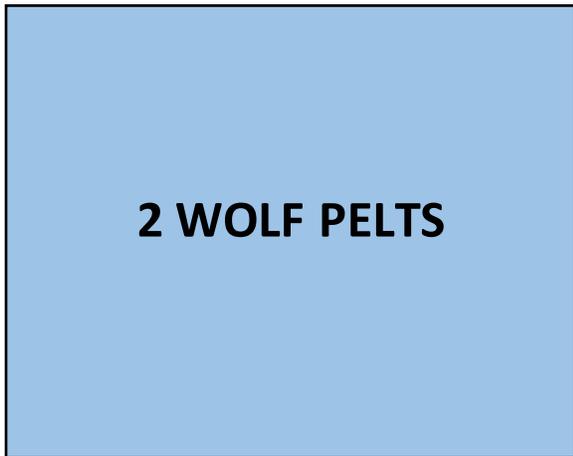
**5 BEAVER PELTS**

**5 BEAVER PELTS**

**3 BEAVER PELTS**

**3 BEAVER PELTS**

*The Trade Meeting* Playing Cards – Trade Goods



*The Trade Meeting* Playing Cards – Trade Goods

**2 BUSHELS OF CORN**

**2 BUSHELS OF CORN**

**5 CLAY POTS WITH LIDS**

**5 CLAY POTS WITH LIDS**

**3 SETS OF SNOW SHOES**

**8 LARGE BLACK ASH  
BASKETS**

*The Trade Meeting* Playing Cards – Trade Goods

**2 SETS OF SNOWSHOES**

**5 PAIRS OF  
MOCCASINS**

**5 COILS OF ROPE**

**15 SMOKED FISH**

**5 POTS OF MAPLE  
SYRUP**

**3 CLAY PIPES**

*The Trade Meeting* Playing Cards – Trade Goods

**2 CANOES**

**5 LACROSSE STICKS**

**5 CORN RATTLES**

**3 DRUMS**

**5 HATCHETS**

**10 BOWS**

*The Trade Meeting* Playing Cards – Trade Goods

**2 SMALL SACKS OF  
GLASS BEADS**

**2 BOLTS OF TRADE  
CLOTH (WOOL)**

**5 COPPER POTS**

**5 COPPER JUGS**

**3 BOLTS OF TRADE  
CLOTH (WOOL)**

**3 BLANKETS (WOOL)**

*The Trade Meeting* Playing Cards – Trade Goods

**2 MUSKETS**

**2 MUSKETS**

**10 CORN HUSK DOLLS**

**3 SMALL SACKS OF  
WAMPUM BELT BEADS**



## Learning Experience 2: Exploring Mathematics Through Indigenous Music

### Learning Destination:

How might music within Indigenous culture connect to a greater understanding of mathematical concepts?

**Rationale:** Since music is commonly referred to as the universal language, the intent is to use Aboriginal music to access mathematical thinking and learning. The learning experiences outlined are not intended to be taught by a music specialist. Educators will co-learn with students and discover new connections between math and music. In our Catholic tradition music is used for celebration, reflection and community building. With this in mind, we recognize the parallel significance with Aboriginal culture as we all use music to celebrate, reflect and build community.

### Setting the Context:

Music is significant to every culture and has varied purposes. For Indigenous people this is true in daily life and ceremony. This learning experience attempts to combine the inherent rhythmic nature of Aboriginal music with some predictable patterns in mathematics. Several math strands are interconnected in the tasks outlined below. Elements of Measurement, Number Sense and Patterning may be explored through the lens of Aboriginal music.

**Division Level:** Intermediate

### Big Ideas:

- ❖ **Math Intermediate** (Marian Small, 2009)
  - **Measurement:**
    - There is a constant relationship between radius, diameter and circumference for every circle.
  - **Number Sense and Numeration:**
    - There are multiple models and/or procedures for comparing and computing with fractions, just as with whole numbers. (p.1)
  - **Patterning and Algebra:**
    - The mathematical structure of a pattern can be represented in a variety of ways. (p.46)
- ❖ **Catholic Graduate Expectations**
  - **A Discerning Believer Formed in the Catholic Faith Community**
    - Respects the faith traditions, world religions and the life-journeys of all people of good will.

- **A Reflective, Creative and Holistic Thinker**
  - Thinks reflectively and creatively to evaluate situations and solve problems.
- **A Self-Directed, Responsible, Lifelong Learner**
  - Demonstrates flexibility and adaptability.
- **A Collaborative Contributor**
  - Works effectively as an interdependent team member.

**Possible products:**

- Performance of a rhythmic piece, demonstrating understanding of equivalent fractions, using drums, rattles, or handmade instruments.
- Each piece will include a distinct pattern, including an accented, or 'honour beat.'
- Students might design and create a drum to use.
- Several groups from different divisions could come together to perform for each other or in a school assembly.

## Task 1: A Focus on Measurement

### Activation:

Show the following video to highlight the importance of the circle and the mathematical thinking in the construction of the drum.

[David Finkle Building a Grandfather Drum<sup>26</sup>](#)

Since the circle is so significant in Aboriginal culture, such as in the Medicine Wheel, talking circle and drum circle, this task will focus on using the drum to explore concepts about circle. Show the video to demonstrate the steps in creating a drum.

Show image of David Finkle and his drum to class. Students will work with a partner and discuss what they already know about a circle.

What do the students notice about the drum and its attributes?

What questions do the students have about this image? (10-15 minutes)

Record student thinking about their prior knowledge, making note of what is unclear to them.



Image<sup>27</sup>

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<sup>26</sup> <https://www.youtube.com/watch?v=NS6b961JXFY>

<sup>27</sup> David Finkle - Indigenous musician, community partner with EOCCC

**Action:**

Grade 7	Grade 8
<b>Learning Goal:</b> We are learning to research and report on real life applications of area measurements and angle properties	<b>Learning Goal:</b> We are learning to have a better understanding of the math terms relating to measurement of a circle.
<b>Success Criteria:</b> <ul style="list-style-type: none"><li>• I can construct related lines using angle properties.</li><li>• I can estimate and calculate the area of composite two-dimensional shapes by decomposing into shapes into known area relationships.</li><li>• I can apply what I've learned about the properties of angles and polygons to explore the structure of the drum</li></ul>	<b>Success Criteria:</b> <ul style="list-style-type: none"><li>• I can determine the relationships for calculating the circumference and the area of a circle.</li><li>• I can solve problems involving the estimation and calculation and circumference and the area of a circle.</li><li>• I can apply what I've learned about the properties of a circle when I explore the structure of the drum.</li></ul>

What predictions can the students make about the relation between the size and/or width (diameter) of the drum and the tone or pitch? If there are any drums within the school, students can then test their thinking as they play and listen to the various tones. Can the students connect their thinking to other examples of instruments?  
Students will review math terms such as radius, diameter and circumference.

**Consolidation:**

Students will construct a circle and will label the radius and diameter. This circle can be done in their notebooks or with materials found in the classroom. Students may wish to work with a partner.

What do they notice about the radius in relation to the diameter?

How might these measurements help to determine how the width of the diameter affects the tone of the drum?

Students will work with a partner to describe the relationship between the two.

What are the students able to demonstrate that they know about the area of a circle?

**Task 2: Number Sense and Numeration Focus: Fractions**

**Activation:**

Explain the significance of the number 4 in Aboriginal culture, such as the 4 sacred medicines, 4 Cardinal directions, 4 seasons, 4 keys to a balanced life: physical, spiritual, intellectual, emotional. Music appeals to us in all 4 of these realms too. Brainstorm how music impacts us physically, spiritually, intellectually and emotionally. Students could consider their own playlists on their devices. What songs do they choose and for what purpose?

**Action:**

Grade 7	Grade 8
<b>Learning Goal:</b> We are learning to become more proficient in our understanding of the relationship between fractions.	<b>Learning Goal:</b> We are learning to identify and describe real-life situations involving quantities that are proportional.
<b>Success Criteria:</b> <ul style="list-style-type: none"> <li>• I can represent fractions by creating a rhythmic piece in 4/4 time</li> <li>• I can recognize the relationship between the following fractions e.g. (<math>\frac{1}{2} = \frac{1}{4} + \frac{1}{4}</math>)</li> <li>• I can add and subtract fractions with simple like and unlike denominators using a variety of tools</li> <li>• I can use a variety of mental strategies to solve problems involving addition and subtraction of fractions</li> </ul>	<b>Success Criteria:</b> <ul style="list-style-type: none"> <li>• I can represent fractions by creating a rhythmic piece in 4/4 time</li> <li>• I can recognize the relationship between the following fractions e.g. (<math>\frac{1}{2} = \frac{1}{4} + \frac{1}{4}</math>)</li> <li>• I can solve problems involving addition, subtraction, multiplication, and division of simple fractions</li> <li>• I can translate between equivalent forms of a number (<math>\frac{1}{4} + \frac{1}{4} = \frac{1}{2}</math>)</li> </ul>

Divide class into 4 groups to explore ‘musical fractions.’ Groups can clap, tap, snap (or use whatever instruments you have available to you) to demonstrate the relationship of the fractions below:

- whole note, lasting 4 beats.
- $\frac{1}{2}$  notes, lasting 2 beats each
- $\frac{1}{4}$  notes, lasting 1 beat each
- $\frac{1}{8}$  notes, lasting half a beat each

An example of this activity is shown in the following video, featuring David Finkle:

[Fractions and Beats<sup>28</sup>](https://www.youtube.com/watch?v=D3vFwZej5N0&feature=youtu.be)

Note that the tempo should remain steady. (Ideally, a drum with some sustaining effect will be helpful to show a whole note. Strike drum on beat 1, then count 2, 3, 4)

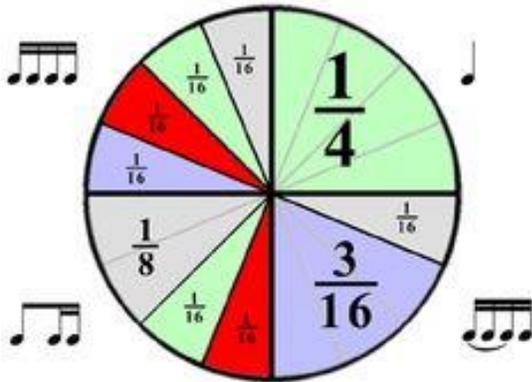
What do the students notice about how the fractions relate to one another? Students will participate in a Think, Pair, Share activity. They will record their ideas and show what they have observed. (Chart paper, audio or video recording).

Students will move to expert (jigsaw) groupings, where they will continue to explore the relationship of the fractions.

**Consolidation:**

What observations or generalizations do the students make about equivalent fractions? Create an anchor chart that shows what they have observed. Introduce the image of the circle graph below. Can they extend the pattern to 32nd notes, 64th notes?

<sup>28</sup> <https://www.youtube.com/watch?v=D3vFwZej5N0&feature=youtu.be>



Image<sup>29</sup>

### Next steps:

Musically, many songs are written in a 4/4-time signature. Using this common time, rearrange the note values from the musical 'fractions' to create measures with 4 beats to the bar.

Students will create a 4 measure rhythmic piece, using all the musical 'fractions' introduced. (whole, half, quarter, eighth).

Students will use standard music notation (refer to the image) to create equations.

Example:  $\frac{1}{4}$  note +  $(\frac{1}{8} + \frac{1}{8})$  notes =  $\frac{1}{2}$  note

### Task 3: Finding Rhythm Patterns in Indigenous Music

**Patterning Focus:** In this task, students will explore patterns in music from different Indigenous nations and will take note of any differences in the rhythmic patterns they hear.

**Activation:** Clap, tap, snap some rhythm patterns for students to echo. If students know "The Cup Song" from the movie *Pitch Perfect*, then they can demonstrate or teach the group. These rhythm patterns engage us and are simply fun to do. Patterns are clearly part of music and math. Show some of the following videos to demonstrate a variety of rhythm patterns in Indigenous music.

[Water Song by the Akwesasne Women Singers](#)<sup>30</sup> (Haudenosaunee music) Indigenous communities are changing. Traditionally, women would not be drumming; they are water carriers. This video includes women drumming, using water drums, along with rattles, while singing about their love of the waters.

In the next video, there are several examples of various rhythms on both rattles and drums. [Examples of a few Anishinabe songs and dance](#)<sup>31</sup> (Anishinabek music) performed by Aurora Finkle.

<sup>29</sup> <https://www.pinterest.com/pin/133841420148242417/>

<sup>30</sup> <https://www.youtube.com/watch?v=9MvNaFWcQf4>

<sup>31</sup> Finkle, Aurora et al <https://www.youtube.com/watch?v=ruVhacWNNkI&list=PL80DD725B4A61126B&index=29>

The following video highlights a popular style of drumming from the North and West.  
[Round Dance](#)<sup>32</sup>(Cree and Ojibway)

One of the most popular beats within Indigenous North American cultures is the heartbeat.  
[Strong Woman Song](#)<sup>33</sup> (Utilizing heartbeat rhythm)

Students will listen to the recordings and identify a rhythmic pattern on a drum or rattle in the recordings. In pairs, students can try to record what they hear using non-standard notation.

Example: ' / ' / ' / ' or // //.

Do the students notice any obvious differences in the rhythm patterns of the songs from different Indigenous groups?

**Action:**

Grade 7	Grade 8
<p><b>Learning Goal:</b>            We are learning to understand that patterns are everywhere, especially in music.</p>	<p><b>Learning Goal:</b>            We are learning to understand that patterns are everywhere, especially in music.</p>
<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>• I can recognize different patterns in the various songs</li> <li>• I can create my own pattern to perform with my group</li> <li>• I can translate phrases describing mathematical relationships into algebraic expressions</li> <li>• I can model real-life relationships involving constant rates where the initial condition starts at 0 through investigation using tables of values and graphs</li> <li>• I can model real-life relationships involving constant rates using algebraic equations with variables to represent changing quantities in the relationship</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>• I can describe different ways in which algebra can be used in real-life situations</li> <li>• I can recognize different patterns in the various songs</li> <li>• I can create my own pattern to perform with my group</li> <li>• I can model linear relationships using tables of values, graphs and equations through investigations using a variety of tools</li> <li>• I can determine a term, given its term number, in a linear pattern</li> </ul>

- 1) Students will explore using the instruments, or claps, snaps and taps to create a rhythmic pattern of at least 8 measures. They should work in small groups to plan their rhythmic pattern performance. Include a variety of sounds, ideally drums and rattles, to authenticate the effect.

<sup>32</sup> Whitefish, Andy, <https://www.youtube.com/watch?v=a2vKnV-CnEE>

<sup>33</sup> [https://www.youtube.com/watch?v=7LAT\\_0zsRoQ](https://www.youtube.com/watch?v=7LAT_0zsRoQ)

- 2) Students will represent their 8 measure rhythmic pattern in a numerical phrase.  
Challenge students to determine an algebraic representation of their numerical phrase.
- 3) Students will extend their rhythmic pattern to determine a term, given the term number.  
E.g. Ask Students, what would the 25<sup>th</sup> beat be in your pattern? 77<sup>th</sup>? Etc.
- 4) Students will manipulate their rhythmic pattern by increasing and decreasing the tempo.  
Again, challenge students to determine a numeric and algebraic representation of their new rhythmic pattern.

**Consolidation:**

Students will sit in their small group in a drumming circle. They will review the expectations for the culminating performance and make any necessary adjustments.

All groups will come together to form 2-3 larger circles. Each group could select a drum leader to ensure a steady beat throughout. They will listen to each other's performances and give informal feedback.

Allow time to make whatever changes might be needed.

All groups will collaborate as one to plan an arrangement of the 8 bar rhythms, where groups come in at various points until they are pleased with the result.

The large group will then perform for an audience.

Students will reflect on the challenges and enjoyment of playing together in a reflective journal.

**Next steps:**

Students might then create a rhythmic piece that tells a story such as a thunder and lightning storm; someone lost in the forest; dawning of a new day; students' ideas...

The Intermediate students could join with other grades to produce music in the following way:

- Primary students could be given the pattern to reproduce as a large group.
- Junior students could create 4 bar rhythm patterns in 2 groups.

**Curriculum Connections:**

- **Geography Grade 7** Physical Patterns in a Changing World:
  - Big Idea: People's activities are related to the physical features and processes in their region.
- **Geography Grade 8** Global Inequalities: Economic Development and Quality of Life:
  - Big Idea: Issues related to inequalities in global development and quality of life can have social, environmental, political, and/or economic implications.
- **History Grade 7** New France and British North America, 1713-1800:
  - Big Idea: Understanding the experiences of and challenges facing people in the past helps put our experiences and challenges into context
- **History Grade 8** Creating Canada:
  - Big Idea: Not all Canadians enjoyed the same rights and privileges in the new nation.
- **Language Grade 7 Writing:**

- Big Idea: Write for a specific purpose and audience-a legend or myth
- **Language Grade 8 Oral Communication:**
  - Big Idea: Use speaking skills and strategies appropriately to communicate for a specific audience and purpose-storytelling of a legend or myth
  
- **Music Grade 7/8:**
  - Big Idea: Exploring Forms and Cultural Contexts: demonstrate an understanding of a variety of musical genres from past and present and their sociocultural and historical contexts.
- **Dance 7/8:**
  - Big Idea: Exploring Forms and Cultural Contexts: demonstrate an understanding of a variety of dance forms, traditions, and styles from the past and present, and their sociocultural and historical contexts.
- **Religion 7/8 Living a Moral Life:**
  - Big Ideas: The four Cardinal Virtues: Prudence, Justice, Fortitude and Temperance can be achieved and sustained by human effort (i.e. education and good actions – habits)

## **Learning Experience 3: Exploring Patterning & Algebra with an Indigenous Lens**

### **Learning Destination**

Acknowledge the territory on which your school resides. Based on educational experiences, students will create a representation of Traditional Indigenous beading practices and show the correlation to the patterning and algebra curriculum based on their grade level.

### **Rationale**

To learn about Traditional Indigenous beading, the history and culture behind it and linking it to patterning and algebra in the grade 4-6 Mathematics curriculum.

### **Setting the Context**

Beading in the current modern sense is considered a “new” Art form to Canadian Indigenous peoples; however, Indigenous peoples worked with quills from porcupines to add beauty to their clothing, footwear and bags which resembled more geometric patterns for many centuries before European contact.

When the Europeans arrived on Turtle Island (also referred to as North America), they brought beads along with them that were ceramic (ceramic pony beads) and glass. Beads were used to trade items during the Fur Trade near Hudson Bay as well as James Bay in Ontario. Indigenous peoples would bring their furs and meat and barter for manufactured goods; beads being one of them. The Indigenous peoples had an extensive tradition of trading all throughout Turtle Island and were able to barter their goods quickly. Word got out quickly about the new types of beads. While beadwork was mainly geometrically styled, Indigenous peoples altered their style, post contact to appeal to the Victorian style of lace. Indigenous peoples use a variety of stitches to obtain a certain outcome of their patterns. Some include: the peyote stitch, the lazy stitch, and the double curve.

Many of the Indigenous patterns resembled the landscape that the specific Indigenous nation came from. This resulted in earth colours, imitations of hills, mountains and/or plains, or of their traditional dwellings (e.g., Teepee, Longhouse) as well as colours that were native to their location in Turtle Island. For example, the Prairies had different shades of yellow and brown to resemble Prairie dresses as well as blue to resemble the vast sky above. Flowers were also predominant in many Indigenous beading patterns. It seems beading patterns were and still are focused on the beauty reflected in nature. This is a reflection of the high respect that Indigenous peoples have for Mother Nature.

In Indigenous nations, having intricately beaded clothing is highly valued as it is a symbol of utmost respect for a particular individual. This individual may be someone who is chief of their nation/village, an Elder or someone who has accumulated much respect for their actions within their community.

As Europeans moved in and began to settle on Turtle Island, a lot of the Indigenous peoples' valuable items (both ceremonial and cultural) were confiscated and eventually ended up in museums (but not the stories that accompany them). Today they serve as historical items for us to look upon and learn about. In the Museum of History (<http://www.historymuseum.ca/>), located in Gatineau, Quebec, visitors can enjoy on-going exhibitions that provide a valuable learning experience. (The information in this Setting the Context section was provided orally from Laura Leonard, July 12, 2016, at the Ottawa Catholic School Board, located in Ottawa, Ontario).

**Focus:** To explore the correlation between Canadian Aboriginal culture, Mathematics, nature, and the interrelated spiritual connection that bind these.

## Big Ideas

### ❖ Mathematics:

- **Patterning and Algebra**
  - A group of items form a pattern only if there is an element of repetition, or regularity that can be described with a pattern rule.
  - Variables can be used to describe relationships of unknowns.
  - The same algebraic expression or equation can be related to different real-world situations or vice versa.
  - Limited information about a mathematical relationship sometimes, but not always, allows us to predict other information about that relationship.
- **Number Sense and Numeration**
  - Numbers tell how much and how many.
  - It is important to recognize when each operation (addition, subtraction, multiplication, or division) is appropriate to use.
  - There are many ways to represent numbers. Each usually highlights something different about the number.
  - The patterns in the place value system can make it easier to interpret and operate with numbers.

### ❖ Catholic Graduate Expectations:

- **A Discerning Believer Formed in the Catholic Faith Community**
  - Respects the faith traditions, world religions and the life-journeys of all people of good will.
- **An Effective Communicator**
  - Presents information and ideas clearly and honestly and with sensitivity to others.
- **A Reflective, Creative and Holistic Thinker**
  - Adopts a holistic approach to life by integrating learning from various subject areas and experience.
- **A Self-Directed, Responsible, Lifelong Learner**
  - Applies effective communication, decision-making, problem-solving, time and resource management skills.
- **A Collaborative Contributor**
  - Achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.
- **A Responsible Citizen**
  - Respects and understands the history, cultural heritage and pluralism of today's contemporary society.

**Possible product(s):**

- A bracelet created on a loom
- A colourful, visual representation of a pattern on grid paper (representation of bead pattern)
- A numerical pattern and a related pattern rule as a reflection of a beading pattern
- An algebraic expression based on the pattern rule
- A visual representation of the pattern on a graph with coordinates plotted
- A table of values.

**Learning Goals (derived from Overall Expectations) Related to Patterns and Relationships, Grades 4, 5, and 6 (Success criteria based on specific expectations)<sup>34</sup>**

By the end of grade 4, students will:	By the end of grade 5, students will:	By the end of grade 6, students will:
<i>Learning Goal</i> We will describe and create a variety of numeric and geometric patterns to extend the patterns.	<i>Learning Goal</i> We will determine relationships in growing and shrinking patterns, and investigate repeating patterns involving translations.	<i>Learning Goal</i> We will describe and represent relationships in growing and shrinking and repeating patterns involving rotations.
<i>Success Criteria</i> -I can extend repeating, growing, and shrinking number patterns -I can describe repeating, growing, and shrinking number patterns -I can create repeating, growing, and shrinking number patterns	<i>Success Criteria</i> -I can create numeric geometric patterns -I can identify numeric and geometric patterns -I can extend geometric patterns	<i>Success Criteria</i> -I can identify geometric patterns -I can represent geometric patterns numerically
-I can connect each term in a growing or shrinking pattern with its term number, -I can record the patterns in a table of values that shows the term number and the term	-I can build a model to represent a number pattern presented in a table of values that shows the term number and the term	-I can make tables of values for growing patterns, given pattern rules in words, -I can list the ordered pairs -I can plot the points in the first quadrant
-I can create a number pattern involving addition, subtraction, or	-I can make a table of values for a pattern that is generated by adding or	-I can determine the term number of a given term in a growing pattern that is

<sup>34</sup> ([http://eworkshop.on.ca/edu/resources/guides/Guide\\_Patterning\\_and\\_Algebra\\_456.pdf](http://eworkshop.on.ca/edu/resources/guides/Guide_Patterning_and_Algebra_456.pdf))

<p>multiplication, given a pattern rule expressed in words</p>	<p>subtracting a number to get the next term (a constant), or by multiplying or dividing by a constant to get the next term, given either the sequence or the pattern rule in words</p>	<p>represented by a pattern rule in words, a table of values, or a graph</p>
<p>-I can make predictions related to repeating geometric and numeric patterns</p>	<p>-I can make predictions related to growing and shrinking geometric and numeric patterns</p>	<p>-I can describe pattern rules (in words) that generate patterns by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term, then distinguish such pattern rules from pattern rules, given in words, that describe the general term by referring to the term number</p>
<p>-I can extend and create repeating patterns that result from reflections</p>	<p>-I can extend and create repeating patterns that result from translations</p>	<p>-I can determine a term, given its term number, by extending growing and shrinking patterns that are generated by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term</p>
		<p>-I can extend and create repeating patterns that result from rotations</p>

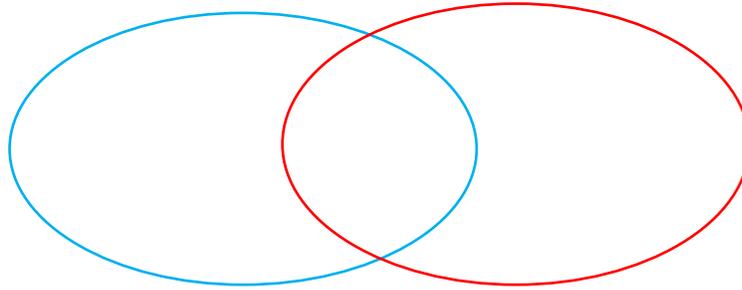
**Learning Goals (derived from Overall Expectations) Related to Variables, Expressions, and Equations, Grades 4, 5, and 6 (Success criteria based on specific expectations)<sup>35</sup>**

By the end of Grade 4, students will:	By the end of Grade 5, students will:	By the end of Grade 6, students will:
<i>Learning Goal</i> We will demonstrate an understanding of equality between pairs of expressions, using addition, subtraction, and multiplication	<i>Learning Goal</i> We will demonstrate, through investigation, an understanding of the use of variables in equations	<i>Learning Goal</i> We will use variables in simple algebraic expressions and equations to describe relationships
<i>Success Criteria</i> -I can determine the inverse relationship between multiplication and division	<i>Success Criteria</i> -I can demonstrate an understanding of variables as changing quantities, given equations with letters or other symbols that describe relationships involving simple rates	<i>Success Criteria</i> -I can demonstrate an understanding of different ways in which variables are used
-I can determine the missing number in equations involving multiplication of one- and two-digit numbers	-I can demonstrate an understanding of variables as unknown quantities represented by a letter or other symbol	-I can identify the quantities in an equation that vary and those that remain constant
-I can identify use the commutative property of multiplication to facilitate computation with whole numbers	-I can determine the missing number in equations involving addition, subtraction, multiplication, or division and one- or two-digit numbers	-I can determine the solution to a simple equation with one variable
-I can identify and use the distributive property of multiplication over addition to facilitate computation with whole numbers.		

<sup>35</sup> ([http://eworkshop.on.ca/edu/resources/guides/Guide\\_Patterning\\_and\\_Algebra\\_456.pdf](http://eworkshop.on.ca/edu/resources/guides/Guide_Patterning_and_Algebra_456.pdf))



Use a Venn diagram such as the one seen below to find commonalities and difference between the Gospel Values and the Seven Grandfather teachings.



### Task 1: Finding Beading Patterns

#### Activation

Suggested duration: 5-10 minutes

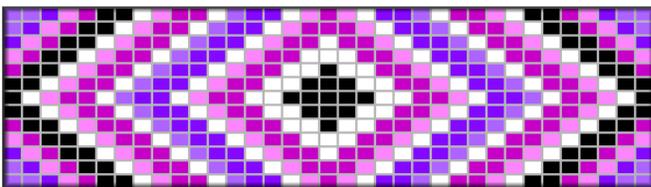
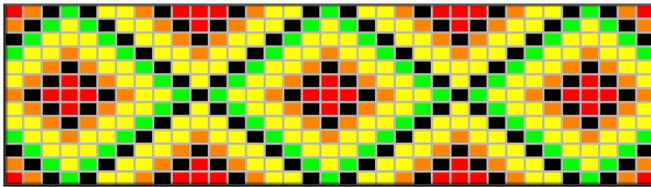
Educators will show the video listed here. This video demonstrates a Traditional Aboriginal Beading Game found in The Forks in Winnipeg, Manitoba.<sup>38</sup> [Aboriginal Beading Game](#)

Possible Questions after viewing:

“Which pattern is being recreated? Prove your thinking.”

“What pattern rule can you find?”

#### Action



[www.free-beading-patterns.com](http://www.free-beading-patterns.com)

Suggested duration: 20 minutes  
Based on the video, provide pairs of students with graph paper and coloured pencils and ask them to attempt to recreate one of the images of beading patterns on the left:

To accommodate students, display the above image on your Smartboard.

If possible, provide students with a coloured printout.

<sup>38</sup> <https://www.youtube.com/watch?v=3HINtBxXLNI>

Another option would be to provide students with a laptop so they can see the image up close.<sup>39</sup>

## **Consolidation**

Duration: 20-30 minutes

Meet with students in a circle formation to discuss their experiences with this activity. Ask students: “What did you notice?” Was anything difficult?”

If you have a Talking Stick<sup>40</sup>, (see protocol explained in the link at the bottom of this page), this would be an excellent time to incorporate it.

This link (<https://www.youtube.com/watch?v=QDq93fz6HWs>) leads to a “5 Minute PD with Renee & April” which will help educators to become (more) familiar with a ‘talking circle’. You may also wish to show a portion of the clip (from 0:30 through 4:20) to students.

Have students share their successes as well as their challenges. As the students share, take notes in the form of an anchor chart.

During the discussion, remind the students of what was learned about Aboriginal beading and the methods that are used.

## **Independent Practice**

Duration: 20 minutes

Students can demonstrate their ability to transfer a beading pattern through the use of technology. Students can navigate through The Museum of History<sup>41</sup> (please note the website link at the bottom of this page) as there is ample opportunity for practice with pattern work.

For pedagogical documentation, educators may choose to take a photograph with the student’s name and pattern. This could be used to assess understanding and help the student plan for their next steps. If technology is not accessible, educators can have students recreate a pattern onto a piece of graph paper.

## **Task 2: Creating Patterns**

### **Activation**

Duration: 10 minutes

Display this image on your Smartboard and have students share with their elbow partner their thoughts and strategies on solving this question.

Possible questions:

“What would stage 6 look like? How do you know?”

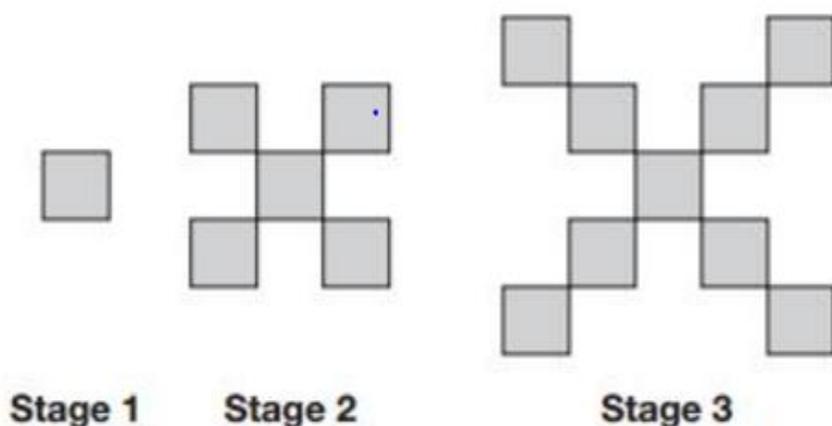
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<sup>39</sup> <http://squeakeycat.net/gallery/index.php/Bead-Pattern-Images/beading-pattern-barrettes-d>

<sup>40</sup> <http://www.ictinc.ca/blog/first-nation-talking-stick-protocol>

<sup>41</sup> <http://www.historymuseum.ca/cmhc/exhibitions/tresors/ethno/ety0102e.shtml>

“What is happening each time the object grows?”  
“What does this remind you of?”



Once students have shared with each other, ask them to share their strategies with the large group.

This question is taken from the grade 6 EQAO, spring 2011 (p. 4)<sup>42</sup>. It was adapted to only display the pattern itself with the term number.

### Action

Suggested duration: 15-20 minutes

In pairs, students create their own generated pattern and determine the pattern rule. Provide students with chart paper to demonstrate their thinking.

### Consolidation

Suggested duration: 20-30 minutes

Ask students to meet in a circle formation and use the Talking Stick to keep the conversation/discussion regulated. Have students share their findings. Encourage respectful talk when students disagree with one another (“I respectfully disagree with you because...”).

As an **extension** of this activity, invite students to go on a “pattern walk” where they can find patterns within their school, out in the school yard or even at home. Educators could share this the following day as an activation.

### Independent Practice

Suggested duration: 10-15 minutes

In student notebooks or as an exit ticket, have students independently create a pattern and identify the pattern rule. Provide parameters based on the grade level taught.

## Task 3: Finding Patterns in Beading

### Activation

Suggested duration: 5-10 minutes

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<sup>42</sup> <http://www.eqao.com/Pages/launch.aspx>

Share images of traditional Indigenous beading patterns found on traditional clothing and footwear to develop students' knowledge of traditional Canadian Indigenous beading practices as well as their historical significance. Here are some examples:



This image is taken from *Walking with Our Sisters* website. Please refer to this article<sup>43</sup> for more information about how this movement is honouring those Indigenous women that have been murdered or are missing.

### Action

Suggested duration: 30 minutes

In pairs, have students do an online inquiry to search “Canadian Indigenous Traditional beading patterns”. Have students keep a record of the online resources in order to save their images and information. Furthermore, if accessibility to technology is limited, have a wide range of books available to the students from the local library and/or school library.

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<sup>43</sup> <http://www.cbc.ca/news/canada/ottawa/walking-with-our-sisters-memorial-for-murdered-and-missing-indigenous-women-drawing-crowds-in-ottawa-1.3260509>

For historical information pertaining to Canadian Indigenous Practices please refer to these texts and links<sup>44</sup>:

*Native North American Art* by Janet C. Berlo and Ruth B. Phillips

*Beadwork: First Peoples' Beading History and Techniques* by Christi Belcourt

### Consolidation

Suggested duration: 45-60 minutes

Meet with students in a circle formation with the class Talking Stick. Have students share their research, images and information.

Writing student feedback on an anchor would also be a useful future reference.

### Possible Extensions



The educator could take the opportunity to explore Indigenous Art and display its correlation to the environment.

Here is an image of art from artist, James Simon Mishibinijima<sup>45</sup>.

Possible questions:

“How does this artist feel about nature?”

“Why is it important to take care of nature?”

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<sup>44</sup> Traditional Métis beading practices:

<http://www.thecanadianencyclopedia.ca/en/article/Métis/>

[http://www.ameriquefrancaise.org/en/article-476/Floral\\_Beadwork:\\_A\\_M%C3%A9tis\\_Cultural\\_Heritage\\_to\\_Rediscover\\_.html](http://www.ameriquefrancaise.org/en/article-476/Floral_Beadwork:_A_M%C3%A9tis_Cultural_Heritage_to_Rediscover_.html)

The history of First Nations beading (refer to Looms and Beads section):

<http://www.thecanadianencyclopedia.ca/en/article/first-nations/>

<http://aboriginalperspectives.uregina.ca/workshops/workshop2010/background.shtml>

For play-related Aboriginal beading games

<http://www.historymuseum.ca/cmhc/exhibitions/tresors/ethno/ety0000e.shtml>

Canadian Indigenous Art Resource

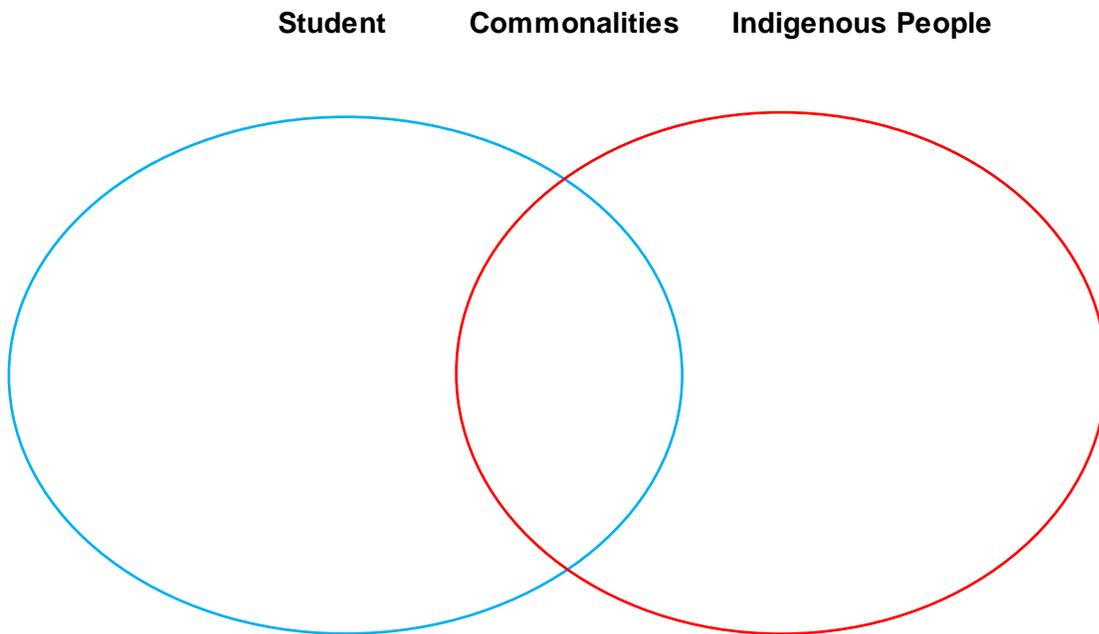
[http://csc.immix.ca/files/258/1334331418/Exploring\\_Aboriginal\\_Art\\_in\\_Canada.pdf](http://csc.immix.ca/files/258/1334331418/Exploring_Aboriginal_Art_in_Canada.pdf)

<sup>45</sup><https://pierreajsabourin.wordpress.com/2014/09/17/canadian-woodstock-features-james-simon-mishibinijima/>

Remind students that beads were made from natural sources such as from shells and bones. Indigenous peoples made beads themselves as they could not go to a store and purchase beads. They hunted animals and used the animal's entire body to help their survival (e.g. meat, hide for making shoes, bags to carry things when travelling, etc.). Indigenous people used nature as their muse for their art; nature was reflected in what they chose to create.

The educator could ask:

“When you think of the work Indigenous people put into their clothing, their shoes, coats and their survival, what do you think about items we buy in a store today?”. Use a Venn diagram to have students show their families’ habits of shopping, those of traditional Indigenous people, and any commonalities.



#### **Task 4: Finding Patterns in Nature**

##### **Rationale**

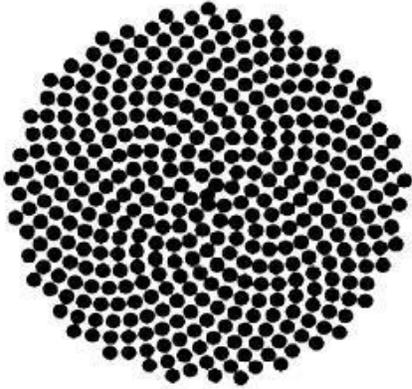
The Fibonacci sequence is seen throughout nature in both plants and animals, as well as in galaxies above Earth. The Indigenous culture in Canada is extremely linked to nature and the environment. In addition, the Fibonacci sequence is proof of a creator that brings all life together.

The Fibonacci sequence puts emphasis on a larger relationship between humans and the Earth and bigger systems, such as space, that surround us. This links to the Catholic Graduate Expectations as well as the Gospel Values which in turn are the Seven Grandfather Teachings.

### Activation

Suggested duration: 5-10 minutes

Display the following image on the Smartboard:



The educator should ask students:

“What do you see?”

“What does this remind you of?”

“Where have you seen this before?”

Students’ answers may include a Sunflower or a Daisy, for example.

### Action

Suggested duration: two days; 45 minutes each day

Materials needed: extra copies of the problems; scissors; envelopes; extra copies of each puzzle so that each group has an unused copy of the puzzle.

Educators will set up the room for small groups of students to experiment with the four puzzles (see below). Each group will be given puzzles in numbered envelopes to be solved in regards to the Fibonacci Sequence. Educators will need to have a copy of each puzzle for each group. The puzzles build in difficulty so they must do them in order. This arrangement also allows groups to work at their own speed.

Each puzzle has a clue, but the group must agree that they’re stuck before they can look at it. When they’ve completed a puzzle, they check with their teacher before moving on to the next.

This is an excellent opportunity for the educator to document students’ understanding and to use assessment for learning options.

- Reminders for Educators to do beforehand:
  - Each group should have:
    - a handout with instructions for each group
    - 4 puzzles (1 laminated Master and 4 other photocopies for students’ work)
    - A clue sheet (for Educator use only)

Educator Instructions for each puzzle:

**Puzzle #1:** Fibonacci numbers - this sheet has a series of Fibonacci numbers which need to be cut up before putting them in the first envelope. There are no instructions, so pupils need to work out what's going on and recognise the pattern and explain it. The background picture might help some pupils construct the jigsaw. I explain that these are called Fibonacci numbers and they are very special, while not giving away anything in later puzzles.

Clue to puzzle 1: Put the numbered cards in order - the picture might help. Look at the sequence you get. Can you work out the rule that links the numbers?

**Puzzle #2:** Fibonacci squares - has a series of squares which need to be cut up before putting them in the envelope, or you can give pupils a photocopy of the random squares to cut up for themselves. Pupils should recognise the pattern, build up the shape and explain what's going on. There's also a spiral to help explore how this relates to the sequence of squares. **Don't provide the complete or combined image in the envelope - you decide when to show it or demonstrate how the separate images overlay. You could revisit this later to discuss Fibonacci numbers in nature.**

Clue to puzzle 2: Look at the side length of each square. Can you work out the rule that links them? How does it compare with the number sequences in puzzle 1?

**Puzzle #3:** Fibonacci Polar Bears - based on the problem Fibonacci was asked to solve.

Clue to puzzle 2: Consider the number of pairs of polar bears each year. How many are there at the beginning? How many after a year? After 2 years? After 3 years? How do the pairs link to Fibonacci?

**Puzzle #4:** Pascal triangle - for pupils to recognise various number sequences.

If extra practice is wanted, similar puzzles and information can be found at <http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fibonacci/fib.html>

### **Consolidation**

Suggested duration: 25-30 minutes

If the book is available to you, read, *Growing Patterns-Fibonacci Numbers in Nature* by Sarah C. Campbell to students.

Meet in a circle formation with the class Talking Stick.

Some possible questions for students:

“What did we learn today?”

“How does today's activities relate to what we have been discussing about Indigenous culture?”

“How do you think the Indigenous community feel about the Creator?”

How does the Fibonacci Sequence change your feelings about nature?

## Handout for Students:

You will have: 4 mathematical puzzles - one in each envelope  
The envelopes are numbered. You must do the puzzles in order!

### In each envelope you will find:

1 x master colour copy of the question

4 x black and white copies to write on if you need to.

**Instructions:** Work through each envelope in order and solve each puzzle. When you've finished one puzzle, **check with me** before going on to the next.

You also have: Clues for each puzzle. **Only open a clue** when the whole group has run out of ideas!

Pack away each puzzle when you have finished with it.

Remember – work as a team to solve the puzzles! Make sure everyone understands.

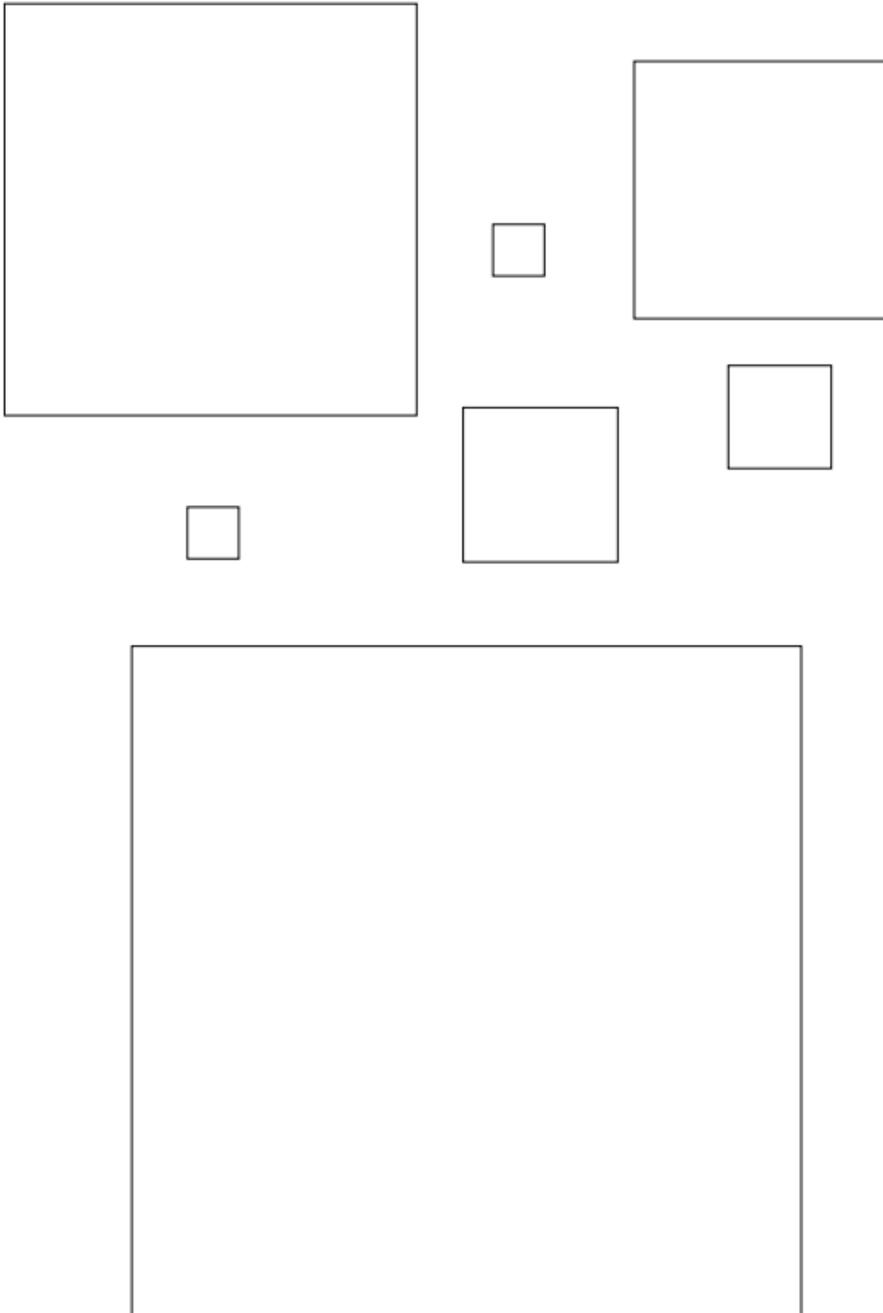
Puzzle #1 Fibonacci Numbers: What connections do you see?

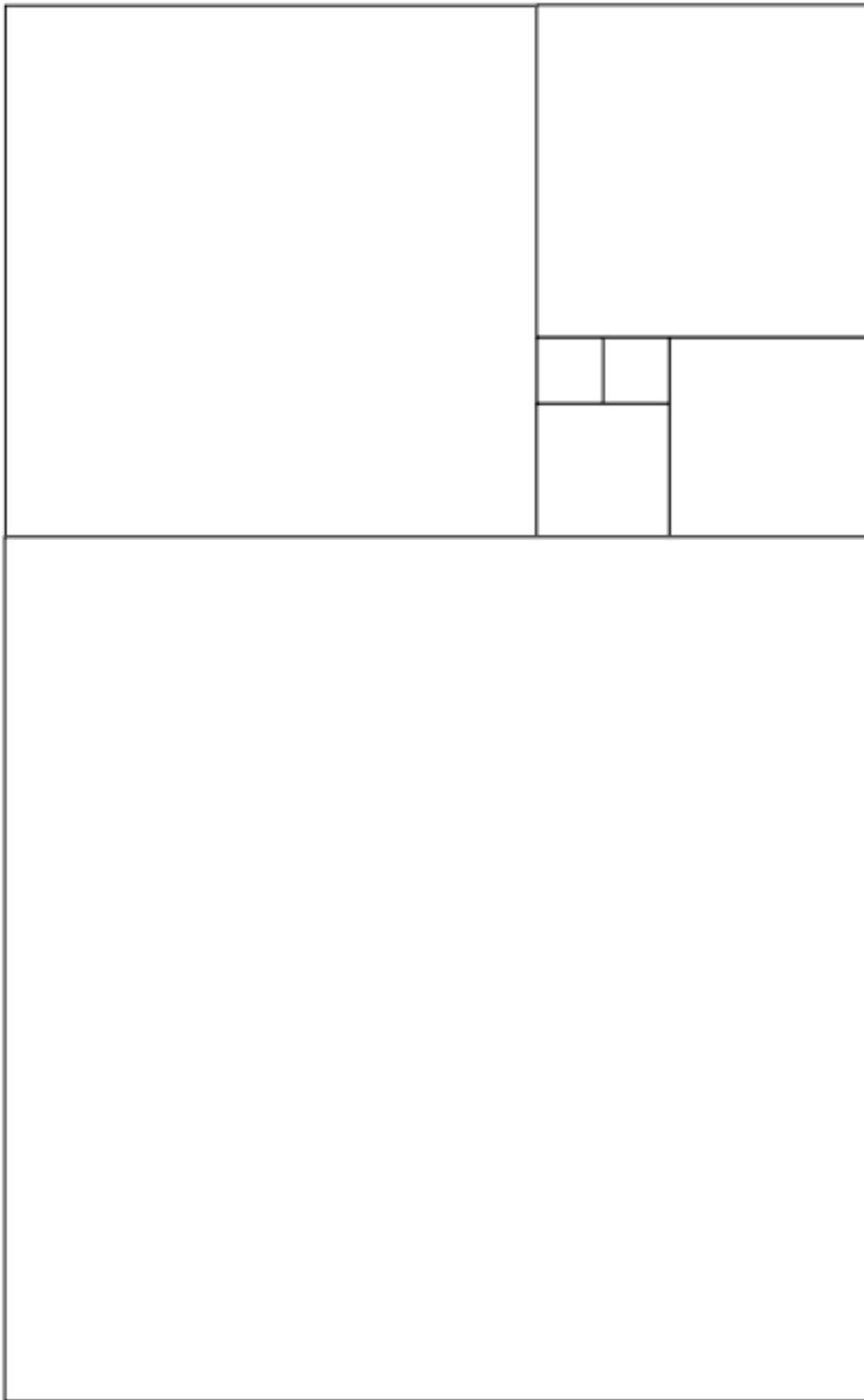


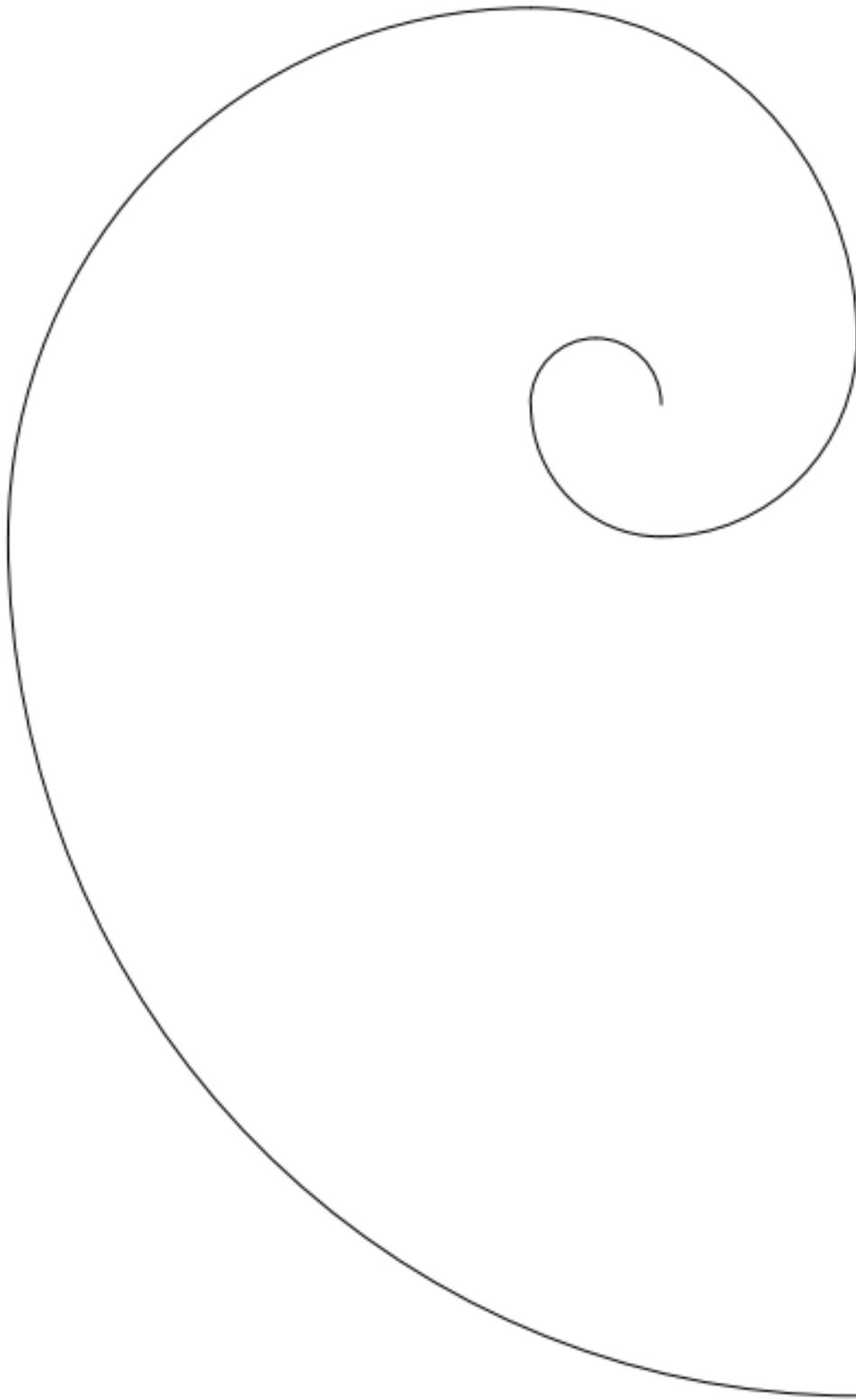
## Puzzle #2 Fibonacci Squares

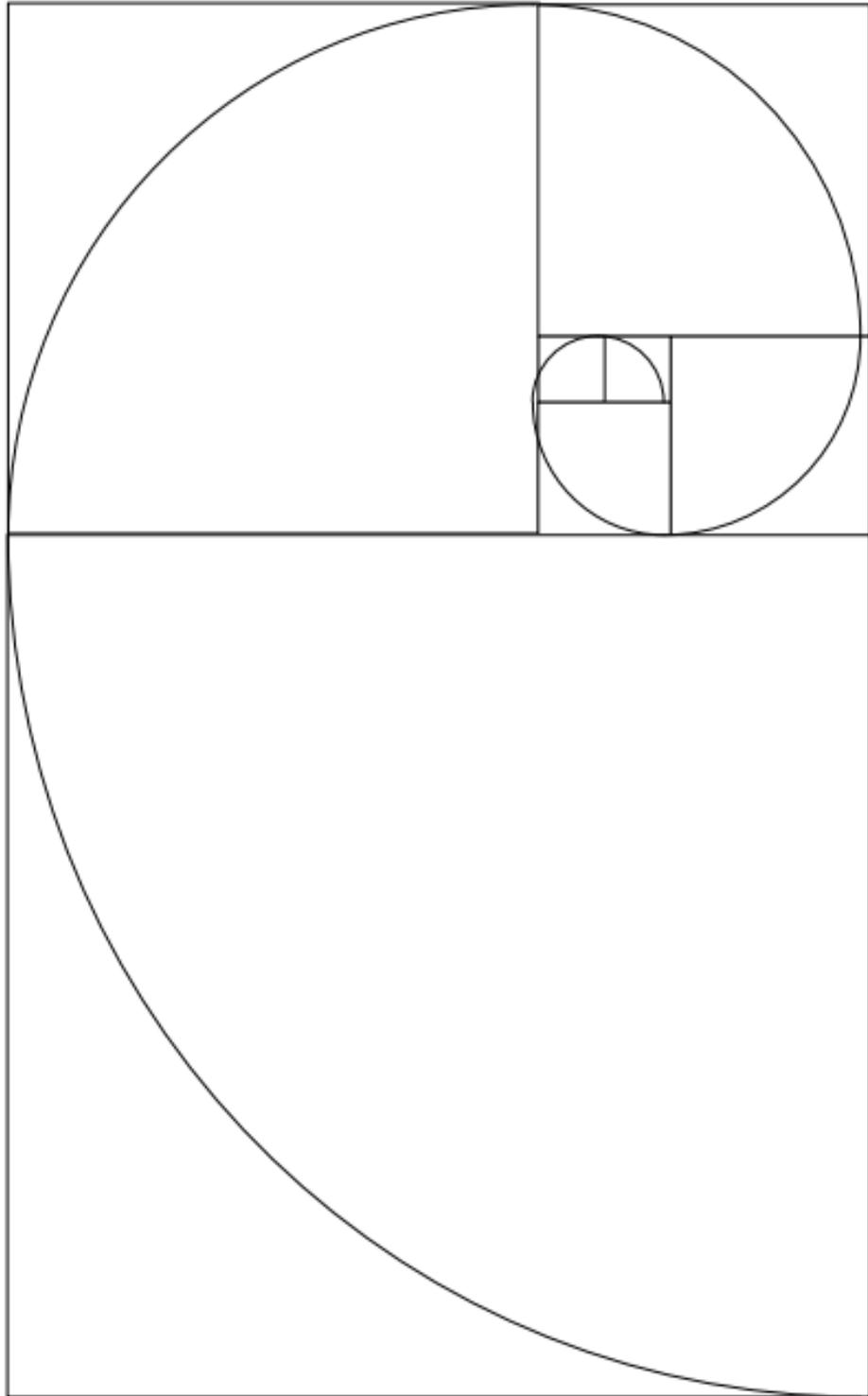
Answer the following questions:

1. What do these squares have to do with Fibonacci numbers?
2. Starting from one of the small squares, can you put them together so that every time you add a square you can create a rectangle?
3. How do these squares help you draw a spiral?









### Puzzle #3 Fibonacci Polar Bears

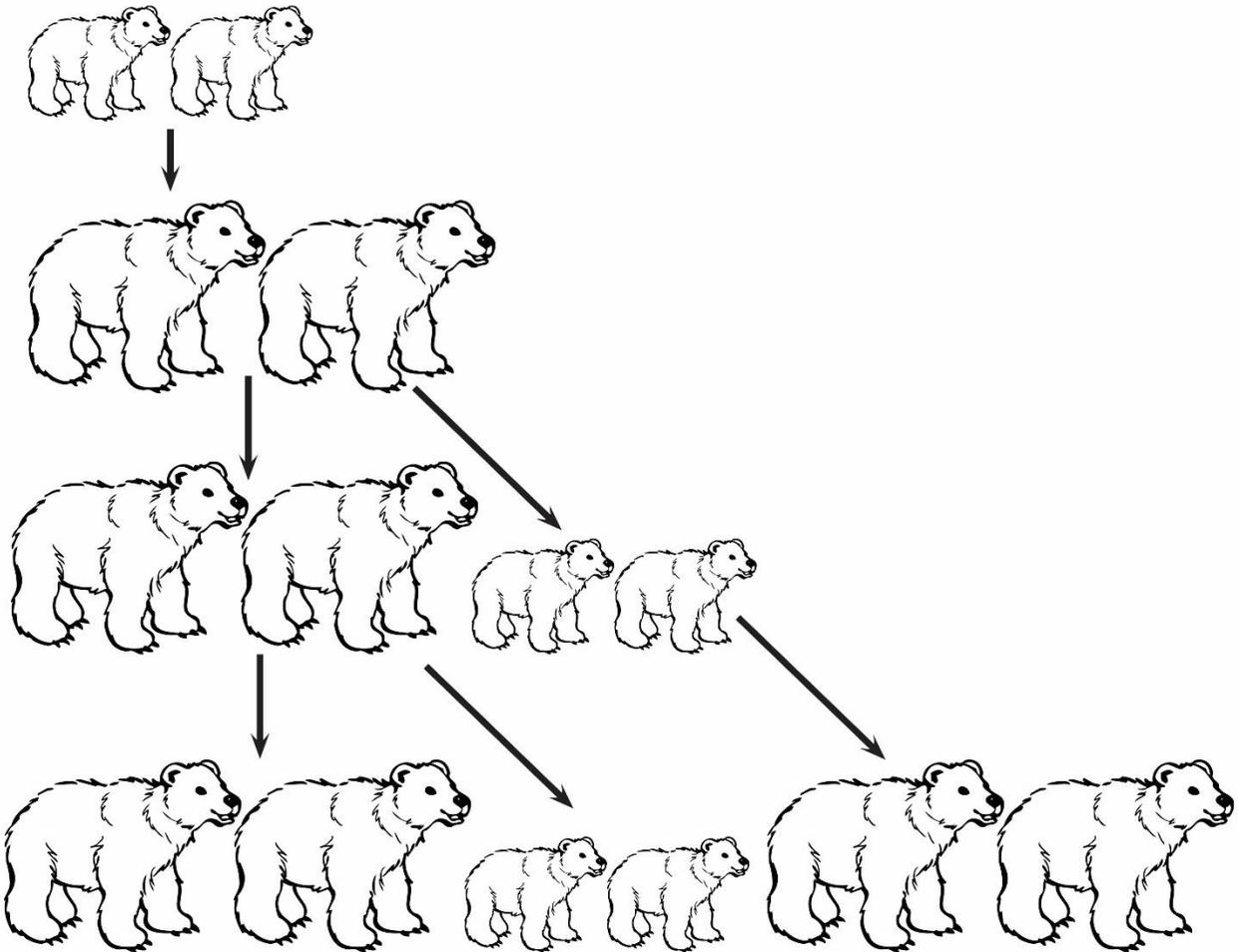
A pair of polar bears are put in an arctic habitat.

Each pair of polar bears produces a new pair of polar bears every year.

From the second year on, these polar bears also become productive.

How many pairs of polar bears will there be in the habitat after one decade?

Continue the diagram and find out the number of pairs of polar bears in the Fibonacci habitat after 10 years.



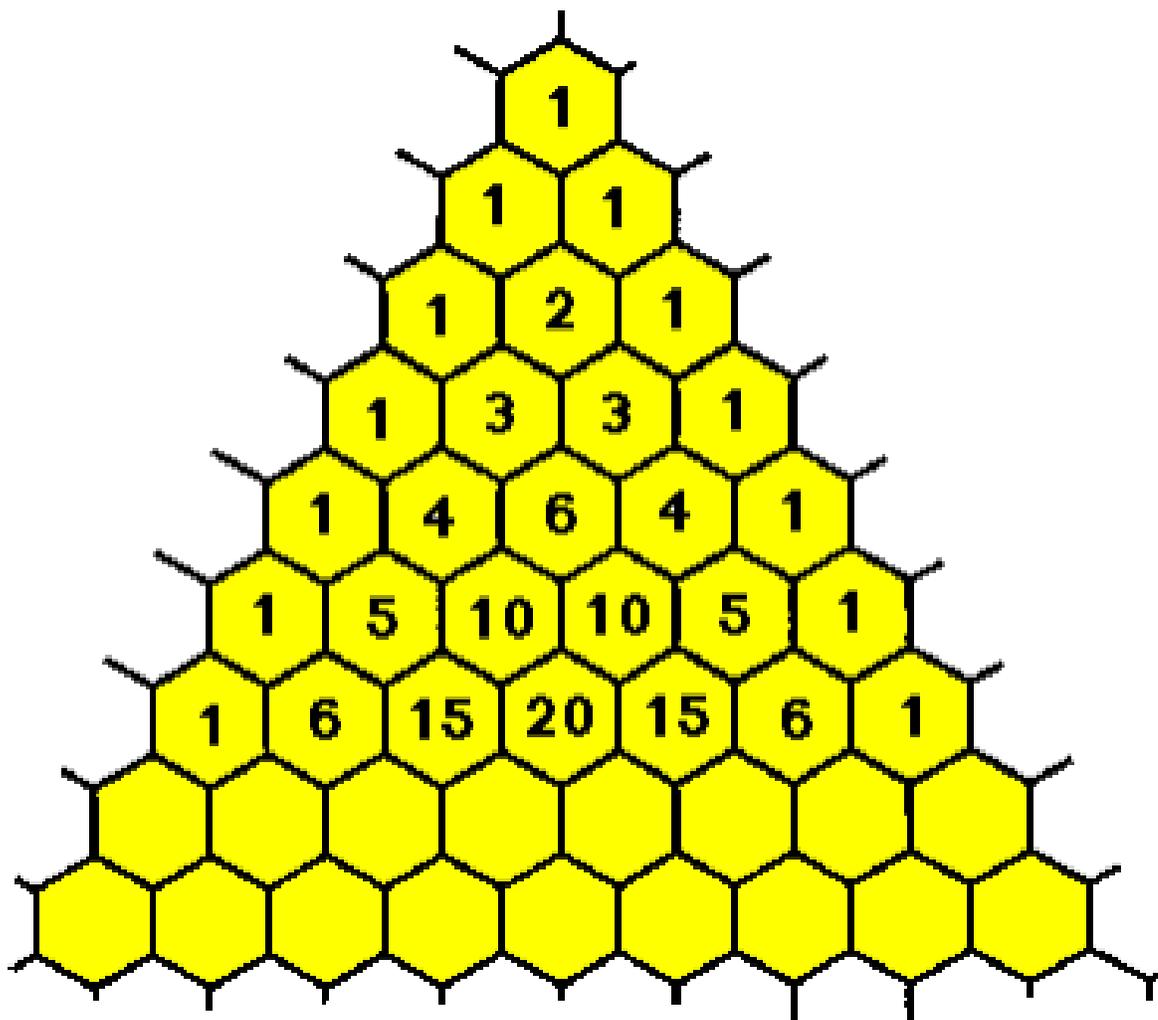
Additional info

<http://www.polarbearsinternational.org/>

<http://www.polarbearhabitat.ca/blog/115-the-inuit-legend-of-nanuk>

#### Puzzle #4 The Pascal Triangle

1. Complete the next 2 rows of this Pascal triangle.
2. Write down as many sequences as you can find in the triangle.
3. Can you find a Fibonacci sequence in the Pascal triangle?



## Task 5: Time to Reflect

### Activation

Suggested duration: 30 minutes

Whole group: ask students, “How much is 6.5 billion?”

“How many years ago was 1200 AD?”

“What do you think is a “perfect” rectangle?”

“Look at the following pattern: 1, 1,2,3,5,8,13. Can you figure out what the next number will be?”

This video will provide the viewer with a connection between nature and Mathematics.

Watch the following video:

<https://www.youtube.com/watch?v=4VrcO6JaMrM> (Watch from 0:30 to 3:12)

Ask students, “What is connection do you see between nature and mathematics?”

In pairs, have students reflect on the videos and have students write down ideas or new found ideas about Mathematics.

“How do you see Math differently?”

### Action:

Suggested duration: 45 minutes

If possible, go on a nature walk around your school to find items (pinecones, flowers, etc. that exhibit the Fibonacci sequence. Have students work with a pinecone; use different colour markers to colour in the spiral. Think, Pair, Share the findings.

Provide students with a printout of the following images: pinecones, sunflower, daisy, starfish and the nautilus shell. Students will use the “perfect” rectangle to uncover the Fibonacci blueprint. (It may be helpful to replay minutes 2:40 to 3:00 to guide their work.)

### Consolidation

Suggested duration: 25-30 minutes

Watch the following video: [https://www.youtube.com/watch?v=aB\\_KstBiou4](https://www.youtube.com/watch?v=aB_KstBiou4)

Use a talking circle that discusses students’ reactions to this video.

Ask students: “How do you see Mathematics now?”

“How do you see the significance of Mathematics in the world?”

Have a large group consolidation session where pairs can share their responses to the questions above. As an alternative or in addition, ask students to reflect on an exit ticket about the big Ideas in Mathematics. This activity will help the educator to filter any misconceptions students may still have.

### **Possible Extensions:**

Suggested duration: 30-45 minutes

- 1) Post the Fibonacci sequence on the Smartboard or chalkboard/whiteboard.

\*The goal of this activity is to get students thinking about these patterns rather than arriving at the correct answer initially.

Ask students, "What is the pattern rule of this sequence?"

"Based on the pattern rule, how could you represent this rule in an algebraic expression?"

In pairs, have students create the algebraic expression of the Fibonacci pattern rule together. If students are finding this activity challenging, allow them access to the video they watched during the consolidation portion

([https://www.youtube.com/watch?v=aB\\_KstBiou4](https://www.youtube.com/watch?v=aB_KstBiou4)) of this learning experience.

You may also choose to have them walk around and share ideas and collaborate with their peers. Provide students with paper and markers to demonstrate their thinking.

- 2) Meet with students in a circle formation and invite them to share the strategies they used to complete the task. Project the following website on the Smartboard:

<https://www.mathsisfun.com/numbers/fibonacci-sequence.html>

This website provides detailed decomposition of the Fibonacci sequence and explains the breakdown of the algebraic expression of the pattern rule.

Students will use this model to create an algebraic expression for a pattern and pattern rule they have previously created.

- 3) View the following website *Fibonacci in Nature* and share with students.

[http://jwilson.coe.uga.edu/emmat6680/parveen/fib\\_nature.htm](http://jwilson.coe.uga.edu/emmat6680/parveen/fib_nature.htm)

- 4) Create a complex pattern with beads, coloured pencils on graph paper or online.

Using this pattern:

- Create a numerical pattern that represents the beading pattern.
- Determine a pattern rule for the numerical pattern.
- Represent the pattern rule as an algebraic expression (grade six).
- Create a table of values to determine term number and term value.

### **Assessment Suggestions**

-Assess students orally with a checklist and space for comments

-Ongoing anecdotal notes, recorded conversations

-Assess products from sub-tasks that students have created

-Mini-conferences with individual students and small groups will support students who require extra assistance as well as provide the educator with excellent assessment information

-Rubric based on co-created success criteria for culminating task

-Ensure on-going communication with parents

## **Possible Cross-Curricular Opportunities/Extensions**

### **Science**

- Grade 4
  - Habitats and Communities
    - ✓ Society relies on plants and animals.
- Grade 5
  - Conservation of Energy and Resources
    - ✓ The properties of materials determine their use and may have an effect on society and the environment.
- Grade 6
  - Biodiversity
    - ✓ Humans make choices that can have an impact on biodiversity.

### **Social Studies**

- Grade 6
  - Heritage and Identity: Communities in Canada, Past and Present
    - ✓ Many different communities have made significant contributions to Canada's development.

### **The Arts**

- All junior grades
  - Visual Art
    - ✓ Exposed to, create, present, analyze and explore the forms and cultural contexts of Indigenous Art.

## Learning Experience 4: Disproportionate Representation A Call to Act Through Data Management

**Learning Destination:** How might exploring current Canadian data related to Indigenous Societal issues foster not only greater understanding of mathematical concepts but also a call to action in regards to social justice for our first peoples?

**Rationale:** These learning experiences will help students to consider the representation of Canada's Aboriginal people (as compared to non-Aboriginals) in three specific situations (education rates, Missing and Murdered Women, children in foster care), based on current Canadian data. In order to support the development of data management concepts, students will be required to read and interpret statistical data, as well as create graphs to display pertinent information.

In accordance with the vision of the Ontario First Nations, Métis, Inuit Education Policy Framework, "First Nations, Métis, Inuit students in Ontario will have the knowledge, skills, and confidence they need to successfully complete their elementary and secondary education in order to pursue postsecondary education or training and/or to enter the workforce. They will have the traditional and contemporary knowledge, skills, and attitudes required to be socially contributive, politically active, and economically prosperous citizens of the world. *All students in Ontario* will have knowledge and appreciation of contemporary and traditional First Nation, Métis, and Inuit traditions, cultures, and perspectives". <http://www.edu.gov.on.ca/eng/aboriginal/fnmiFramework.pdf>

It is important for all students to become aware of the true history of our Indigenous Peoples. Knowing this history will give impact to the statistics that they will analyze in these learning experiences. The facts will hopefully create empathy and a will to create change in our schools, our communities, and our country.

**Division:** Intermediate (Grades 7/8)

### Big Ideas:

#### ❖ Mathematics

##### ○ Data Management

- Graphs are powerful data displays since visual displays quickly reveal information about data.
- It is important for students not only to read information from graphs but to make inferences and draw conclusions.
- Connecting math to real-world problems helps makes the math relevant to students

#### ❖ Catholic Graduate Expectations:

##### ○ A Discerning Believer Formed in the Catholic Faith Community

- develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity and the common good (CGE1d);
- respects the faith traditions, world religions and the life-journeys of all people of good will (CGE1h);

- **A Reflective and Creative Thinker**
  - thinks reflectively and creatively to evaluate situations and solve problems (CGE3c);
- **A Self-Directed, Responsible, Lifelong Learner**
  - demonstrates a confident and positive sense of self and respect for the dignity and welfare of others (CGE4a);
  - responds to, manages, and constructively influences change in a discerning manner (CGE4d);
- **A Responsible Citizen**
  - respects and understands the history, cultural heritage and pluralism of today's contemporary society (CGE7g);
  - exercises the rights and responsibilities of Canadian citizenship (CGE7h);

**Mathematical Learning Goals:**

Grade 7 & 8 Mathematical Process Expectations:

- develop and apply reasoning skills (e.g., recognition of relationships, generalization through inductive reasoning, use of counter examples) to make mathematical conjectures, assess conjectures and justify conclusions, and plan and construct organized mathematical arguments;
- make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);

<b>Overall Expectations</b> By the end of Grade 7, students will:	<b>Overall Expectations;</b> By the end of Grade 8, students will:
<ul style="list-style-type: none"> <li>• collect and organize categorical, discrete, or continuous primary data and secondary data and display the data using charts and graphs, including relative frequency tables and circle graphs;</li> <li>• make and evaluate convincing arguments, based on the analysis of data;</li> </ul>	<ul style="list-style-type: none"> <li>• collect and organize categorical, discrete, or continuous primary data and secondary data and display the data using charts and graphs, including frequency tables with intervals, histograms, and scatter plots;</li> <li>• apply a variety of data management tools and strategies to make convincing arguments about data;</li> </ul>

**Possible Product(s):**

- Student-created graphs and charts, based on inferences from the data and media;
- Reflective journal entries;
- Talking Circles;
- Student-determined responses, based on personal inquiries and a desire to create change in our country

## Task 1: Comparing Education Rates of Aboriginal and non-Aboriginal People

### Setting the Context:

Data for 2011 from the National Household Survey (NHS) show that attainment rates for First Nations people, Inuit and Métis at the trades and college levels are comparable to those of the non-Aboriginal population. **However**, many First Nations people, Inuit and Métis do not finish high school, and their university completion rates lag behind those of the non-Aboriginal population (Statistics Canada, 2013a).

“In its 1996 report, *Gathering Strength*, the Royal Commission on Aboriginal Peoples called **education “the key that unlocks the door to the future”** (RCAP, 1996). Education is a priority for First Nations people, Inuit and Métis:

“Education offers the spark that can light the fire of potential in an individual”	“Existing socio-economic conditions will worsen unless more Inuit children graduate from high school.”	“Education must prepare Métis people to fully participate in the economy of our communities and Canadian society”
Shawn Atleo, National Chief of the Assembly of <b>First Nations</b> , (Atleo, 2012).	Terry Audla, President of <b>Inuit</b> Tapiriit Kanatami (Audla, 2012)	Clément Chartier, President of the <b>Métis</b> National Council (Chartier, 2013)

Excerpts are from: *The Education and Employment Experiences of First Nations People Living Off Reserve, Inuit, and Métis: Selected Findings from the 2012 Aboriginal Peoples Survey*  
Downloaded @ <http://www.statcan.gc.ca/pub/89-653-x/89-653-x2013001-eng.htm> July 15, 2016

Until recently, research that addressed factors related to school outcomes specifically for Aboriginal peoples in Canada was limited. In 2007, the Canadian Council on Learning, in partnership with First Nations, Inuit and Métis communities and organizations across Canada, undertook an initiative - “Redefining how Success is Measured in Aboriginal Learning.” Frameworks were developed that recognize that Aboriginal learning is holistic and lifelong, comes from many different sources, and is rooted in Aboriginal languages and cultures (Canadian Council on Learning, 2009).”

In a 2015 interview, prior to the release of the Truth and Reconciliation Commission’s Final Report, chair Murray Sinclair proclaimed, “Education is what got us into this mess — the use of education at least in terms of residential schools — but education is the key to reconciliation...We need to look at the way we are educating children. That’s why we say that this is not an aboriginal problem. It’s a Canadian problem.”<sup>46</sup>

<sup>46</sup> *Truth and Reconciliation chair urges Canada to adopt UN declaration on Indigenous Peoples*, Haydn Watters, CBC News Posted: Jun 01, 2015; downloaded @ <http://www.cbc.ca/news/politics/truth-and-reconciliation-chair-urges-canada-to-adopt-un-declaration-on-indigenous-peoples-1.3096225> Retrieved July5, 2016

## Activation

Video: A brighter future through indigenous prosperity: Gabrielle Scrimshaw at TEDxToronto. <https://www.youtube.com/watch?v=9z9QKRsiql8#action=share> This is a 13 minute video. Consider starting at the beginning and pausing at 1:30 for a brief discussion about Gabrielle's comments: "Statistically speaking, I'm not supposed to be on this stage. Growing up, I didn't actually realize that being an Indigenous person was a difficult experience." What can we infer from this statement? What statistics might she be referencing? What (growing up) difficulties might she be referring to? How might the circumstances and challenges of growing up as an Indigenous Person be similar to/different from those of a non-Indigenous person? (continue viewing to 3:15 as Gabrielle provides additional information).

Skip to view from 8:20 through 11:00, as she discusses hope for the future of Indigenous Persons.

Consider pausing (and/or re-watching the clip) to discuss her statement: "...the tides are starting to shift in our community and this is why I think it's such an exciting time to be an Indigenous Person in our country"; consider the mathematical and social significance of "the estimated cumulative benefit, for increased Indigenous well-being, and this includes closing that skills and education gap, is an estimated \$500 Billion over a 25 year period..."; briefly discuss the significance of "...the education we provide Indigenous, and just as importantly, NON-Indigenous people..."

Why would Gabrielle have emphasised the importance of educating non-Indigenous people? Also consider the significance of the year 2026, for the 400 000 Indigenous youth referenced by Gabrielle, as well as for the students in your classes (who will also be "of working age")

## Action

Display or distribute the graph, "Highest Certificate, Diploma, or Degree", (found in Appendix 1). Working in pairs or small groups, have students discuss, and draw inferences about, the data. Share some of the insights with the larger group, modelling where necessary.

Using charts found in Appendix 2, "Barriers to Future Education and Training" and/or 3, "Literacy and Numeracy..." and/or additional research data, students will create a graph or chart (possibly using graphing software) to display data of their choosing.

Though a Gallery Walk or Stay & Stray technique (see following link(s) if not familiar with these strategies: <http://www.theteachertoolkit.com/index.php/tool/gallery-walk> or <https://www.originsonline.org/educator-help/stay-and-stray-0>, students will use their displayed data to make convincing arguments on the topic of education rates for groups of Canada's Aboriginal people.

## Consolidation

Through large or small group discussions, the disproportionate numbers of FNMI students **not** receiving post-secondary education can be uncovered and explored.

**Next Steps/Reflection:** View the video (3 minutes long) found within the: *2012 Aboriginal Peoples Survey: A brief portrait of education and employment*. Additional data is embedded in the short video, as it briefly discusses the numbers of FNMI students who complete high school and discusses financial benefits of doing so, including future employment & increased wages. [Link to clip: <http://www.statcan.gc.ca/eng/sc/video/aps>]

Consider having students create a chart or graph which illustrates these numbers and/or pose questions about the data. Students could also share their reflections, about the information learned within this lesson, through a journal or other written form.

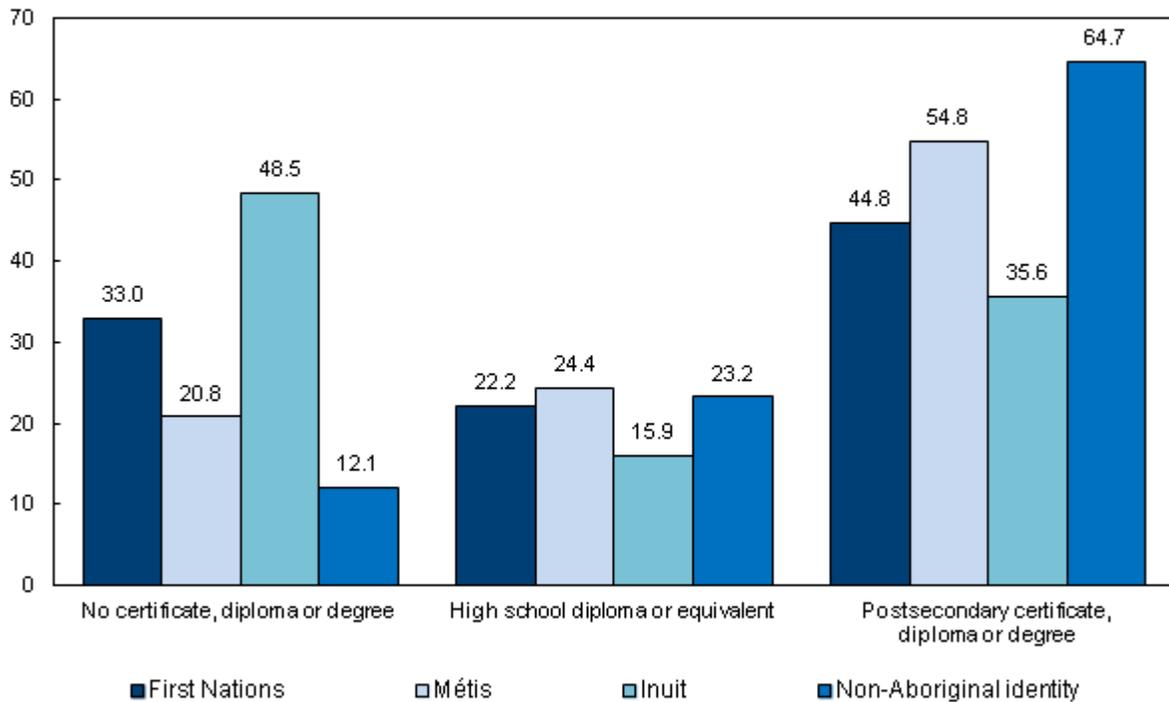
Students may also wish to explore additional negative consequences which are related to this issue, including;

- the disproportionate numbers of FNMI students requiring special education and the response by the Ontario Ministry of Education;
- the differences in levels of attained education, for many Aboriginal vs. non-Aboriginal people, often results in vastly different incomes. The significantly higher cost of food in the North, unaffordable for many, necessitates hunting or fishing for food which is often toxic due to environmental issues in certain geographical areas.

## Highest certificate, diploma, or degree

**Chart 13**  
**Highest level of educational attainment, population aged 25 to 64 years, by Aboriginal identity, Canada, 2011**

percent



**Notes:** Excludes data for one or more incompletely enumerated Indian reserves or Indian settlements.  
 'High school diploma or equivalent' refers to graduation from a secondary school or equivalent. It excludes persons with a postsecondary certificate, diploma or degree.  
 'Postsecondary certificate, diploma or degree' includes 'apprenticeship or trades certificates or diplomas', 'college, CEGEP or other non-university certificates or diplomas' and 'university certificates, diplomas and degrees'.  
 The three Aboriginal groups are based on the population reporting a single identity of 'First Nations,' 'Métis,' or 'Inuit.'  
**Source:** Statistics Canada, National Household Survey, 2011.

## Barriers to further education or training

Table 2

Barriers to further education or training, by Aboriginal identity, high school completers and leavers aged 18 to 44 years, Canada, 2012

	Off-reserve First Nations people		Métis		Inuit	
	completers <sup>‡</sup>	leavers	completers <sup>‡</sup>	leavers	completers <sup>‡</sup>	leavers
	percent					
Time constraints	24	38*	21	48*	26	39*
Courses do not match needs	19	26*	18	30*	27	27
Lack of confidence/preparedness	20	42*	19	46*	22	32*
Not a personal priority	25	45*	24	41*	27	43*
Cost	34	42*	37	52*	18	19
Personal/family responsibilities	31	50*	24	46*	37	52*
Personal health	10	21*	6	13*	7	12

<sup>‡</sup> reference category

\* significantly different from reference category (p < 0.05)

**Notes:** 'Completers' refers to people who have a high school diploma or equivalent and 'leavers' refers to those who were not attending school at the time of the survey and had not completed high school.

Percentages do not add up to 100% because respondents could choose more than one answer.

**Source:** Statistics Canada, Aboriginal Peoples Survey, 2012.

### More barriers to education or training among high school leavers than completers

Leavers were more likely than completers to report that they lacked the confidence or felt unprepared to further their schooling. For example, among First Nations people living off reserve aged 18 to 44 years 42% of leavers identified this as a barrier, compared with 20% of completers. Leavers among this group were also more likely than completers to report that furthering their education was not a personal priority (45% versus 25%).

## Literacy and numeracy

**Table 3**  
**Average literacy and numeracy scores of population aged 16 to 55 years, by Aboriginal identity, Canada and oversampled populations, 2012**

	Aboriginal identity population	Non-Aboriginal identity population	Aboriginal identity population	Non-Aboriginal identity population
	Literacy score	Literacy score	Numeracy score	Numeracy score
<b>Canada</b>	<b>260</b>	<b>274</b>	<b>244</b>	<b>266</b>
Ontario	269	276	252	267
Manitoba	259	276	245	267
Saskatchewan	248	274	232	266
British Columbia	266	275	250	267
Yukon	242	288	224	274
Northwest Territories	229	280	210	271
Nunavut	207	290	187	279

**Notes:** Aboriginal peoples surveyed in the Programme for the International Assessment of Adult Competencies (PIAAC) are composed of First Nations people living off reserve (48%), Métis (44%), and Inuit (5%). In PIAAC, oversamples of Aboriginal people were drawn in Ontario, Manitoba, Saskatchewan, British Columbia (only for those living off reserve in large urban population centres), Yukon, Northwest Territories and Nunavut. The results were compiled to provide a picture of their skill levels in literacy, numeracy and problem solving in technology-rich environments (PS-TRE), enabling more detailed analysis of the proficiency of these populations in the seven provinces and territories.

**Source:** Statistics Canada, International Survey of Adults, Programme for the International Assessment of Adult Competencies, 2012.

### Aboriginal people have lower literacy and numeracy scores than their non-Aboriginal counterparts

The Aboriginal population across Canada scored an average of 260 in literacy, which was lower than the average score of 274 for the non-Aboriginal population. For the seven provinces and territories that were oversampled, this difference also held true, but the magnitude of the difference varied. In Ontario and British Columbia, it was 7 and 9 points lower respectively; in the three territories, it was more than 40 points lower.

## Task 2: Understanding the Reality of Missing and Murdered Aboriginal Women

\*\*\*Educators should note that this section of the learning experience contains highly sensitive content and material. This material should be presented in a careful manner cognizant of backgrounds of the learners.

### Setting the Context:

This experience will help students to become aware of the statistics surrounding the number of murdered and missing Aboriginal females; particularly the fact that the numbers are disproportionately high. In a Globe and Mail article, entitled *Indigenous people six times more likely to be murder victims*, Tavia Grant writes, “In its first-ever complete analysis on homicides and aboriginal identity, Statistics Canada said Indigenous people were about six times more likely than non-Indigenous people to be victims of homicide last year. Almost a quarter of last year’s 516 homicide victims were reported by police as Aboriginal – a group that accounted for just 5 per cent of the Canadian population.”<sup>47</sup> The disproportionality of these numbers was expressed by the Native Women’s Association of Canada, whose research indicates, “between 2000 and 2008, Aboriginal women and girls represented approximately 10% of all female homicides in Canada. However, Aboriginal women make up only 3% of the female population.”<sup>48</sup>

Prime Minister Justin Trudeau’s statement, regarding the release of the Final Report of the Truth and Reconciliation Commission, illustrates the timeliness of educating our students on this matter, as follows: “A national inquiry into missing and murdered Indigenous women and girls is now underway. Ministers are meeting with survivors, families, and loved ones to seek their input on how best to move forward.”<sup>49</sup> On August 3, 2016, there was an official announcement of the terms of the MMIW Inquiry, including the names of the five-member panel, timeline, estimated cost, etc. (Details and references are included in the Activation) It is hoped that these activities will help students to better understand this issue, and the ways in which it is being addressed, while considering ways to respond and “constructively influence change in a discerning manner” (CGE4d).

### Activation:

Use the information and two graphs (‘Female Homicides by Aboriginal Identity’; ‘Homicides in Canada’) in Appendix 4, to introduce this tragic and timely topic.

Educators should consider asking,

“What information is portrayed in these graphs?”

“What information is *not* included?” (I.e. total population data is missing. Help students to see that the number of homicides of Aboriginal women, when compared to population rates, is actually much higher than that of non-Aboriginal women.

View or distribute the 5 page “Fact Sheet: Missing and Murdered Aboriginal Women and Girls” (as shown below, at right; download pdf @ [http://www.nwac.ca/wp-content/uploads/2015/05/Fact\\_Sheet\\_Missing\\_and\\_Murdered\\_Aboriginal\\_Women\\_and\\_Girls.pdf](http://www.nwac.ca/wp-content/uploads/2015/05/Fact_Sheet_Missing_and_Murdered_Aboriginal_Women_and_Girls.pdf)).

<sup>47</sup> <http://www.theglobeandmail.com/news/national/aboriginals-six-times-more-likely-to-be-homicide-victims-statscan/article27475106/> , Retrieved July 15, 2016).

<sup>48</sup> [http://www.nwac.ca/wp-content/uploads/2015/05/Fact\\_Sheet\\_Missing\\_and\\_Murdered\\_Aboriginal\\_Women\\_and\\_Girls.pdf](http://www.nwac.ca/wp-content/uploads/2015/05/Fact_Sheet_Missing_and_Murdered_Aboriginal_Women_and_Girls.pdf), Retrieved July 15, 2016).

<sup>49</sup> <http://pm.gc.ca/eng/news/2015/12/15/statement-prime-minister-release-final-report-truth-and-reconciliation-commission>, Retrieved July 15, 2016.

Explore the data contained within the fact sheet, noting that it was relevant in 2010 and is not current to this year. Use this Native Women's Association of Canada's resource to illustrate the disproportionality. Specifically, their research indicates that, "between 2000 and 2008, Aboriginal women and girls represented approximately 10% of all female homicides in Canada. However, Aboriginal women make up only 3% of the female population."<sup>50</sup>

Share and discuss PM Trudeau's statement, "A national inquiry into missing and murdered Indigenous women and girls is now underway. Ministers are meeting with survivors, families, and loved ones to seek their input on how best to move forward"<sup>51</sup>, as well as that of Chief Commissioner, Marion Buller, "The spirits of the missing and murdered Indigenous women and girls will be close in our hearts and in our minds as we do our work...The families' and the survivors' losses, pain, strength and courage will inspire our work." The inquiry will begin Sept. 1 and run until Dec. 31, 2018, at an estimated cost of \$53.8 million, higher than the \$40 million earmarked in the budget.<sup>52</sup>

A paragraph from the same article clarifies additional details about the commission and may also help to connect several components of this learning experience for students, as follows: "At this point, the government takes an arm's length approach and it's up to the commission to decide when and where to meet and who to interview. The commission will have the authority to summon witnesses and compel documents. It will examine the factors driving a systemic, high rate of violence against Indigenous women and girls, and the role of various institutions, including police forces, governments and coroner's offices. It will also review various federal and provincial laws, but will not find criminal liability."<sup>53</sup>

It is hoped that this brief activation and overview may also provoke students to initiate their own inquiry into aspects of this issue.

## Action

Compare the information shown in Chart 9 of Appendix 5, "Average Rate of Aboriginal Female Homicide", with that of the 'Female Homicides by Aboriginal Identity' graph (Appendix 4) that was used during the activation.

\*\*\*Note that the graphs look somewhat similar, visually, but the lines for Aboriginal vs. non-Aboriginal women are in opposite positions on the two graphs:

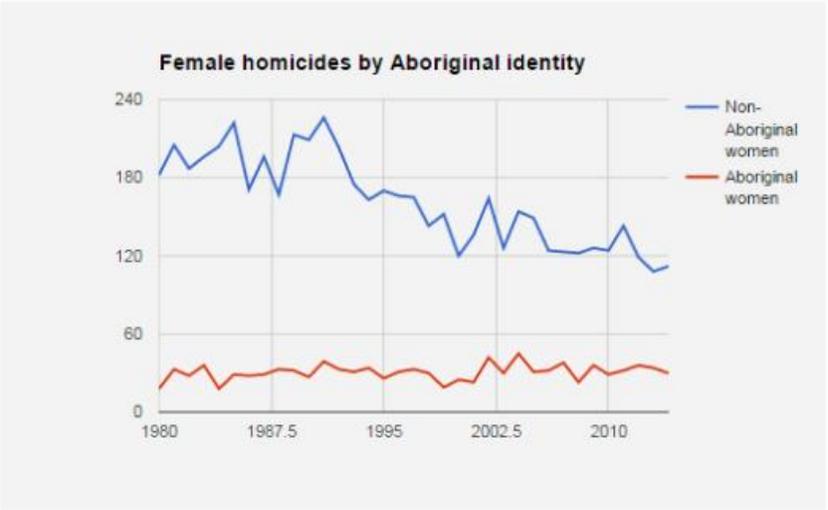
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<sup>50</sup> [http://www.nwac.ca/wp-content/uploads/2015/05/Fact Sheet Missing and Murdered Aboriginal Women and Girls.pdf](http://www.nwac.ca/wp-content/uploads/2015/05/Fact_Sheet_Missing_and_Murdered_Aboriginal_Women_and_Girls.pdf), Retrieved July 15, 2016).

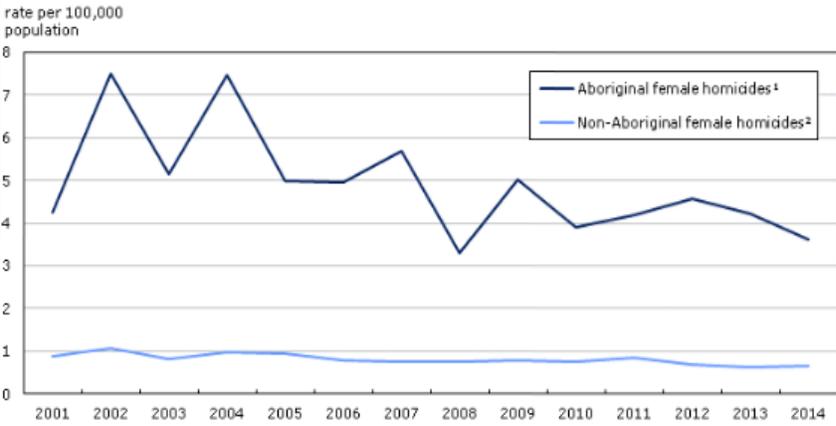
<sup>51</sup> <http://pm.gc.ca/eng/news/2015/12/15/statement-prime-minister-release-final-report-truth-and-reconciliation-commission>, Retrieved July 15, 2016.

<sup>52</sup> From *Marion Buller, B.C. First Nations judge, to lead MMIW inquiry: Federal government officially launches inquiry, names 5-member commission led by Buller*, Catharine Tunney & Kathleen Harris, *CBC News*, Posted: Aug 03, 2016 5:00 AM ET & retrieved August 5, 2016, @ <http://www.cbc.ca/news/politics/mmiw-inquiry-launch-details-1.3704191>.

<sup>53</sup> *ibid.*



**Chart 9**  
**Rate of female homicides, by Aboriginal identity, Canada,**  
**2001 to 2014**



Consider using the “Description for Chart 9” information (found at <http://www.statcan.gc.ca/pub/85-002-x/2015001/article/14244/c-g/desc/desc09-eng.htm>) to explore/review various aspects of the graph with students, including: number of categories, units used on horizontal axis, minimum and maximum values, etc.

Working in pairs, have students compare the Statistics Comparing Aboriginal and Non-Aboriginal Female Homicides in Canada from ‘Data Table for Chart 9’ (also available in Appendix 6) with the graph in Chart 9 (see above) and consider how it was compiled. Students might also determine the ratios for a particular year (or years) and discuss trends, controversies, etc. with partner. Finally, pairs or individuals can create their own chart or graph using a self-selected portion of the data.

Alternate/additional idea: Use ‘Self-reported non-spousal violent victimizations, Canada’s ten provinces, 2009’ graph (Appendix 7) to explore causes of homicide and to consider why rates are higher for Aboriginal people. Note that this graph is part of a larger series, entitled “Violent victimization of Aboriginal people in the Canadian provinces, 2009” (can be found @:

<http://www.statcan.gc.ca/pub/85-002-x/2011001/article/11415-eng.htm#a1>) and includes links to numerous other related data that may be of interest.

### Consolidation

This link (<https://www.youtube.com/watch?v=QDq93fz6HWs>) leads to a “5 Minute PD with Renee & April” which will help educators to become (more) familiar with a ‘talking circle’. You may also wish to show a portion of the clip (from 0:30 through 4:20) to students, in order to help them understand the significance of the circle as well as the difference between a ‘talking circle’ and a ‘sharing circle’.

Establish criteria for a talking circle within your class and have pairs of students share significant discoveries (& personal insights) from their research. Note specific trends that emerge from the discussion and use these categories for students to decide which area(s) they would like to explore further, using the Statistics Canada website (<http://www.statcan.gc.ca/>) and other sources of information.



Consider sharing “Sisters in Spirit: Grandmother Moon” poem (Appendix 8) following the talking circle. It will also introduce students to the Native Women’s Association of Canada website (<https://nwac.ca/>), which includes information and additional resources for possible next steps in research (i.e. Violence Prevention and Safety links: Project PEACE, Sisters in Spirit, You Are Not Alone).

### Next steps

You may wish to research the most current discussion regarding the National Inquiry. Currently (July, 2016), concerns have been voiced regarding the [freedom, etc.] of the commission as it is described in the Draft Terms of Reference. (A pdf version of the draft can be downloaded at: <http://www.cbc.ca/news/canada/mmiw-inquiry-violence-prevention-1.3686671>). A recent article in the Globe and Mail included quotes from a joint statement, issued by “various high-profile advocates, including from Amnesty International Canada and the Canadian Feminist Alliance for International Action, [who]... lamented the lack of an independent case-review process... This appears to be sending families back in a circle, to the same authorities with whom they were/are having problems to start with...This risks putting the Commissioners in an untenable position as they will appear to be part of the problem, not the solution.”<sup>54</sup>

**[\*Please note** that much of the content of this article is **sensitive and extremely graphic**, including links which describe how the victims were stalked by serial killers. Should you decide

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<sup>54</sup> from Missing, murdered inquiry will lack power to compel police action by K. Blaze Baum and G. Galloway in The Globe and Mail; Published Wednesday, Jul. 20, 2016 4:14PM EDT Retrieved July 21, 2016 @ <http://24h.bestthenews.com/content/view/119539>

to use the above-mentioned quote, we recommend that the full article **NOT** be shared with students at these grade levels.]

On August 3, 2016, the names of the five members of the Commission were revealed, as follows: “Marion Buller, British Columbia's first female First Nations judge, was revealed as chief commissioner of a five-member panel tasked by Ottawa to help bring a "national tragedy to an end."...The other commissioners are:

- Michèle Audette, leading women's First Nations advocate, Innu francophone and former president of the Native Women's Association of Canada.
- Qajaq Robinson, Ottawa-based lawyer specializing in Aboriginal issues and land and treaty claims, born in Nunavut.
- Marilyn Poitras, constitutional and Aboriginal law expert at the University of Saskatchewan.
- Brian Eyolfson, First Nations and human rights lawyer, former vice-chair of the Human Rights Tribunal of Ontario.<sup>55</sup>

With the Commission set to begin on September 1, 2016 (through December, 2018), students may wish to research one or more of the five panel members, in order to explore how their backgrounds and experiences may impact their work with the Commission.

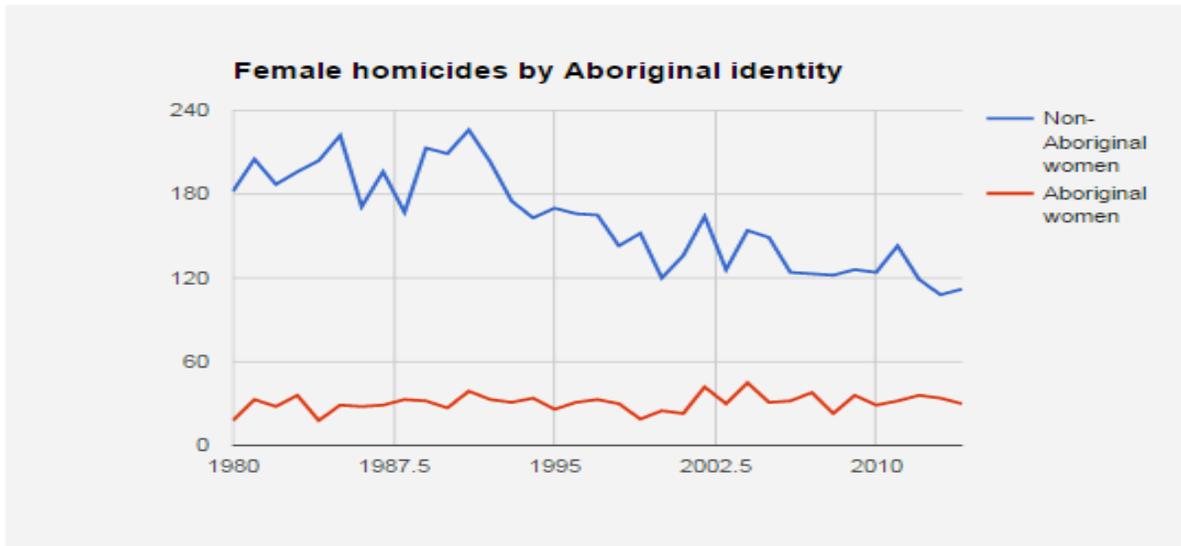
Additionally, there has been controversy about the effectiveness of the MMIW Inquiry. In a National Post article, *Robyn Urback: A proper inquiry into missing and murdered Indigenous women cannot shy away from uncomfortable truths*, Robyn Urback speculates, “...it is unlikely that this \$53.8 million inquiry will unearth a previously unexamined cause of the violence that many Indigenous girls and women are made to endure: countless reports and studies — including the Truth and Reconciliation Commission’s report, the Royal Commission on Aboriginal Peoples, the RCMP’s 2014 report on missing and murdered Aboriginal women and a recent United Nations report on human rights in Canada — have detailed the myriad of conditions that make Aboriginal women six times more likely, for example, to be victims of homicide than non-Aboriginal women. They include the lingering trauma of Canada’s residential school system, ongoing systemic oppression, institutional racism, substance abuse, family violence, poverty, lack of resources on reserves and so forth, all of which demand immediate action, arguably more so than continued study.”<sup>56</sup> Students may wish to explore some of these named conditions, in an effort to better understand these issues and circumstances, possibly discovering ways to respond and “constructively influence change in a discerning manner” (CGE4d).

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<sup>55</sup> From *Marion Buller, B.C. First Nations judge, to lead MMIW inquiry: Federal government officially launches inquiry, names 5-member commission led by Buller* By Catharine Tunney, Kathleen Harris, *CBC News* Posted: Aug 03, 2016; Retrieved August 5, 2016, @ <http://www.cbc.ca/news/politics/mmiw-inquiry-launch-details-1.3704191>

<sup>56</sup> From *Robyn Urback: A proper inquiry into missing and murdered indigenous women cannot shy away from uncomfortable truths*, published August 3, 2016; retrieved August 5, 2016, @ <http://news.nationalpost.com/full-comment/robyn-urback-a-proper-inquiry-into-missing-and-murdered-indigenous-women-cannot-shy-away-from-uncomfortable-truths>

Appendix 4: Female Homicides by Aboriginal Identity and Homicides in Canada (Retrieved July 28th @ <http://www.ctvnews.ca/canada/homicide-rate-6-times-higher-for-aboriginal-canadians-statscan-1.2673751>)



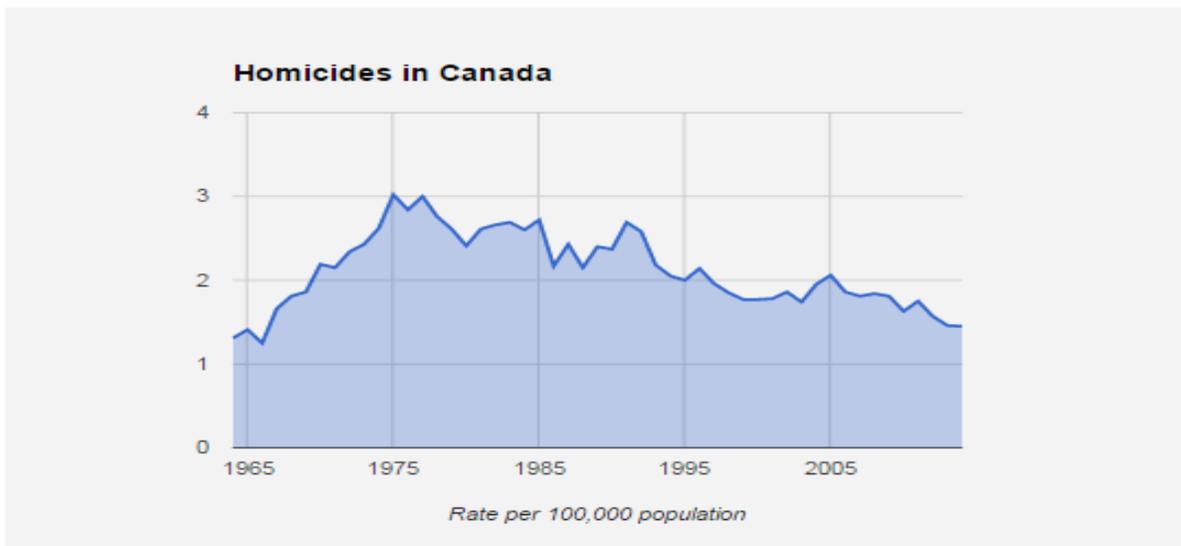
### Plans for national inquiry

The report comes as the new Liberal government looks to announce a national inquiry into missing and murdered aboriginal women.

Minister of Indigenous and Northern Affairs Carolyn Bennett said earlier in November, that she's hoping to announce a pre-inquiry consultation process within the next few months.

In general, Canada's homicide rate remained stable, with 2013 and 2014, posting the lowest homicide rates since 1966.

This chart shows Canada's overall homicide rate. it excludes the victims of the 1985 Air India bombing.



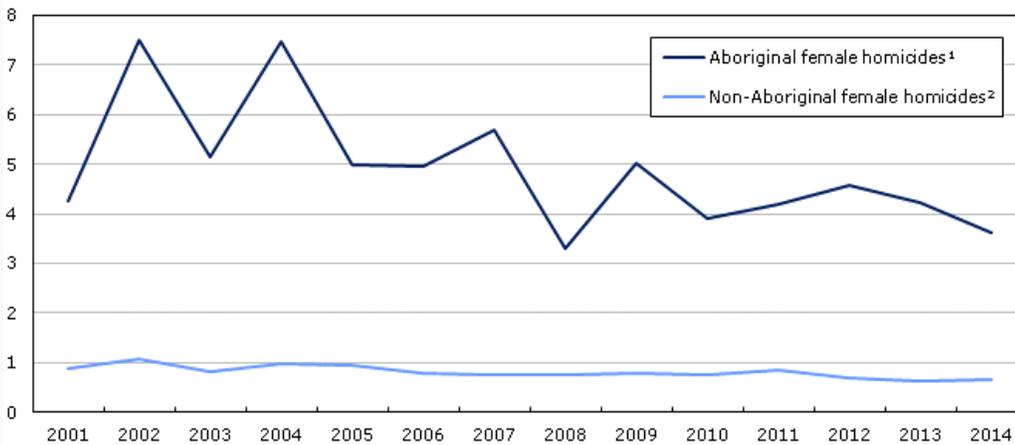
Appendix 5: Average Rate of Aboriginal Female Homicide is six times higher than for non-Aboriginal females (Downloaded @ <http://www.statcan.gc.ca/pub/85-002-x/2015001/article/14244-eng.htm#a14> (scroll to 'Chart 9'); Retrieved on July 21, 2016

## Average rate of Aboriginal female homicide is six times higher than for non-Aboriginal females

From 2001 to 2014,<sup>10</sup> the average rate of homicides involving Aboriginal female victims was 6 times higher than that of homicides where female victims were not Aboriginal (average rate of 4.82 per 100,000 compared to 0.81) (Table 7; Chart 9).<sup>11</sup>

**Chart 9**  
Rate of female homicides, by Aboriginal identity, Canada, 2001 to 2014

rate per 100,000 population



1. Rates are calculated per 100,000 Aboriginal female population in Canada. Refer to the 'Data Sources' section of this report for further information.

2. Rates are calculated per 100,000 non-Aboriginal female population in Canada. Refer to the 'Data Sources' section of this report for further information.

Appendix 6: Statistics Comparing Aboriginal and Non-Aboriginal Female Homicides in Canada  
 “Data Table for Chart 9: (Retrieved July 21, 2016, @ <http://www.statcan.gc.ca/pub/85-002-x/2015001/article/14244/c-g/desc/desc09-eng.htm>;

**Data table for chart 9**

	<b>Aboriginal female homicides<sup>1</sup></b>	<b>Non-Aboriginal female homicides<sup>2</sup></b>
2001	4.26	0.90
2002	7.49	1.08
2003	5.16	0.82
2004	7.47	0.99
2005	4.97	0.95
2006	4.97	0.79
2007	5.68	0.77
2008	3.32	0.76
2009	5.02	0.78
2010	3.91	0.76
2011	4.18	0.86
2012	4.58	0.71
2013	4.22	0.64
2014	3.64	0.65

1. Rates are calculated per 100,000 Aboriginal female population in Canada. Refer to the 'Data Sources' section of this report for further information.
2. Rates are calculated per 100,000 non-Aboriginal female population in Canada. Refer to the 'Data Sources' section of this report for further information.

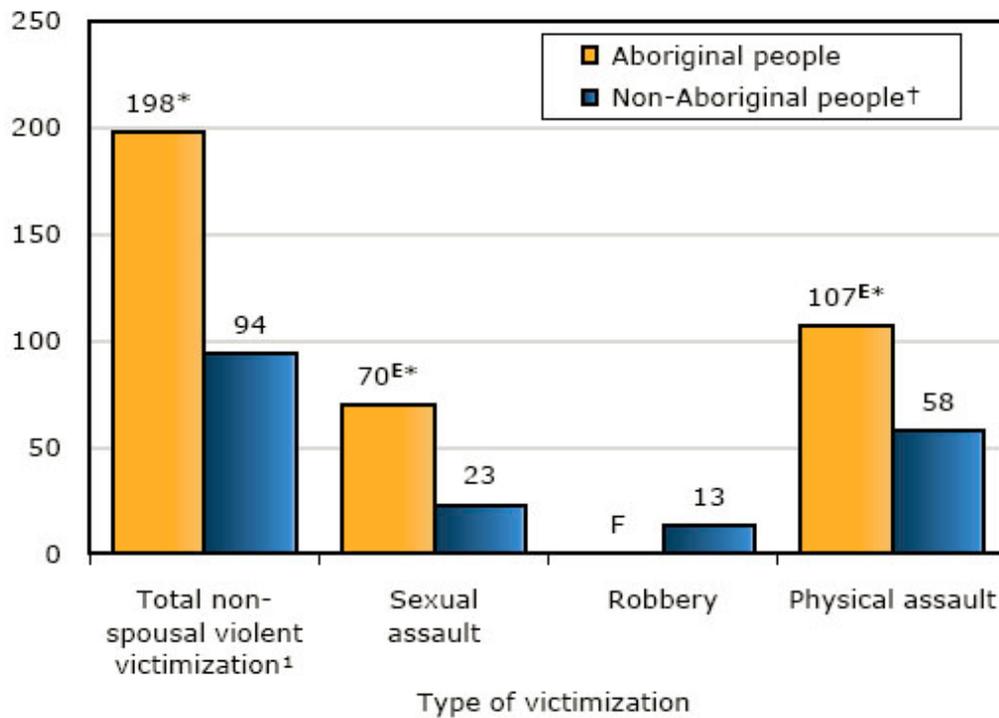
Appendix 7 Self-reported non-spousal violent victimizations, Canada's ten provinces, 2009  
(Downloaded @ <http://www.statcan.gc.ca/pub/85-002-x/2011001/article/11415-eng.htm#a1>, July 12, 2016.)

### Chart 1

### Self-reported non-spousal violent victimizations, Canada's ten provinces, 2009

[Data table for chart 1](#)

rate per 1,000 population age 15 years and older



## Sisters In Spirit

### Grandmother Moon

You know all women from birth to death  
We seek your knowledge  
We seek your strength  
Some are STARS up there with you  
Some are STARS on Mother Earth  
Grandmother, lighten our path in the dark  
Creator, keep our sisters safe from harm  
Maa duu? Mussi cho

-Kukdookaa



## Appendices

### A. The Peace Prayer of St. Francis of Assisi:

Make me a channel of your peace,  
Where there is hatred let me bring your love,  
Where there is injury your pardon Lord,  
And where there's doubt true faith in you.

Make me a channel of your peace,  
Where there's despair in life, let me bring hope,  
Where there is darkness, only light,  
And where there's sadness, ever joy.

O Master grant that I may never seek,  
So much to be consoled as to console,  
To be understood as to understand,  
To be loved as to love with all my soul,

Make me a channel of your peace,  
It is in pardoning that we are pardoned,  
In giving of ourselves that we receive,  
And in dying that we're born to eternal life.

O Master grant that I may never seek,  
So much to be consoled as to console,  
To be understood as to understand,  
To be loved as to love with all my soul,

Make me a channel of your peace,  
It is in pardoning that we are pardoned,  
In giving of ourselves that we receive,  
And in dying that we're born to eternal life.  
Make me a channel of your peace.

## B. Ontario Catholic School Graduate Expectations

### Ontario Catholic School Graduate Expectations

#### A Discerning Believer Formed in the Catholic Faith Community

- ✚ CGE1a Illustrates a basic understanding of the saving story of our Christian faith.
- ✚ CGE1b Participates in the sacramental life of the church and demonstrates an understanding of the centrality of the Eucharist to our Catholic story.
- ✚ CGE1c Actively reflects on God's Word as communicated through the Hebrew and Christian scriptures.
- ✚ CGE1d Develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity and the common good.
- ✚ CGE1e Speaks the language of life... "recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it." (Witnesses to Faith)
- ✚ CGE1f Seeks intimacy with God and celebrates communion with God, others and creation through prayer and worship.
- ✚ CGE1g Understands that one's purpose or call in life comes from God and strives to discern and live out this call throughout life's journey.
- ✚ CGE1h Respects the faith traditions, world religions and the life-journeys of all people of good will.
- ✚ CGE1i Integrates faith with life.
- ✚ CGE1j Recognizes that "sin, human weakness, conflict and forgiveness are part of the human journey" and that the cross, the ultimate sign of forgiveness is at the heart of redemption. (Witnesses to Faith)

#### An Effective Communicator

- ✚ CGE2a Listens actively and critically to understand and learn in light of gospel values.
- ✚ CGE2b Reads, understands and uses written materials effectively.
- ✚ CGE2c Presents information and ideas clearly and honestly and with sensitivity to others.
- ✚ CGE2d Writes and speaks fluently one or both of Canada's official languages.
- ✚ CGE2e Uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology and information systems to enhance the quality of life.

#### A Reflective and Creative Thinker

- ✚ CGE3a Recognizes there is more grace in our world than sin and that hope is essential in facing all challenges.
- ✚ CGE3b Creates, adapts, evaluates new ideas in light of the common good.
- ✚ CGE3c Thinks reflectively and creatively to evaluate situations and solve problems.
- ✚ CGE3d Makes decisions in light of gospel values with an informed moral conscience.
- ✚ CGE3e Adopts a holistic approach to life by integrating learning from various subject areas and experience.
- ✚ CGE3f Examines, evaluates and applies knowledge of interdependent systems (physical, political, ethical, socio-economic and ecological) for the development of a just and compassionate society.

## A Self-Directed, Responsible, Lifelong Learner

- ✚ CGE4a Demonstrates a confident and positive sense of self and respect for the dignity and welfare of others.
- ✚ CGE4b Demonstrates flexibility and adaptability.
- ✚ CGE4c Takes initiative and demonstrates Christian leadership.
- ✚ CGE4d Responds to, manages and constructively influences change in a discerning manner.
- ✚ CGE4e Sets appropriate goals and priorities in school, work and personal life.
- ✚ CGE4f Applies effective communication, decision-making, problem-solving, time and resource management skills.
- ✚ CGE4g Examines and reflects on one's personal values, abilities and aspirations influencing life's choices and opportunities.
- ✚ CGE4h Participates in leisure and fitness activities for a balanced and healthy lifestyle.

## A Collaborative Contributor

- ✚ CGE5a Works effectively as an interdependent team member.
- ✚ CGE5b Thinks critically about the meaning and purpose of work.
- ✚ CGE5c Develops one's God-given potential and makes a meaningful contribution to society.
- ✚ CGE5d Finds meaning, dignity, fulfillment and vocation in work which contributes to the common good.
- ✚ CGE5e Respects the rights, responsibilities and contributions of self and others.
- ✚ CGE5f Exercises Christian leadership in the achievement of individual and group goals.
- ✚ CGE5g Achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.
- ✚ CGE5h Applies skills for employability, self-employment and entrepreneurship relative to Christian vocation.

## A Caring Family Member

- ✚ CGE6a Relates to family members in a loving, compassionate and respectful manner.
- ✚ CGE6b Recognizes human intimacy and sexuality as God given gifts, to be used as the creator intended.
- ✚ CGE6c Values and honours the important role of the family in society.
- ✚ CGE6d Values and nurtures opportunities for family prayer.

## A Responsible Citizen

- ✚ CGE7a Acts morally and legally as a person formed in Catholic traditions.
- ✚ CGE7b Accepts accountability for one's own actions.
- ✚ CGE7c Seeks and grants forgiveness.
- ✚ CGE7d Promotes the sacredness of life.
- ✚ CGE7e Witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society.
- ✚ CGE7f Respects and affirms the diversity and interdependence of the world's peoples and cultures.
- ✚ CGE7g Respects and understands the history, cultural heritage and pluralism of today's contemporary society.
- ✚ CGE7h Exercises the rights and responsibilities of Canadian citizenship.
- ✚ CGE7i Respects the environment and uses resources wisely.
- ✚ CGE7j Contributes to the common good.

## **C: Resources to Explore**

Visit the [Learn Teach Lead](#) site to access a variety of resources highlighting Indigenous ways of knowing. Examples of relevant resources based on the context of this document are suggested below.

### **Coming Together to Learn Together.** Dr. Lisa Lunney Borden

Dr. Lisa Lunney Borden shares her work in supporting mathematics with the Mi'kmaw community in Nova Scotia, where the graduation rate of Indigenous students is higher than that of the general population. Lisa's work highlights the importance of "Making Meaningful Personal Connections" to mathematics, including understanding Ways of Learning, Values, Language and Culture. Lisa's practical examples and stories will support all educators to integrate these perspectives into math learning for all students.

### **The Listening Stone Project:** Dr. Susan Dion

Dr. Dion shares the challenges, successes and next steps to increase First Nation, Métis and Inuit student achievement and well-being. She emphasizes the importance of learning with and from community partnerships. Susan reminds us how critical it is to increase the knowledge, understanding and awareness of First Nation, Métis and Inuit histories, cultures and perspectives for all people.

### **N'gwii Kendaasmin - We'll learn and Teach Together:** First Nations, Métis and Inuit

In this video series, experts in Aboriginal education [Lisa Lunney Borden, Florence Glanfield, Wab Kinew, Deborah McGregor, Elder Betty McKenna and Ed Doolittle] share insights on how to improve achievement for all students. The importance of educating all students about indigenous history and current issues is emphasized.

### **What Works? Integrating Aboriginal Teachings and Values into the Classroom**

A new body of research is beginning to demonstrate that Aboriginal students' self-esteem is a key factor in their school success. An educational environment that honours the culture, language and worldview of the Aboriginal student is critical. Schools need to meaningfully represent and include Aboriginal people's contributions, innovations and inventions.

**D. Resources to Explore: Focus on Mathematics within Indigenous Cultures:**

**Iroquois Museum**

<http://www.iroquoismuseum.org/ve11.html>

**National Gallery of Canada: Aboriginal Voices in Canadian Contemporary Art**

[http://cybermuse.gallery.ca/cybermuse/teachers/plans/activities\\_e.jsp?lessonid=44](http://cybermuse.gallery.ca/cybermuse/teachers/plans/activities_e.jsp?lessonid=44)

**NativeTech: Native American Technology & Art**

<http://www.nativetech.org/wampum/wamphist.htm>

**Office of the Treaty Commissioner: Saskatchewan**

<http://www.otc.ca/siteimages/TELS.pdf>

**University of British Columbia: Indigenous Foundations**

<http://indigenousfoundations.arts.ubc.ca/home/government-policy/royal-proclamation-1763.html>

**University of Regina: Aboriginal Perspectives (2010)**

<http://aboriginalperspectives.uregina.ca/workshops/workshop2010/>

**University of Regina: Aboriginal Perspectives (2011)**

<http://aboriginalperspectives.uregina.ca/workshops/workshop2011/>

**We Stand Together:**

[http://www.weday.com/we-schools/educator-resources/library/#search\\_target](http://www.weday.com/we-schools/educator-resources/library/#search_target)

## E. Additional Resources:

### Print Resources:

Aboriginal Healing and Outreach Program. (2008). *Traditional Teachings Handbook*. Native Women's Centre. Hamilton.

Beatty, R., & Blair, D. (2015). "Indigenous Pedagogy for Early Mathematics: Algonquin Looming in a Grade 2 Math Classroom." *The International Journal of Holistic Early Learning and Development*, 1, 3-24.

Bishop, Alan J. (1988). *Mathematical Enculturation: A Cultural Perspective on Mathematics Education*. Kluwer Academic Publishers, Boston.

Catholic Principals' Council of Ontario. *Principal Connections: Aboriginal Education*. Winter, 2015. 10, 1.

Borden, L. "3 Good Ideas". 24-26.

Burton Spohn, R. "Crossing the Borders of Catholicity, FNMI Teachings and Technology". 36-37.

Garbutt, P. & Webster, T. "The Metaphor of the Circle". 13-15.

Tratnyek, P., Elder Sagassige. "Native Spirituality and Catholic Praxis". 22-23.

Donald, D., Glanfield, F., & Sterenberg, G. "Culturally Relational Education in and with Indigenous Community." [*Indigenous Education*] in *Education*. 17, 3, Autumn 2011, 72-82.

Institute for Catholic Education. (2012). *Ontario Catholic Elementary Curriculum Policy Document for Religious Education, Grades 1 - 8*, Toronto.

Institute for Catholic Education. (2012). *Ontario Catholic Elementary Curriculum Policy Document, Grades 1-8: Family Life Education*, Toronto.

Institute for Catholic Education. (2011). *Ontario Catholic School Graduate Expectations*. Toronto.

Kovach, M. "Conversational Method in Indigenous Research." *First Peoples Child and Family Review*. 5, 1, 2010, 40-48.

Kovach, M. (2012). *Indigenous Methodologies: Characteristics, Conversations and Contexts*. University of Toronto Press, Toronto.

Lunney Borden, L. "The 'Verbification' of Mathematics: Using the Grammatical Structures of Mi'kmaq to Support Student Learning." *For the Learning of Mathematics*. 31, 3, Nov. 2011. 8 - 13

Munroe, E., Lunney Borden, L. Murray Orr, A., Toney, D., & Meader, J. "Decolonizing Aboriginal Education in the 21st Century." *McGill Journal of Education*. 48, 2, Spring 2013. 317- 337.

Sterenberg, G., & Hogue, M. "Reconsidering Approaches to Aboriginal Science and Mathematics Education." *Alberta Journal of Educational Research*. 57, 1. Spring 2011, 1-15

Wilson, S. (2008). *Research Is Ceremony: Indigenous Research Methods*. Fernwood Publishing, Winnipeg.

**Ontario Ministry of Education Resources:**

Ontario Ministry of Education. [Integrating Aboriginal Teaching and Values into the Classroom](#). What works: Research into Practice, #11. March, 2008

Ontario Ministry of Education. [Pedagogical Documentation Revisited: Looking at Assessment and Learning in New Ways](#), Toronto, 2013.

Ontario Ministry of Education: Aboriginal Education Office: [Ontario First Nation, Métis and Inuit Policy Framework](#). Toronto, 2007

Ontario Ministry of Education: Aboriginal Education Office: [Sound Foundations for the Road Ahead](#). Toronto, 2009

**Digital Resources:**

Encyclical Letter Laudato Si' of the Holy Father Francis - On Care for Our Common Home: Retrieved on July 15, 2016 from:

[http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco\\_20150524\\_enciclica-laudato-si.pdf](http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.pdf)

Gospel Values: Retrieved on July 14, 2016 from:

[http://www.lovingjustwise.com/gospel\\_values2.htm](http://www.lovingjustwise.com/gospel_values2.htm)

[Truth and Reconciliation Commission of Canada](#)

"5 Minute PD with Renee & April": Retrieved on July 15, 2016 from:

<https://www.youtube.com/watch?v=QDq93fz6HWs>

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