

First Nations, Métis, and Inuit Student Challenge: Indigenous Innovation - Teacher Guide & Lesson Plan

Overview

Grade Level:

Grades 7–8

Time Required:

45–60 minutes

Activity Type:

Indigenous-informed STEM engineering challenge

Big Question:

How can Indigenous engineering knowledge inspire modern solutions?

Activity Description

The birchbark canoe is an example of Indigenous innovation, engineering, and environmental knowledge. For generations, Indigenous canoe builders developed technologies that responded to specific needs, environments, and available materials.

In this challenge, students explore the canoe as an engineered solution. They investigate how materials, structure, and design choices work together to solve problems, then reflect on how Indigenous knowledge systems contributed to technological innovation.

Students will use the engineering design process to analyze:

- Material properties
- Structural design
- Function and purpose
- Environmental considerations
- Problem-solving strategies

This activity encourages students to recognize Indigenous technologies as examples of scientific knowledge, experimentation, and innovation.

Learning Goals

Students will:

- ✓ Identify how technologies are designed to solve specific problems
- ✓ Explore how material properties influence design choices
- ✓ Explain how structures support function
- ✓ Apply engineering thinking through observation and analysis
- ✓ Recognize Indigenous innovation as an important contribution to STEM

Indigenous Context

Indigenous peoples across Turtle Island have developed diverse canoe technologies adapted to their specific environments, waterways, and community needs.

Birchbark canoe construction required deep knowledge of:

Materials

- Understanding tree properties
- Selecting materials based on strength, flexibility, and water resistance

Waterways

- Understanding rivers, lakes, currents, and seasonal conditions

Engineering

- Creating strong but lightweight structures
- Designing for transportation, stability, and efficiency

Relationships with the Land

- Using resources responsibly
- Understanding that materials come from relationships with the natural world

Teacher Note:

Canoe designs and construction methods vary among Indigenous Nations and regions. This activity focuses on engineering principles and innovation while recognizing that there is no single “Indigenous canoe design.”

Ontario Curriculum Connections

Grade 7 Science

Form and Function / Structures

Students explore:

- How structures are designed for specific purposes
- How materials influence strength and function
- How design choices affect performance

Interactions in the Environment

Students consider:

- Relationships between humans and the natural environment
- Sustainable use of resources

Grade 8 Science

Fluids

Students explore:

- Buoyancy
- Floating and sinking
- How shape affects movement through water

Technology Education (Grades 7–8)

Students apply the engineering design process:

1. Identify a problem
2. Investigate possible solutions
3. Develop a design
4. Build/test a model
5. Evaluate and improve

Materials

Included in the Canoe Kit:

- Birchbark canoe materials
- Wooden structural pieces
- Sinew/lashing materials
- Additional canoe components

Classroom Materials (Optional):

- Student worksheets
- Pencils
- Images of different canoe designs
- Reflection materials

Lesson Sequence

Part 1: Introduction — The Canoe as Technology

Time: 10 minutes

Begin by asking:

“When you hear the word technology, what comes to mind?”

Students may suggest:

- Computers
- Phones
- Machines

Expand the discussion:

Technology is any human-created solution designed to solve a problem.

Examples:

- Clothing
- Shelter
- Tools
- Transportation

Introduce the canoe:

“What problems did canoe builders need to solve?”

Possible responses:

Problem	Engineering Solution
Staying afloat	Lightweight, water-resistant materials
Carrying supplies	Strong, balanced structure
Moving efficiently	Streamlined shape
Travelling through different environments	Adapted designs
Trasnporting the canoe	Lightweight construction

Part 2: Materials & Design Investigation

Time: 10 minutes

Students examine the canoe materials.

Guide discussion:

Birch Bark / Hull

Ask:

“What properties make this material useful?”

Students may identify:

- Flexible
- Lightweight
- Water-resistant

Wooden Supports

Ask:

"Why does the canoe need internal support?"

Students may identify:

- Maintains shape
- Adds strength
- Helps distribute forces

Sinew/Lashing

Ask:

"Why join pieces together instead of creating one solid piece?"

Students may identify:

- Allows flexibility
- Creates strong connections
- Makes repair possible

Part 3: Build & Analyze Challenge

Time: 20–25 minutes

Students work through the student challenge sheet while assembling the canoe.

Encourage students to think like engineers:

Observe:

What purpose does each part serve?

Analyze:

Why was this material chosen?

Connect:

How does this design respond to the environment?

Guiding Questions During Construction

Ask:

Structure:

- ***Where does the canoe need strength?***
- ***How do the supports affect the design?***

Materials:

- ***Why are different materials used for different purposes?***
- ***What properties make each material effective?***

Function:

- ***Why is the canoe shaped this way?***
- ***How does the design help it move through water?***

Part 4: Reflection & Discussion

Time: 10 minutes

Bring students together and discuss:

Reflection Questions:

- 1. What engineering problem does the canoe solve?***
- 2. What material choice was most important to the design? Why?***
- 3. How did knowledge of the land influence canoe design?***
- 4. What modern technologies use similar engineering principles?***

Examples:

- Lightweight materials
- Strong structures
- Flexible designs
- Sustainable materials

Extension Activity (Optional)

Modern Canoe Design Challenge

Students redesign a canoe for a modern purpose.

Examples:

Environmental Research Canoe

Needs:

- Quiet movement
- Stability
- Low environmental impact

Emergency Response Canoe

Needs:

- Strength
- Cargo capacity
- Durability

Recreation Canoe

Needs:

- Speed
- Comfort
- Efficiency

Students create:

- A labelled design drawing
- Material choices
- Explanation of engineering improvements

Teacher Closing Message

The birchbark canoe demonstrates that engineering is not only a modern discipline — it is a practice rooted in observation, experimentation, and problem-solving.

Indigenous innovators developed technologies by understanding the relationships between materials, environments, and human needs. This activity invites students to explore those same engineering principles and recognize Indigenous contributions to science and technology.

Additional Resources (Optional)

Meet Kaella Earle, Engineering Technologist - Indigenous Role Model (6 min video)
<https://youtu.be/c5svcq41aFU?si=aeS11dzaU5wuimok>

Meet Kurtis Bolduc, Electrical Designer - Indigenous Role Model (5 min video)
https://youtu.be/GKYI-LeDff4?si=LPb_qFyDzt2QOn4P

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