



Date: _____

Ratios of Maple Syrup and Sweet Water

 Math

ACKNOWLEDGEMENT

Please read this Acknowledgement before the start of this lesson to respect the knowledge that is being shared and the Land of the People where the knowledge originates.:

This lesson plan was created by faculty, students, and partner school boards of Trent University's School of Education and Professional Learning. We recognize and honour Traditional Knowledge carriers - Anishinaabe Elder Doug Williams, of Curve Lake First Nation, and Potawatomi faculty Barbara Wall, of the Chanie Wenjack School for Indigenous Studies at Trent University.

LEARNING OUTCOMES

Upon successful completion of this lesson plan, students will be able to:

1. Explain the ratio of sweet water to maple syrup;
2. Use proportional reasoning to calculate the volume of sweet water required in order to support Canada's maple syrup industry;
3. Understand how Canada's claim to maple syrup as a national identity can be an act of Indigenous erasure.

Origin
Elders and Traditional Knowledge carriers involved with Trent University and Curve Lake First Nation
Peterborough
Ontario

Learning Level / Grade

5

Also: 6

 **95 mins**

LIST OF ACTIVITIES

1. Activating Prior Learning
2. Exploring Ratios and Identity
3. Reflection and Consolidation

MATERIALS

- Story: Nanaboozo and the Maple Trees Info
- Supplies: the Canadian flag
- Maple Sugar Videos
- Supplies: a measuring cylinder, pipette, and tablespoon; a stopwatch (e.g., app on phone)
- statistics about maple syrup production
- How Maple Syrup is Made

Related Subjects

Commerce or Business,
History, Science, Social
Studies, Indigenous Ways of
Knowing & Being

DESCRIPTION

This lesson plan examines ratios of sweet water to maple syrup to determine how much sweet water is needed to produce litres, gallons, or massive volumes of maple syrup, e.g. Canada's annual maple syrup industry. Maple syrup, in Canadian society, has been portrayed as a component of Canada's identity; however, this lesson plan is based on Indigenous People's lived experiences and traditional teachings about sugar maple trees. It also pays tribute to sustainable practices of harvesting sweet water.

It is written as one lesson plan but could easily be extended into multiple lessons as the students explore the different activities and aspects of learning about sugar maple trees.

HOLISM AND ALL OUR RELATIONS

This lesson plan has been developed with an Indigenous lens that is holistic in nature, a way of being and knowing that acknowledges our relationships with 'all our relations', including plants and animals, other human beings, the water, land, wind, sun, moon, stars, and more - everything seen and unseen. With 'all our relations' in mind, this lesson plan has been developed with a focus on:

- Language and Culture
- Participatory and experiential learning activities
- Intergenerational learning with Elders/Knowledge Holders
- Different learning styles; attention given to mind, body, and spirit
- Connections are made with everyday life
- Ethics in the classroom: care, truthfulness and trust, respect, integrity
- Relationship with the land
- Personal reflection time (connecting with thoughts and feelings)

TEACHERS' GUIDE

Background/Foundational Information

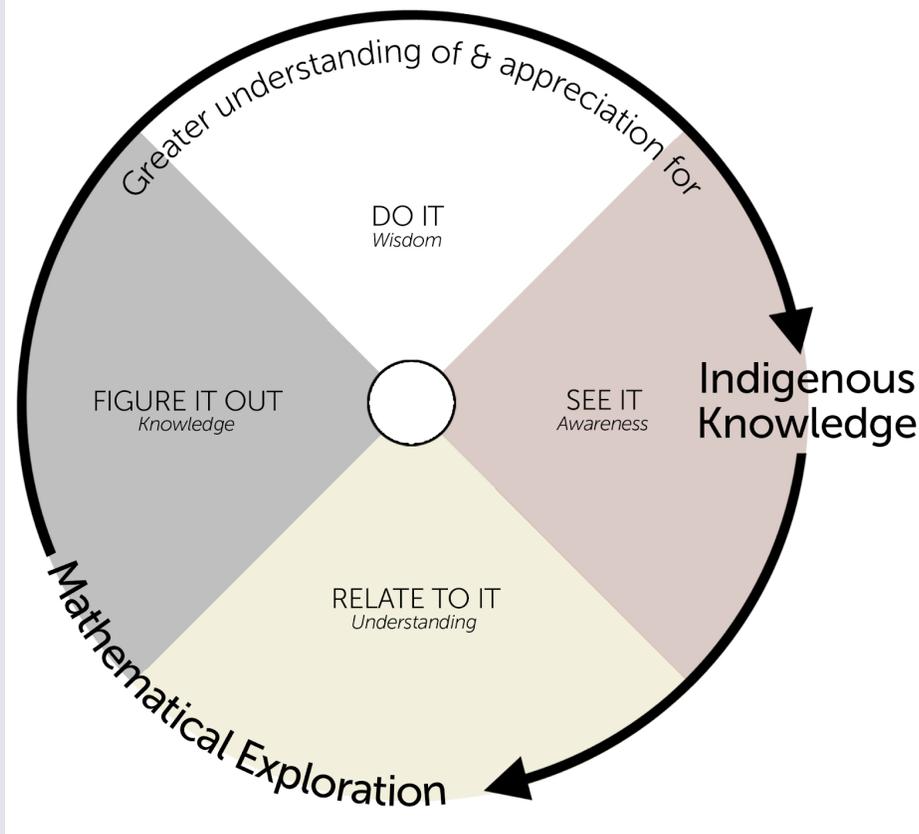
- This lesson plan was designed according to the Medicine Wheel diagram produced by Anishinaabe faculty in Trent University's School of Education and Professional Learning, Dr. Nicole Bell (see figure below). We recommend educators familiarize themselves with the Medicine Wheel and how learning commences through each of the four quadrants (<https://www.edcan.ca/articles/teaching-by-the-medicine-wheel>). Through using the Medicine Wheel as a theoretical framework for inquiry-based learning, each lesson starts with and concludes with Indigenous Knowledge (<https://vimeo.com/paradigmpost/maple-sugar-videos/video/367440434>).

The objective of this lesson is for students to form a greater appreciation and deeper understanding of Indigenous Knowledge as transmitted through the act of making maple sugar or maple syrup. In essence, this is land-based education.

Familiarity with the following resources is also recommended: "Nanaboozo and the Maple Tree" in *Keepers of the Earth: Native American Stories and Environmental Activities for Children*, M. J. Caduto & J. Bruchac (1997) and "Nanaboozo Saves Nokomis" in *Tales of Nanabozho*, D. M. Reid (1963).

Educators should take additional time to study and learn about the importance of storytelling according to Anishinaabe ways of knowing. It is evident across many Indigenous cultures that while storytelling is an art, more importantly, stories emerge from Land and they embody ancestral knowledge and intelligence of Indigenous people that stretches back centuries.

We strongly recommend building relationships with Elders, Knowledge Holders, and your local Indigenous community. Please seek advice for protocols in storytelling; some stories are recited at certain times of the year (e.g. Nanabozho stories are only recited when Creation is resting during the winter months).



Connections to Curriculum (Ontario Curriculum Guidelines)

Note: page numbers noted below are found in this document
<http://www.edu.gov.on.ca/eng/Curriculum/elementary/scientec18currb.pdf>

Grade 5

Overall Expectation(s) addressed:

(NS&N) Solve problems involving the multiplication and division of multi-digit whole numbers, and involving the addition and subtraction of decimal numbers to hundredths, using a variety of strategies;

(NS&N) Demonstrate an understanding of proportional reasoning by investigating whole-number rates;

(M) Estimate, measure, and record perimeter, area, temperature change, and elapsed time, using a variety of strategies.

Specific Expectation(s) addressed:

(NS&N) Multiply two-digit whole numbers by two-digit whole numbers, using estimation, student-generated algorithms, and standard algorithms;

(NS&N) Use estimation when solving problems involving the addition, subtraction, multiplication, and division of whole numbers, to help judge the reasonableness of a solution;

(NS&N) Demonstrate an understanding of simple multiplicative relationships involving whole-number rates, through investigation using concrete materials and drawings;

(M) Estimate, measure, and represent time intervals to the nearest second;

(M) Estimate and determine elapsed time, with and without using a time line, given the durations of events expressed in minutes, hours, days, weeks, months, or years.

Grade 6

Overall Expectation(s) addressed:

(NS&N) Solve problems involving the multiplication and division of whole numbers, and the addition and subtraction of decimal numbers to thousandths, using a variety of strategies;

(NS&N) Demonstrate an understanding of relationships involving percent, ratio, and unit rate;

(M) Estimate, measure, and record quantities, using the metric measurement system.

Specific Expectation(s) addressed:

(NS&N) Solve problems involving the multiplication and division of whole numbers (four digit by two digit), using a variety of tools and strategies;

(NS&N) Represent ratios found in real-life contexts, using concrete materials, drawings, and standard fractional notation;

(M) Demonstrate an understanding of the relationship between estimated and precise measurements, and determine and justify when each kind is appropriate;

(M) Estimate, measure, and record length, area, mass, capacity, and volume, using the metric measurement system.

ACTIVITIES

1 - Activating Prior Learning

Purpose

The purpose of this activity is for students to recognize how Traditional Teachings and Traditional Knowledge about sugar maple trees underpin an aspect of Anishinaabe identity. Moreover, it is crucial in this part of the lesson to guide students towards thinking critically about how maple syrup or maple products are a significant part of Canada's identity. Consider discussing Canada's flag as an example of how maple trees are used to tell a story.

Time: 20 mins

Activity Instructions

1. Read the story:

Depending on the age and experience of the learners, either the student(s) or the educator reads: *Keepers of the Earth - 'Nanaboozo and the Maple Tree'* and/or *'Nanaboozho saves Nokomis'*.

2. Watch videos:

Students watch selected parts of the videos *'Ziinzibaakwadgummig - The Sugar Bush'* and *'Collecting the Maple Sap'* (included in this lesson plan) to explore how sugar maple trees and maple syrup production are components of Anishinaabe identity.

3. Show a picture of Canada's flag, highlighting the maple leaf.

4. Use prompt questions to stimulate thinking and discussion:

"What do you notice?"

"What do you wonder?"

"How might the perspectives of Indigenous and non-Indigenous people differ?"

"Why might the Indigenous story not be part of Canada's national identity as told through iconic images such as Canada's flag?"

"What do these stories tell us about Anishinaabe People's relationship with Land and their sense of identity?"

Guiding question to the educator:

"How are your students 'seeing it' (the vision)?"

This activity is designed to connect with learners with these learning styles...

- Spiritual (e.g., Relational) Learners
- Physical (e.g., Tactile, Experiential, Visual) Learners
- Intellectual (e.g., Rational, Logical) Learners

... in the following ways:

Spiritual Learners - are accommodated through hearing Nanaboozho stories and teachings. The videos highlight the importance of relationships with the natural world, such as when the Knowledge Holders offer tobacco to the sugar maple tree before collecting any sweet water. This, in turn, signifies the importance of reciprocity and that we ask Creation for permission to take what we need.

Physical Learners - are supported through the images of Canada's flag and videos of collecting sugar maple sap.

Intellectual Learners - This activity activates logical and critical thinking through analyzing the dominant narratives told and reinforced in Canada with regards to Canada's claim of maple trees as a symbol of its national identity. In essence, this may require students to re-visit the Canadian identity.

Materials

Click the *'Link'* to open and view videos.

To open and print files, please go to the *'files'* folder accompanying this downloaded lesson plan.

Resource Title	Type
Story: Nanaboozo and the Maple Trees Info	Link 
See if your library has the book, <i>Keepers of the Earth</i> (by Michael J. Caduto and Joseph Bruchac), where this story is found. Otherwise, here is a link to the story re-printed on-line.	
Supplies: the Canadian flag	Supplies 
This can be either a real flag or a digital image.	
Maple Sugar Videos	Link 
<p>These videos provide a general overview in the process of making maple syrup from start (tree identification) to common practices for storing maple sugar. Each video is approximately 10-12 minutes in length, which is ideal for learners of all ages.</p> <ol style="list-style-type: none"> 1. Stories (11:41) 2. Language (7:43) 3. Collecting Sap (12:48) 4. Trees (11:20) 5. Maple Sugar (14:25) 	

TEACHING NOTES

2 - Exploring Ratios and Identity

Purpose

This activity provides opportunities for students to recognize the volume of sweet water required each year to support the sugar maple industry in this region of Turtle Island (North America). Students also explore how Canada's identity claim to maple syrup can erase Indigenous Peoples without whom this industry could not have existed.

Required materials for this activity are: a cylinder, pipette, and tablespoon.

Time: 60 mins

Activity Instructions

1. Measurements:

- Ratio of 40:1, sweet water to syrup.

- Experiment: Use a measuring cylinder and pipette. If you do not have a measuring cylinder use a tablespoon which is 15 ml.

Questions:

"How many drops are in 10 ml, 1 litre, or 40 litres?"

Using the video to time the drops, "How long would it take to gather all the sweet water from one tap?"

"How many hours a day does the sweet water run?" This question does not have just one answer as it depends on many environmental factors. Educators can use 12 hours for the purpose of calculation, keeping in mind that sweet water flows mainly during the daytime, which can be cold and the days are often very short.

2. Scale it up.

For baseline information, approximately 40,000,000 litres of maple syrup were produced in Canada in 2019.

"What does this tell you about peoples' relationship with sugar maple trees?"

"How much of this natural resource do we take and consume each year?"

Note: If choosing to explore Indigenous identity erasure, have students answer the questions in 'minds-on' activity through doing research. In essence, what is important is for students to recognize that Indigenous Peoples, such as the Anishinaabe People, have been harvesting and processing sweet water into maple syrup for thousands of years, whereas this is still somewhat new for Settlers or non-Indigenous peoples.

Key question for students: "What are the origins of maple syrup?"

Guiding questions for educators:

"How are your students 'relating to' the vision?"

"How are your students 'figuring out' the vision?"

This activity is designed to connect with learners with these learning styles...

- Physical (e.g., Tactile, Experiential, Visual) Learners
- Intellectual (e.g., Rational, Logical) Learners

... in the following ways:

Physical Learners - This activity supports visual learners when students explore Canadian symbolism (e.g. Canada's flag) in relation to concepts of identity. Visual learners also have the opportunity to witness the ratio of 40:1 through engaging with tactile or kinaesthetic activities, e.g. when establishing the ratios of 40:1.

Intellectual Learners - This activity activates logical and critical thinking through analyzing the dominant narratives told and reinforced in Canada with regards to claims of maple trees as a symbol of its national identity. This research may result in emotional responses; students may discover that the dominant narrative re-told in Canada may be problematic.

Materials

Click the 'Link' to open and view videos.

To open and print files, please go to the 'files' folder accompanying this downloaded lesson plan.

Resource Title	Type
Supplies: a measuring cylinder, pipette, and tablespoon; a stopwatch (e.g., app on phone)	Supplies 📄
To measure sweet water and the time it takes to gather sweet water from a tree tap	
statistics about maple syrup production	Link 🔗
This website shares statistics about maple syrup production in Canada over time.	
How Maple Syrup is Made	Link 🔗
This website explains how maple syrup is made with links to learn more about flavour, density, colour, and clarity.	

TEACHING NOTES

3 - Reflection and Consolidation

Purpose

This activity is an opportunity for students to reflect on their learning from this lesson. The reflection aspect can be tailored towards the learning environment in your class. For example:

- a sharing circle can be supportive;
- students can answer questions that emerged through inquiry and submit a written reflection;
- students develop and deliver a community presentation (if possible).

Time: 15 mins

Activity Instructions

Incorporate a discussion time with students to reflect upon their learning.

Guiding questions to the students:

"What captured your attention?"

"What was new information?"

"The ratio is 40:1 and Canada produced 40 million litres of maple syrup in 2019. Based on these figures, how much sweet water is being drawn from maple sugar trees each year?"

"The volume of harvested sweet water has increased since 2018. What does this tell us about peoples' relationship with the environment?"

"How might Canada's identity claim to the sugar maple impact Indigenous Peoples? What might Indigenous Peoples feel when they are not recognized in the industry?"

"What are the long-term impacts of over harvesting sweet water as opposed to collecting what the trees give us?"

Guiding question for the educator:

"How are your students 'doing' the vision?"

Additional Background Information for this Activity

Encouragement with readings/participating in sharing circles will be recommended.

This activity is designed to connect with learners with these learning styles...

- Spiritual (e.g., Relational) Learners
- Physical (e.g., Tactile, Experiential, Visual) Learners
- Intellectual (e.g., Rational, Logical) Learners
- Emotional (e.g., Feeling, Intuitive) Learners

... in the following ways:

Spiritual Learners: Students are prompted to realize that relationships with trees, and the natural world, is a core element of harvesting and processing sugar maple sap into syrup.

Physical Learners: Students can reflect on their physical learning through calculating the 40:1 ratio.

Emotional Learners: In that this activity includes elements of social justice, students have the opportunity to express their emotional learning with regards to Canada's claim of maple trees as its national identity.

Intellectual Learners: Students calculate the volume of sweet water used on an annual basis and recognize how dependant humans are on the natural world for survival. In addition, students researching the Indigenous erasure component of this activity can share their research findings and potential questions for further investigation.

TEACHING NOTES

ASSESSMENT

This section contains information for assessing progress in students' learning. While Indigenous approaches to assessment may be highlighted, conventional assessment methods may also be discussed.

There is no formal summative assessment ('Assessment of Learning') in this lesson; assessment is integrated within the learning tasks to inform the next steps of the lesson. It is a supportive learning situation that is not focused on specific task outcomes but on developing an understanding of the importance of relationship with the trees. However, one potential form of Indigenous assessment could be through holding a sharing circle where students are asked to share what they learned or found to be important to themselves. Prompting and guiding questions (in the 'Activities' section of this lesson plan) can easily be adapted to 'Assessment for, as, and of Learning'.

ADDITIONAL RESOURCES

Click the 'Link' to open and view videos.

To open and print files, please go to the 'files' folder accompanying this downloaded lesson plan.

Resource Title	Type
Teaching by the Medicine Wheel: An Anishinaabe Framework for Indigenous Education	Link 
This article by Dr. Nicole Bell provides educators with an opportunity to familiarize themselves with the Medicine Wheel and how learning commences through each of the four quadrants.	
Maple Sugar Videos	Link 
<p>These videos provide a general overview in the process of making maple syrup from start (tree identification) to common practices for storing maple sugar. Each video is approximately 10-12 minutes in length, which is ideal for learners of all ages.</p> <ol style="list-style-type: none"> 1. Stories (11:41) 2. Language (7:43) 3. Collecting Sap (12:48) 4. Trees (11:20) 5. Maple Sugar (14:25) 	

HOLISM AND ALL OUR RELATIONS

This lesson plan has been developed with an Indigenous lens that is holistic in nature, a way of being and knowing that acknowledges our relationships with 'all our relations', including plants and animals, other human beings, the water, land, wind, sun, moon, stars, and more - everything seen and unseen. With 'all our relations' in mind, this lesson plan has been developed with a focus on:

Relationship with the land
<p>Through their explorations of maple trees, consideration of care for the trees, and sharing, students will develop a relationship with the land. Students will also recognize that we are only to collect what the trees give us and we must be careful in not overharvesting so future generations can reap the same benefits. This lesson will also help students realize that trees and plants are living beings, they are our teachers because they carry knowledge. This lesson will help students learn the amount of natural resources we consume when harvesting significantly large volumes of sweet water to sustain Canada's sugar maple industry. In addition, this activity also can disrupt the dominant narrative that North America was uninhabited because Indigenous Peoples (Anishinaabe in particular) have been harvesting sweet water for thousands of years.</p>
Participatory and experiential learning activities
Language and Culture
<p>Depending upon the video used, the Ojibwe language can be introduced, explored and developed through this lesson.</p>

Connections are made with everyday life

Maple syrup has become a staple of Canadian homes. This lesson aims to develop a greater understanding of, and appreciation for, the Indigenous Knowledge that underpins the harvesting and production of maple syrup. Trees, in addition to providing sweet water, help clean the air and provide us with natural resources that heat our homes or 'warm bodies when the wind becomes cold'.

This lesson encourages students to reflect on human's dependency on the natural world as the industrialization of the maple syrup industry results in harvesting large volumes of sweet water from the land.

Intergenerational learning with Elders/Knowledge Holders

Were Elders or Knowledge Holders involved in the development of this Lesson Plan? Yes

Can Elders or Knowledge Holders be invited to help teach part of this lesson plan? Yes

Intergenerational learning with Elders/Knowledge Holders**Ethics in the classroom: care, truthfulness and trust, respect, integrity**

Care and Respect - Students learn care and respect for the trees; the need to look after and nurture the trees for future generations.

Truthfulness and Trust - Trust is placed in us all to look after and not exploit the gifts of the trees. Students will be trusted to share truth about Canada's history of attempting to erase Indigenous Peoples.

Integrity - Students learn that we will do the right thing in honouring our relationship with the trees and other aspects of Creation and Land.

Different learning styles; attention given to mind, body, and spirit**Healthy relationship with self and identity**

Students will recognize an important worldview, or understanding, that we (people) are the youngest of Creation. We have much learning to do through spending time (re)building our relationship with Creation. This is applicable to all peoples since we all depend on the natural world for survival.

Personal reflection time (connecting with thoughts and feelings)

The reflection activity is guided by the consolidation part of the learning in which students are asked to share their learning. Reflection activities may include: a sharing circle or students submitting a written assignment using prompts such as "today I learned..."

OTHER DETAILS

This Lesson Plan aims to meet curriculum expectations or outcomes for: Ontario Yes

RELATED LESSON PLANS

- Sirop d'érable et changements climatiques
- Measuring Sweet Water and Maple Syrup
- Maple Syrup and Climate Change
- Tree Tapping
- The Seasons

CONTRIBUTORS

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QUESTIONS/MORE DETAILS

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