

# Exploring the Bentwood Box

## Math 8

### ***META-MOMENT***

The intention of this activity plan is to learn how, as non-Indigenous mathematics educators, to embed local Indigenous content, First Peoples Principles of Learning, and Indigenous worldviews and ways into our secondary mathematics classes using BC's curriculum. As non-Indigenous mathematics educators, we are NOT the experts in Indigenous content or competencies, but we are willing to try, make mistakes, learn, understand, and do better next time. We will remain respectful to the First Peoples and reach out to those who can help us.

Focusing on local Indigenous education is imperative to the implementation of this activity plan. When developing, we focused on the bentwood box, a traditional item made by the First Peoples from the Pacific Northwest Coast of British Columbia, including the Haida, Coast Salish, Tsimshian, and Gitksan. We look at the bentwood box, historically and contemporarily, to develop culturally relevant math exercises. The learning can be iterative and may extend beyond this activity plan.

We highly recommend that you choose a starting point or artefact that is prominent for the local Indigenous peoples in your area. We hope that you will be able to situate the learning in place to deepen one's learning experience and understandings, have elders or experts to speak about the artefact (bentwood box in this activity) and its significance and have students make cultural, mathematical, and personal connections while they develop their curricular and core competencies in the process.

Use this activity plan as a framework to personalize for your class, grade level, course content, local First Peoples, and your local community. In this exemplar, we will be looking at a Math 8 class situated in an urban setting. However, this activity plan can be used as a framework for Workplace Mathematics 10, 11, and Apprenticeship Mathematics 12 looking at 3D shapes, surface area, and volume; used for Pre-calculus Mathematics 12 where volume is maximized and surface area minimized; and, it can also accommodate learning in rural settings.

Videos on this activity's design considerations, classroom delivery and teacher/student reflections are available on [Focusing on Competencies in Math](#).

LOCAL CONTEXT: Bentwood Boxes (Pacific Northwest Coast of British Columbia)

PLACE-BASED LEARNING: Museum of Anthropology at the University of British Columbia

**TIMELINE:** 1-2 weeks (highlighted with a field trip, guest speaker, video, and/or bentwood box) *Note: this lesson plan can evolve into a unit plan or ongoing inquiry due to its iterative design.*

**GRADE LEVEL:** Math 8 *Note: Initial planning for Workplace Mathematics 10, 11, and Apprenticeship Mathematics 12*

**CORE COMPETENCIES:**

- **COMMUNICATION**
  - Connecting and engaging with others
  - Working collectively
  
- **THINKING**
  - Evaluating and developing
  - Questioning and investigating
  
- **PERSONAL/SOCIAL**
  - Understanding relationships and cultural contexts

**BIG IDEA:**

The relationship between surface area and volume of 3D objects can be used to describe, measure, and compare spatial relationships.

**CONTENT:**

- surface area and volume
- construction, views, and nets of 3D objects

**CURRICULAR COMPETENCIES:**

- Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts
- Reflect on mathematical thinking
- Connect mathematical concepts to each other and to other areas and personal interests
- Represent mathematical ideas in concrete, pictorial, and symbolic form.
- Model mathematics in contextualized experiences

**FIRST PEOPLES PRINCIPLES OF LEARNING**

- Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
- Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place)
- Learning is embedded in memory, history, and story.

- Learning involves patience and time.
- Learning requires exploration of one's identity.
- Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.

### ***META MOMENT***

One of the driving questions for the writers of this activity plan was the calculus concept of a CUBE, which minimizes surface area and maximizes volume: Are bentwood boxes generally shaped like cubes or do they more like rectangular prisms? If not a cube (considering resources), then what were the bentwood boxes used to influence the dimensions of the bentwood box?

## **ACTIVITY PLAN**

### **Introduction: What is a bentwood box?**

Show video of artist and Kwakwaka'wakw Chief Mungo Martin from the 1960s. Please note that the language used in this video such as "Indian" and 'primitive' is inappropriate and outdated. Moreover, the word Kwakiutl is now commonly known as Kwakwaka'wakw. Please take a moment to clarify these terms with your students and appropriate language before watching this video.

This video was chosen because it shows how a bentwood box was traditionally made with steam and kerfs to bend the wood to form the box. Clips of this video can be used to emphasize this point but also provoke the thinking of your students as to why this is significant.

Citation: Barrett, S. (1963). *Wooden Box: Made by steaming and bending (Kwakiutl Indians of British Columbia)* [Film]. University of California Berkeley: Department of Anthropology. <https://www.youtube.com/watch?v=astU3VQwWx0>

Another video to consider: *Mungo Martin: A Slender Thread /The Legacy*.by Namgis filmmaker Barb Cranmer [https://movingimages.ca/store/products.php?mungo\\_martin](https://movingimages.ca/store/products.php?mungo_martin)

To compare and contrast the traditional bentwood boxes with contemporary, two videos:

Haida artists Gwaii and Jaleen Edenshaw: conveys that these traditions continue.  
*Carving the new Great Box*  
<https://vimeo.com/121244543>

*The Great Box Project*  
<https://www.youtube.com/watch?v=KhKpbyeeuql>

Jason Todd Robert Makah artist making a bentwood box (for cooking).

*Bentwood Box Cooking*

<https://www.youtube.com/watch?v=6d9P-ODggaM>

If possible, visit an Elder, an Indigenous artist or knowledge keeper who can speak about the bentwood box, how it is made, how it is/was used, and why it is/was important to the people and community.

Possible Indigenous artists to contact regarding bentwood boxes from the Lower Mainland:

- Jim Charlie – Squamish
- Gerry Sheena – Coast Salish
- Joe Campbell – Coast Salish/ Musqueam
- Chrystal Sparrow – Musqueam
- Richard Campbell – Musqueam
- Martin Sparrow – Musqueam

Contact your local museum or band office to get referrals. You will need to speak directly to the artist and describe what you are hoping for and negotiate a fee for their time and work.

Video: *Bentwood Boxes*, Pam Spooner, Director of Indigenous Education, Prince George School District speaks about boxes. Includes images of boxes at Museum of Anthropology at UBC.

<https://www.openschool.bc.ca/competenciesmath/index.html>

Images: bentwood boxes by contemporary Indigenous artists from the Lattimer Gallery:

<https://www.lattimergallery.com/collections/bentwood-boxes-1>

Book: Hilary Stewart's *Cedar* (1995) – a great accessible resource with good illustrations.

<http://www.douglas-mcintyre.com/book/cedar>

Images of kerfs: <http://www.makingchoices.info/interests/working-with-wood/bent-boxes.html>

If possible, find a way to access a bentwood box (in real-life) by visiting a museum or artefacts shared by the local First Nations community to compliment images of the bentwood box.

## **DISCUSSION**

### **Student-led and Teacher Guided**

Possible questions to explore, compare, and contrast about the bentwood box (the hook):

- What was it used for?
- What do you notice (waterproof, lid, construction, etc.)?
- What makes it unique?
- Where are the mathematics? What math do you see?
- Is there any other learning we can explore?

Teacher emphasis (META MOMENT): we don't have all the answers, excited to learn, set stage for student discussion to find the answer: "Lets co-construct knowledge."

### **Trip to the Museum of Anthropology (MOA)**

*Place-based Learning:* Have students meet outside of the longhouses so they can imagine what life would be like a thousand years ago for the Coast Salish People. Return to those questions from class discussion. What did you notice? What changed?

Have students work with the MOA staff person (and you become the learner too) to guide and facilitate learning as to the history and relevance of the bentwood box to the Coast Salish people. Return to those questions from class discussion. What did you notice? What changed?

Compare and contrast bentwood boxes. What do you notice? For example, are the dimensions of the bentwood boxes the same or different? Based on this observation, what factors (or limitations) do you think would influence these boxes to be built in a certain shape or size?

*MATH MOMENT:* Measure surface area and volume of a bentwood box (inside the box). Students will have the opportunity to observe and look at a bentwood box at the museum. What was this bentwood box used for? Was the box waterproof? Why did it matter if it was or not?

Once students establish what bentwood boxes are used for, students can be asked more culturally appropriate questions such as measuring the volume of water a box can hold, determining how volume changes when you put hot rocks in the box to cook food (displacement) or estimate how many cultural belongings can fit into a box that is designed and built to hold cultural regalia.

Other math to consider... filling space with the bentwood box (outside of the box):

- How many bentwood boxes would a family or village need?
- How many trees would be needed to build the bentwood boxes?
- How many boxes can be stored and transported in a canoe?

*FOLLOW-UP APPLICATIONS:* Design a 2D plan to represent the 3D bentwood box, including measurements and units, and scale (extension 1:1 or 1:3)

- Front, side, top view of the bentwood box
- Creating a net/blueprint of the bentwood box
- Build a 3D scale model of a bentwood box

ASSESSMENT:

*FORMATIVE:*

- Students record and reflect in a learning journal:
  - What am I learning and how do I know this?
  - Where do I go next? What do I need to learn?
  - How do I improve (or how am I going to get there)?
  - Make connections to Indigenous content.
- Single Point Rubric on content and the Curricular Competencies
- Formative feedback and observations made throughout the learning activity

*SUMMATIVE:*

- Final rubric looking at reflective journal, class discussions, and final project
- Assessment is done by both teacher and student
- The teacher and student must agree on (1) what went well; (2) what to improve; (3) where to go next; (4) how did I learn from my mistakes; and (5) final grade

FIRST PEOPLES PRINCIPLES OF LEARNING (group assessment):

- Have posters located around the classroom where each poster captures one of the First Peoples Principles of Learning. There will be nine posters in total. Students are asked to “cast a vote” (could be three dots) to indicate which of the nine FPPL were emphasized during the learning activity and then follow up with a class discussion.

- ... OR students put three post-it notes around onto the nine posters where students write down how the learning activity emphasized the identified FPPL and why.
- A similar activity can be done with the CORE COMPETENCIES.

### ***META MOMENT***

Throughout this activity, the teacher is a facilitator and learner. We rely on others to provide the Indigenous content and context and our job is to find ways (or at least be curious about) how mathematics is embedded in that content or context. There are other factors to consider such as mindset. For example, since time immemorial, the First Peoples have had a deep connection to and deep respect for the environment, so they only took what they needed for their family and community. This mindset may be revealed by an Elder or member of the local Indigenous community.

This activity plan is also in its first iteration. As we learn and experience more with our learners concerning Indigenous education and mathematics, the more we will see connections and make extensions, revisions, and adaptations to suit our learners in our communities. We hope that you can take this activity plan as a framework to help you learn about your local Indigenous community and culture and how you can embed them into your secondary math classrooms.

**Sample Single Point Rubric:** (Can be self-assessed, teacher-led, or both)  
 (from: *Cult of Pedagogy*, <https://www.cultofpedagogy.com/single-point-rubric/> )

Emerging/Developing	Criteria/Competency	Extending
	Incorporate First Peoples worldviews, perspectives, knowledge, and practices to make connections with volume and surface area	
	Reflect on mathematical thinking	
	Connect volume and surface area with each other, other areas, and personal interests	
	Represent volume and surface area in concrete, pictorial, and symbolic forms using construction, views, and nets of 3D objects	
	Model mathematics in contextualized experiences using construction, views, and nets of 3D objects	