Maple Syrup Inquiry

Spiral Inquiry Activity
Grade Level: 3-12

About This Activity

Learners will use GreenLearning's Spark Inquiry Model to discover and explore the importance of the maple syrup industry, and the impacts of climate change on this vital industry.

Learning Outcomes

By the end of this activity, learners will:

- Discover the implications of climate change on the Maple Syrup industry
- Investigate various topics surrounding maple syrup, and present their findings to the class
- Collaborate amongst peers to develop their own focus question(s) and inquiry plan

Curriculum Connections

Ontario

Grade 3 Science and Technology (Growth and Changes)
Grade 3 Social Studies (Pioneer Life)
Grade 4 Social Studies (Habitats and Communities)
Grade 6 Social Studies (Aboriginal Peoples and Early Explorers)
Grade 7 Science and Technology (Interactions within Ecosystems)
Grade 7 Social Studies (Natural Resources)
Grade 8 Science and Technology (How Roots, Stems and Leaves Permit Movement of Food, Water and Gas)
Grade 9 Academic Science (Biology: Sustainable Ecosystems)
Grade 9 Applied Science (Biology: Sustainable Ecosystems and Human Activity)
Grade 10 Academic Science (Earth and Space Science: Climate Change)
Grade 10 Applied Science (Earth and Space Science: Earth's Dynamic Climate)
Grade 9 Academic Issues in Canadian Geography (Managing Canada's Resources and Industries)
Grade 9 Applied Issues in Canadian Geography (Managing Canada's Resources and Industries)
Grade 11 Workplace Preparation Environmental Science (Sustainable Agriculture and Forestry)

Length of Activity

30 minutes – 1.5 hours

Materials List

Internet-enabled device
Maple Syrup Inquiry Worksheet
Maple Syrup Inquiry Additional Resources
Pancake mix and all the fixings (i.e. maple syrup, fruits, etc.)
Corn syrup

Step 1: Spark (A Student Investigation)

a. Begin by getting familiar with GreenLearning's Spiral Inquiry Model found here: https://programs.greenlearning.ca/course/spiral-inquiry-model
b. Prepare the ingredients of a classroom pancake breakfast. If your school has an in-school kitchen, or the tools needed for the class to make, and serve their own pancakes this would be ideal.

c. Pose the question, "Will maple syrup still be available and affordable by 2050?" to the class at large.
   i. Allow learners to break out into think-pair-share groups to begin generating some ideas.
   ii. Ask the groups to share their ideas, and record down their responses in a bullet list at the front of the class on the board (hopefully hitting on tree range, drought/waterfall, severe storm damage, invasive species, etc.).
   iii. Each bullet can be discussed at large with the class by providing them with some teaser information on those points so it really gets them thinking further.
   iv. Have maple syrup, and corn syrup as toppings on your pancakes (the educator's) for comparison so that learners can easily see the difference.
d. Now you can open the discussion on how the cost is linked to supply and demand. Some questions to guide their thinking are:
   i. What aspect of climate might impact the supply of maple syrup?
   ii. Is this just from changes in weather or is the climate changing?
   iii. How do we know? Where can we find out?
e. Some other questions to Spark their inquiry are:
   i. What if maple syrup costs $100/litre?
   ii. What if all our maple syrup was shipped to China?
   iii. What do maple producers watch the weather report so intensely?
f. To further this discussion, you could explain how people have utilized their understanding of weather patterns for various purposes (e.g., to harvest sap and produce maple syrup). Also, you could explain the role of weather dynamics in environmental phenomena and consider the consequences to humans of changes in weather (e.g., global warming and its impact on maple syrup production).

Step 2: Hypothesize and Plan

a. As a class, decide the focus of your inquiry. Revisit the pancake breakfast and think of the issues, topics and climate change concerns that the class shared. Learner's interests and issues within their own community can help them pursue something that is connected to their lives.
b. Learners can be split up into groups so that they can brainstorm potential inquiry questions. Have the groups discuss what they have taken away from the class discussions. Pose the following questions:
   i. What interests you about maple syrup and the changes that are coming with climate change?
   ii. What issues interest your group and are relevant to their lives?
   iii. What topics do you want to research?
c. Remind learners that the inquiry question needs to investigate both the impacts of climate change on maple syrup and the actions required to address it.
d. Allow learners to state their questions as a hypothesis using the "If...then...because..." format. For example, "If climate change continues as it is, then maple syrup will be unaffordable for me to give to my future children because maple trees will be so limited in numbers."
e. Hand out the "Maple Syrup Inquiry Worksheet" to the learners in their groups and allow them to complete Part 1.

Step 3: Explore and Research

a. This step involves the groups of learners to research the information required for your topic. Below are some investigation suggestions:
   i. Local connections to maple syrup production.
   ii. The maple syrup economy in your area.
   iii. The process of making maple syrup.
   iv. Connections with Indigenous knowledge.
   v. The geographic range of maple syrup production.

vi. Connections between maple syrup and tourism.
vii. Effects of climate change on northern hardwood forests.
viii. Meeting the challenges of a shorter maple syrup season.
ix. Canada's role in the world of maple syrup.
x. The connections between maple syrup and medicine.
xi. How maple syrup forests also support songbirds.

b. Inform learners in their groups to gather and review information needed to answer their questions or to test their hypotheses. The internet, libraries, or experts in the field are all great tools for research. The resources found on the "Maple Syrup Inquiry Additional Resources" handout can be a great start for learners.
c. Below are some questions many educators have used in the past to give their learners to get them started on their research:
   i. When is the best time to collect maple sap?
   ii. What are the best conditions for collecting maple sap?
   iii. What happens inside of the tree that causes sap to flow?
   iv. How will climate change cause changes in the collection period for sap?
   v. How do farmers turn sap into sugar?
   vi. What is changing the flow of the sap in your area?
   vii. How have sugar tappers met the challenges of a shortened tapping season?
   viii. How did Indigenous Peoples discover maple syrup?
   ix. What has been the impact of warmer weather on maple trees?
   x. When might the maple sugar industry in Canada be wiped and how big is this industry?
   xi. Describe some of the impacts that climate change is having on the northern hardwood forests by describing the change to the following; length of seasons, snowpack, soil, animals, parasites, and economic activity.
   xii. What does skiing and maple syrup production have in common?
   xiii. How many gallons of sap are needed to produce one gallon of maple syrup?
   xiv. What two effects is the gradual warming caused by climate change having on maple trees?
   xv. How much of the world's maple syrup is produced in Canada and what is its value?
   xvi. How much has maple sap production dropped in the past 5 years?
   xvii. List three factors that may account for reduced maple syrup production?
   xviii. Why is the solution to reduced maple syrup production not as simple as the range of maple trees migrating northward?
d. Hand out the "Maple Syrup Inquiry Worksheet" to the learners in their groups and allow them to complete Part 2. Be sure to remind learners to record their information and remember to keep track of their sources. Groups can evaluate their information they have collected and answer these questions:
   i. Does your research answer your questions or test your hypothesis?
   ii. Does it raise more questions, and how can you answer these?
e. Allow groups to reflect and discuss their findings and observations to their previous knowledge. They may need to clarify and modify their focus question(s) and inquiry plan.

Step 4: Analyze and Check

a. Allow learners to compare, soft and classify their information.
b. Get learners to draw conclusions about your questions and hypotheses. Remind them to focus on both the impacts of climate change on maple syrup and the actions required to address each impact.
c. Hand out the "Maple Syrup Inquiry Worksheet" to the learners in their groups and allow them to complete Part 3.

Step 5: Communicate and Act

a. Now the groups are ready to turn their knowledge into action. Allow the learners to communicate their findings to the class. Be sure to remind them about the message they want to get across and to tailor it to the classroom audience. Learners might produce a YouTube video, PowerPoint presentation, research blog, web pages on the school site, podcast, mind map, poster, or infographic, etc.
b. During their research, learners may have come across many calls to action; ideas for what you and your class could do to make things better for maple syrup and everything that depends on it. Here are some ideas various classes have come up with for helping with maple syrup production: take part in a local Maple Syrup Festival, campaign to raise awareness in shops where maple syrup is sold, meeting with local politicians about issues, or selling local maple syrup as a fundraiser. The ideas are endless!

Step 6: Conclusion

a. Refer to the marking rubrics on the various ways learners could communicate their findings.