

# Haida Legends: Culturally Responsive Mathematics

*The following lesson idea is shared by Haida Gwaii educators: Dan Burton (grade 7 teacher), Marcy Perren (grades 8 & 9 teacher), Kim Madore (secondary teacher), Cathy Baran (k/1 teacher), Michelle Hagenson (k/1 teacher), Peter Reynolds (grades 4/5 teacher), Joanne Yovanovich (Principal of Aboriginal Education in SD 50) and Cynthia Nicol and Janice Novakowski of the University of British Columbia.*

Using oral legends as told by Haida elders (produced by CBC Radio), we are developing mathematics lessons for use in Kindergarten–grade 12 classrooms. We have developed and tried the lessons in our classrooms and then re-constructed the lesson as a group of teachers in order to consider questions we could ask, what extensions we could provide and what mathematics we could assess. During our project meetings, we have discussed and compared our students' responses and engagement with the tasks and then further refined the lessons to share with our colleagues in our district.

The following lesson stems from the Haida legend "Raven Brings the Light" and involves exploring the mathematics of building paper bentwood boxes with intermediate and middle-school aged students (grades 4-9). Mathematical skills and concepts that could be explored in the lesson include ratio and three-dimensional geometry and measurement. A proposed project will have students in Haida Gwaii building their own bentwood boxes as part of their secondary school experience and then are presented with their boxes, along with other cultural items they have created, upon graduation. Cultural information and ways of constructing actual Haida bentwood boxes can be found at:

[www.skidegate.ca/Boxes.html](http://www.skidegate.ca/Boxes.html)

We hope to share further lessons from our project in future Vector articles and include both student and teacher responses to the lessons. We would like to invite teachers in British Columbia to try the following lesson with their own students or to use this idea to develop a math lesson based on a story from their own community and share their students' responses.

# Exploring Math through Haida Legends

(grades 4-9)

## The Big Mathematical Ideas

- Measurement involves a comparison of an attribute of an item (ie. length, weight) to a related unit of measurement (ie. cm, kg).
- A ratio is a comparison of two quantities.
- Proportions involve multiplicative rather than additive comparisons.
- Area, perimeter and volume are related to each other.

## Materials and Resources

- Legends of the Old Masset Haida: Gaaw Xaadee Gyaahlaangaay Raven Brings the Light, track 5 – 4:00 (produced by CBC Radio) available at <http://www.cbcshop.ca> (or one of the many versions of this Raven legend available in print form)
- Paper for folding
- Scissors
- Rulers

## The Lesson

- Listen to the legend “Raven Steals the Light” on CD.
- Discuss the legend and then focus attention on the chief’s bentwood box. Have students consider:  
*What might the bentwood box hold? For what purposes would these boxes be used?* If it does not come up in the discussion, share that Haida bentwood boxes were made watertight, to allow for transportation of items to the mainland. Show a bentwood box or an image of one if possible.
- Have students brainstorm mathematical connections relevant to the bentwood box such as its shape, size, dimensions, materials and tools needed, space and time required, etc.
- Have each student construct a paper box with the same provided dimensions. Have students consider:  
*What are some different ways the volume, shape, ratio, proportions, dimensions or surface area of the box can be measured? (example: sand, rice, marbles, rulers, etc.)*

- Have students design and build boxes of various shapes and sizes. Provide one measurement for students such as the volume or the surface area of one of the faces. Encourage students to create a 2D plan or scale drawing before they begin paper folding.
- Have students discuss and compare the shapes and sizes of their boxes, using mathematical language and concepts.

#### **What to watch and listen for...**

- Do students measure accurately, using appropriate tools and units of measurement?
- Do students generalize a rule/formula for finding the volume or surface area of the box?
- Are students able to visualize and describe what they will need to do?
- Are students able to create a 2D plan or scale drawing of a 3D box or prism?

#### **Questions and problems to extend thinking...**

- If you use the same size paper but fold it the opposite way (hamburger/hotdog) to begin, how would it change the volume, shape, ratio, proportions, dimensions or surface area of the box?
- If you use paper that is half the size how will it change volume, shape, ratio, proportions, dimensions or surface area of the box?
- How can you make a series of nested boxes? (box inside a box, as in the legend)
- How would this connect to the making of a bentwood box?
- If you were to make a nested set of bentwood boxes/box drums how would/could you do it? (traditionally made?)
- Have students design and construct a box that will hold a specific object. For example, connect to the legend by asking, *"If the ball of light had a radius of 10cm, what size box would be best suited to holding it?"*
- How could you create a visual representation of an algebraic expression that corresponds with this task?

#### **Connections to BC Mathematics IRP PLOs**

- describe patterns and generalize the relationships by determining the areas and perimeters of quadrilaterals and the areas and circumferences of circles (grade 8)
- clearly and logically communicate a solution to a problem and the process used to solve it (grade 9)
- sketch or build a 3-D object, given its plan and elevation views (grade 9)

- demonstrate an understanding of ratio, concretely, pictorially and symbolically (grade 6)
- evaluate which units of measure would be most appropriate when selecting different measuring tools (grade 5)
- estimate, measure, and then calculate the surface area of right rectangular prisms (grade 6)
- describe and construct rectangular and triangular prisms (grade 4)
- demonstrate an understanding of volume and capacity using  $\text{cm}^3$ ,  $\text{m}^3$ , ml and l (grade 5)
- discover, generalize, and use rules to determine the volume of right rectangular prisms (grade 6)
- design and construct rectangles, given either or both the perimeter and the area (grade 7)
- demonstrate and generalize that many rectangles are possible for a given perimeter or a given area (grade 7)

**Examples of paper folding boxes include:**

[www.wikihow.com/Fold-a-Paper-Box](http://www.wikihow.com/Fold-a-Paper-Box)

[www.paperfolding.com/diagrams](http://www.paperfolding.com/diagrams)

[www.paperfolding.com/math](http://www.paperfolding.com/math)

[www.instructables.com/id/Paper-Gift-Box/](http://www.instructables.com/id/Paper-Gift-Box/)