Date:_____

Measuring Sweet Water and Maple Syrup

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.

Origin

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

LEARNING OUTCOMES

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

1. **Use proportional reasoning to work out how many drops of sweet water are needed to make 10 ml of maple syrup.**
2. **Explain the importance of community in harvesting and processing maple syrup.**

Learning Level / Grade

4

Also: 3

95 mins

Related Subjects

History, Science, Social Studies, Indigenous Ways of Knowing & Being, Nutrition, Biology, Indigenous Language

LIST OF ACTIVITIES

1. **Counting Drops**
2. **Counting Drops - Proportional Reasoning**
3. **Consolidation and Reflection**
4. **Cross Curricular Connections**

MATERIALS

- **Video: Watch And Listen To Maple Sap Dripping Into A Maple Syrup Bucket**
- **Maple Sugar Videos**
- **Supplies: sweet water (or plain water as a representation of sweet water); cups, droppers, teaspoons**

DESCRIPTION

The focus for this lesson plan is the measurement and the amount of sweet water that is required to produce maple syrup or maple sugar. It is written as one lesson plan but it could easily be developed into multiple shorter lessons as the children explore the different activities and aspects of learning about 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**
- **Different learning styles; attention given to mind, body, and spirit**
- **Connections are made with everyday life**
- **Intergenerational learning with Elders/Knowledge Holders**
- **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

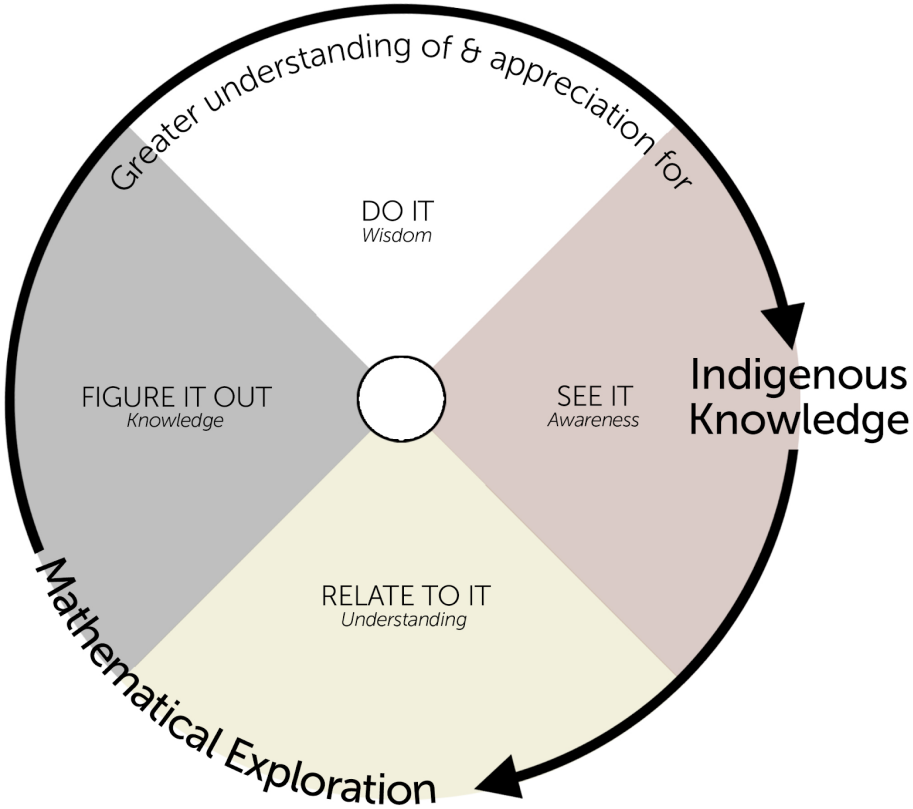
- **This lesson plan was designed according to the Medicine Wheel diagram produced by Anishinaabe faculty in Trent University's School of Education and Professional Learning, Dr. Nicole Bell (see figure below). We recommend educators familiarize themselves with the Medicine Wheel and how learning commences through each of the four quandrants (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 and concludes with Indigenous Knowledge by watching a video (https://vimeopro.com/paradigmpost/maple-videos; see the 'Materials' section in the Activities for more information about the videos).**

  The objective of this lesson plan 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/math18curr.pdf

Grade 3

Overall Expectations addressed:

(NS&N) Demonstrate an understanding of magnitude by counting forward and backwards by various numbers and from various starting points (p.55).

(M) Estimate, measure, and record length, perimeter, area, mass, capacity, time, and temperature, using standard units (p.57).

Specific Expectation(s) addressed:

(NS&N) Count forward by 1's, 2's, 5's, 10's, and 100's to 1000 from various starting points, and by 25's to 1000 starting from multiples of 25, using a variety of tools and strategies (p.55).

(M) Estimate, measure, and record the capacity of containers using the standard unit of the litre or parts of a litre (p.57).

Grade 4

Overall Expectations addressed:

(NS&N) Demonstrate an understanding of proportional reasoning by investigating whole-number unit rates (p.66).

(M) Estimate, measure, and record length, perimeter, area, mass, capacity, volume, and elapsed time, using a

variety of strategies (p.69).

Specific Expectation(s) addressed:

(NS&N) Demonstrate an understanding of simple multiplicative relationships involving unit rates, through investigation using concrete materials and drawings (p.68).

(M) Estimate, measure, and record the capacity of containers (e.g., a drinking glass, a juice box), using the standard units of the litre and the millilitre (p.69).

ACTIVITIES

1 - Counting Drops

Purpose

This activity is intended for students to count or explore how many drops of sweet water collect in the bucket in one or two minutes.

Time: 20 mins

Activity Instructions

Students watch the video (included in this lesson plan) of sweet water collecting in a bucket. Depending on the group of learners, the video can be viewed for approximately 1 - 3 minutes.

For additional background knowledge, watch selected sections of the *Collecting Maple Sap* video (included with this lesson plan), which explores the process of collecting sweet water and the various techniques used both historically and in modern times.

Use prompting questions to stimulate thinking and discussion:

"What do you notice?" "What do you wonder?"

Jot down all ideas on chart paper, Smartboard, etc.

Guiding question for 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
- Emotional (e.g., Feeling, Intuitive) Learners

... in the following ways:

Spiritual and Emotional learners - One of the videos featured in this lesson reviews the protocols of offering tobacco to maple trees before starting the process of collecting sweet water. In essence, this captures the understanding that we have a relationship with Creation and we must always ask for permission to collect natural resources.

Physical learners - The videos provide a visual representation of sweet water collecting in a bucket.

Intellectual learners - Students have the opportunity to assess how many drops of sweet water can fall in one minute, which can be developed further in this lesson.

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
Video: Watch And Listen To Maple Sap Dripping Into A Maple Syrup Bucket	Link
During this first activity, students can watch this video for 1-3 minutes and count the number of drops per minute.	
Maple Sugar Videos	Link

Resource Title	Type
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. 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 - Counting Drops - Proportional Reasoning

Purpose

This activity is designed to prompt the students to investigate how much sweet water is required to make maple syrup.

Time: 60 mins

Activity Instructions

Counting drops: forty drops of sweet water yields one drop of maple syrup.

1. Students count forty drops in one cup and then place one drop in a separate cup. Educators should encourage the students to consider what this tells us about the process of making maple syrup.

Guiding question: "Is this an easy process if takes forty drops of sweet water to make one drop of syrup?"

2. Explore how many drops there are in one teaspoon. Ask students how many drops of sweet water are needed to make one teaspoon of maple syrup?

3. What if we wanted to make 10 ml, 15 ml, 20 ml, 25 ml, 30 ml, etc. of maple syrup? Ask students to determine how many ml of sweet water are needed for each measurement and record their findings in a chart (e.g. 10 ml = ____ ml of sweet water, and so on for each measurement).

Guiding questions:

How are your students 'relating to' the vision?

How are your students 'figuring it (the vision) out'?

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
- Emotional (e.g., Feeling, Intuitive) Learners

... in the following ways:

Emotional learners - This activity can prompt learners to recognize the importance of community, because making maple syrup is something beyond the capabilities of one individual. This activity demonstrates how working together towards a common objective was, and still is, a crucial factor in being successful in making maple sugar.

Physical learners - Students actively engage in the experiment by measuring droplets of sweet water in various volumes or measurements (ml).

Intellectual learners - Students engage in proportional reasoning to undertake calculations.

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: sweet water (or plain water as a representation of sweet water); cups, droppers, teaspoons	Supplies
• The teacher will need to supply enough sweet water so students can work individually or in small groups. If sweet water is unavailable, plain water can be used to represent sweet water. • Enough cups, droppers, and teaspoons are needed for students to work individually or in small groups.	

TEACHING NOTES

3 - Consolidation and Reflection

Purpose

This activity allows time for the students to consolidate and reflect on their learning.

Time: 15 mins

Activity Instructions

Educators should guide a discussion with the students to reflect upon their learning.

Guiding questions:

"Given the measurement you and your partner(s) were assigned, what caught your attention and what did you find surprising?"

"Looking at the broad context, is this something one person could do by themselves? What does this tell us about the importance of community?"

"What new questions did you think about while doing this activity?"

Guiding question for the educator:

"How are your students 'doing' 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:

Intellectual learners - Can use their understanding of proportional reasoning to: i) focus on the importance of community when harvesting and processing maple syrup; and ii) recognize that this process requires a large measurement of sweet water.

Physical learners - This lesson accommodates physical learners when holding a sharing circle, which will require reorganizing classroom furnishings. This lesson also encourages physical learners through interaction and discussion.

TEACHING NOTES

4 - Cross Curricular Connections

Purpose

This is a list of optional activities and cross-curricular links that may be explored in order to extend the learning.

Time: 30 mins

Activity Instructions

Educators can also incorporate Science and Technology (2007) curriculum as follows (see: http://www.edu.gov.on.ca/eng/Curriculum/elementary/scientec18currb.pdf):

Grade 4

Understanding Life Systems (Habitats and Communities) 1.1, 1.2, and 3.10

Grade 3

Understanding Life Systems (Growth and Changes in Plants) 1.1, 1.2, and 3.5

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. 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
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. 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
Through their explorations of maple trees, consideration of care for the trees, and sharing, students will develop their 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, they are our teachers because they carry knowledge to share.
Participatory and experiential learning activities
Language and Culture
Depending upon the video used, the Ojibwe language can be introduced, explored, and developed through this lesson.
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 processing of maple syrup. Trees, in addition to providing maple syrup, help clean our air and provide us with materials that heat our homes or 'warm bodies when the wind becomes cold'.
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 are demonstrated in our connection with the trees, the need to look after and nuture the trees for the future, and to not take from trees which are not yet mature. This ethical value also reminds us that working together towards a common goal is important, as making maple syrup is an extremely difficult task for just one person. Truthfulness and Trust - the trust that is placed in us all to look after and not exploit the gifts of the trees. Integrity - that we will do the right thing in our relationship with the trees.
Different learning styles; attention given to mind, body, and spirit
Healthy relationship with self and identity
This lesson plan will help students (re)build their relationship with Creation and Land. They will grow to see themselves as having a relationship with the natural world.
Personal reflection time (connecting with thoughts and feelings)
The reflection is a guided part of the consolidation of the learning. Students identify how the treatment of trees is reflected in how we treat our friends; how we don't just take from our friends but also share with them. For reflecting on the learning, we recommend that educators facilitate a sharing circle. This shifts the energy of the space so learners can share their thoughts and feelings while their classmates and teacher listen. Including a closing discussion provides students an opportunity to ask questions that could be investigated further.

OTHER DETAILS

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

RELATED LESSON PLANS

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

CONTRIBUTORS

Name	Role/Job Title	Place
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QUESTIONS/MORE DETAILS

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