

## **Mathematics Through Tlingit Basketry**

Lesson 1: Math Through Basketry

Lesson Title: Introduction to Tlingit Basketry

Juneau CORE Math

Algebraic Thinking

❖ Represent patterns in a variety of ways, including rules and tables.

Geometry and Measurement

❖ Identify right angle, vertex, perpendicular and intersecting lines, and regular polygons.

Purpose:

Students will be able to explain the significance of the patterns, designs and cultural aspects of Tlingit basketry.

Materials:

- ❖ Poster or book of common Tlingit basketry designs
- ❖ Tlingit or Southeast basket, or pictures of local baskets--for motivation
- ❖ 1/4 inch Graph paper
- ❖ Markers, crayons or colored pencils

Outcome:

Students will learn about Tlingit basketry and apply geometric knowledge to create their own pattern using Tlingit designs.

Procedure:

1. Start off the lesson with a model of a Tlingit basket, if you have one. (Indian Studies has several basket models). If not, use some of the digital pictures, included with this unit, to introduce the Tlingit basket design. Discuss and record characteristics, such as repeating patterns, perpendicular and intersecting lines,

right angles, shapes, polygons, meaning of design, placement of design on the basket, supplies needed to make the basket, etc.

2. Share the Tlingit basket poster, or photocopied examples, to introduce the students to basketry. Use the basketry poster to show the students more examples of Tlingit weaving, even if you have a basket for an example. Go over each design name and purpose with students.
3. Show the Hyperstudio stack on basketry. (This is a good time to talk about the history of basketry among the Tlingits and the use of the baskets. You may want to ask an elder to talk to the students about basketry.)
4. Read the story of, "The Legend of the Woodworm," from Spruce Root Basketry of the Alaska Tlingit by Frances Paul, enclosed. (This legend tells the story behind a certain Tlingit design.)
5. Show the students the design Mouth Track of the Woodworm on the overhead. Talk about how it graphically illustrates the irregular course of the woodworm as it eats its way through the wood.
6. Have the students draw their own woodworm patterns on graph paper.

#### Assessment:

Observe student interactions and conversations to gain knowledge about student understanding. View individual student designs and compare them to the Tlingit Woodworm pattern. Take note of how each student used the 1/4-inch graph paper. Assist those in lesson 2 who may need clarification.

Lesson 2: Math Through Basketry  
Lesson Title: Symmetry & Pattern in Basketry

Juneau CORE Math

Algebraic Thinking

- ❖ Represent patterns in a variety of ways, including rules and tables.

Geometry and Measurement

- ❖ Measure dimensions of geometric figures
- ❖ Identify and model horizontal and vertical line symmetry

Purpose:

Students will be able to explain two Tlingit design patterns using the math vocabulary words: symmetry, tessellations, and repeating patterns.

Materials:

- ❖ Poster or book of common Tlingit basketry designs
- ❖ Copy for each student of Tlingit basket designs: Tooth of the Tropical Shark and the Tail of the Snow-Tail (Arctic tern).
- ❖ Tlingit or Southeast basket, or pictures of local baskets--for motivation
- ❖ 1/4 inch graph paper
- ❖ Markers, crayons or colored pencils
- ❖ Scissors

Outcome:

Students will learn about two different Tlingit basketry designs and apply geometric knowledge to use a few common shapes to create their own pattern using the concepts of tessellations,

Procedure:

1. Discuss some of the more simple Tlingit designs. Two in particular are natural tessellations. The Tooth of the Tropical Shark, and the Tail of the Snow Tail. One is a chevron, the other a pentagon. Distribute copies of each and ask students

to demonstrate how the two designs fit together. Students may want to cut out the designs to help recognize how they create a pattern.

2. Have students share their findings. Introduce math vocabulary tessellations and flip, slides and rotations if students have not shared it already. Use students' examples to teach students.
3. Now is the time to talk about symmetry and give the students some examples from Tlingit basket patterns. Use the basketry poster or handouts to elicit students' observations about designs. Encourage students to recognize the balance in the designs. Introduce math vocabulary symmetry. Discuss how the individual designs are symmetrical.
4. Introduce more simple designs giving the students copies of the designs on worksheets. Ask them to cut the individual designs out and play with them to come up with their own symmetrical pattern.
5. Have them reproduce their patterns on 1/4-inch graph paper. Students should name and add color to their designs if time allows.
6. Gather students together and review the math terms introduced: tessellations, flip, slide, rotations, symmetry and symmetrical. Ask individual students to come up to the front of the room and model examples of each using the white board, overhead or the pattern they created.

#### Assessment:

Observe students as they work. Help as needed. Review students' sample patterns and take note of students who made symmetrical patterns and those who need additional clarification in lesson 3.

## Lesson 3: Math Through Basketry

Lesson Title: Recognizing Tessellations thru Basketry

Juneau CORE Math

Algebraic Thinking

- ❖ Represent patterns in a variety of ways, including rules and tables.

Geometry and Measurement

- ❖ Measure dimensions of geometric figures
- ❖ Identify and model horizontal and vertical line symmetry

Purpose:

Students will be able to explain basketry designs using math vocabulary words: symmetry, symmetrical, asymmetrical, tessellations, repeating patterns, flip, slide, and rotation.

Materials:

- ❖ Poster or book of common Tlingit basketry designs
- ❖ Tlingit or Southeast basket, or pictures of local baskets -- for motivation
- ❖ 1/4 inch graph paper
- ❖ Markers, crayons or colored pencils
- ❖ Scissors
- ❖ Pattern Blocks
- ❖ 1 sheet of large chart paper for recording tessellation properties

Outcome:

Students will learn how to tessellate regular polygons, and use their geometric knowledge to create their own patterns using concepts of tessellations.

Procedure:

1. Gather students together and review the math terms introduced in lesson 2, tessellations, flip, slide, rotations, symmetry and symmetrical, regular polygon, equilateral triangle. Ask individual students to come up to the front of

the room and model examples of a tessellation using the white board, overhead or the pattern they created.

2. On the overhead, using a regular polygon such as an equilateral triangle, ask for students to volunteer to demonstrate a flip. Discuss what happens to a regular polygon when it flips. Record properties and example on large chart paper.
3. Follow the procedures in #2 for all properties of tessellations: flips, slides, and rotations. Make sure to include a simple example of each using a regular polygon. At the end, the students will have created a great reference chart to view.
4. Look at the Tlingit Basketry poster, or samples of patterns. Have students work in small table groups to identify any tessellating patterns they find. Have students be prepared to share their findings with the class.
5. Distribute pattern blocks and graph paper to students. Give students 10 to 15 minutes to make several patterns that tessellate in each way: one pattern that tessellates using flips, one that tessellates using slides, and one that tessellates using rotations. These should all be done using a single regular polygon.
6. Once students have made a pattern, they should trace each of the three patterns on graph paper and label them "flip, slide, rotation." Encourage students to color their pattern.
7. Enthusiastic students should share patterns with the class when students finish.

#### Assessment:

Observe students as they work. Help as needed. Review student sample patterns of tessellations and take note of students who need more help creating one of each tessellation: flip, slide, rotation. In lesson four target students who need additional assistance on the concepts of tessellations, regular polygons, symmetry.

Lesson 4 & 5: Math Through Basketry  
Lesson Title: Recognizing ordered pairs thru Basketry

Juneau CORE Math

Algebraic Thinking

- ❖ Represent patterns in a variety of ways, including rules and tables.

Geometry and Measurement

- ❖ Measure dimensions of geometric figures
- ❖ Identify and model horizontal and vertical line symmetry and asymmetry.

Number Sense

- ❖ Use negative and positive numbers

Purpose:

Students will be able to recognize how ordered pairs, positive and negative numbers help to create basketry designs.

Materials:

- ❖ Poster or book of common Tlingit basketry designs
- ❖ Tlingit or Southeast basket, or pictures of local baskets -- for motivation
- ❖ 1/4-inch graph paper
- ❖ Markers, crayons or colored pencils
- ❖ Transparency of a student-created pattern
- ❖ Transparency of 1/4 inch grid paper

Outcome:

Students will learn the following math vocabulary:

- ❖ ordered pairs,
- ❖ coordinates,
- ❖ negative numbers,
- ❖ positive numbers,
- ❖ x-axis and
- ❖ y-axis.

Students will use their geometric knowledge to create their own patterns using concepts of ordered pairs. Students will record the ordered pairs for others to recreate their pattern.

Procedures:

1. On the overhead, place a transparency of the four quadrants.
2. Place transparency of student pattern on overhead. Ask students how to recreate the pattern exactly, as if making a basket. Elicit responses, record ideas on white board.
3. Place transparency of 1/4-inch grid paper over the student pattern. Ask students to notice the spaces the pattern fills. Count over and up to model one way of recreating the pattern; hopefully a student will have already shared this strategy.
4. Introduce the concept of ordered pairs, x and y axis to students. Model how the first number in a set of ordered pairs refers to the x-axis and the second to the y. Show students, using the student pattern, it can be recreated exactly by knowing where the designs are located on the grid. Draw a red line down the center to symbolize the x and y-axis. Ask students what the ordered pair would be to the right of the red line, (positive) and to the left of the red line (negative). Have volunteers come up and plot the ordered pairs, listing the recipe alongside the pattern.
5. Elicit responses on how this strategy would be useful in creating baskets. Encourage students to reflect on previous math vocabulary in this unit such as symmetry, pattern and tessellation. These all must be exact or the basket will not line up.
6. Ask students to take their best design they've created and plot the ordered pairs. Next, have students wrap their completed graph paper around in a cylindrical fashion to create their own representation of a basket.
7. Review math vocabulary with students: ordered pairs, coordinates, negative numbers, positive numbers, x axis and y axis

## Assessment:

Have students exchange their recipes for their baskets and have a friend plot the ordered pairs accordingly on 1/4-inch grid paper. Help students who may need additional assistance. Display patterns for all to see.

Lesson 6 & 7: Math Through Basketry

Lesson Title: Creating a Basket using the Tlingit style

Juneau CORE Math

Algebraic Thinking

- ❖ Represent patterns in a variety of ways, including rules and tables.

Geometry and Measurement

- ❖ Measure dimensions of geometric figures
- ❖ Identify and model horizontal and vertical line symmetry and asymmetry.

Number Sense

- ❖ Use negative and positive numbers

Purpose:

Students will be able to use their geometric knowledge of flips, slides, rotations, regular polygon, symmetry, and ordered pairs to make and decorate a basket using one of their favorite designs.

Materials:

- ❖ Poster or book of common Tlingit basketry designs
- ❖ Tlingit or Southeast basket, or pictures of local baskets -- for motivation
- ❖ 1/4 inch graph paper
- ❖ Markers, crayons or colored pencils
- ❖ Several spools of yarn, all earth tone colors such as light browns, ivory, etc.
- ❖ Small paper bowls
- ❖ Bottles of glue
- ❖ Scissors

## Outcome:

Students will create a Tlingit style basket using their geometric knowledge of ordered pairs, coordinates, negative numbers, positive numbers, x axis and y axis, tessellations, regular polygons, and symmetrical figures. Students will transfer their designs to their basket using markers, once the glue has dried.

## Procedures:

1. First, to make the bowl, swirl glue on the inside bottom of the paper bowl.
2. Take the end of a long length of yarn and begin wrapping it in a circular pattern, using the Popsicle stick to pat the yarn in place. Go around and around. Keep going around the inside of the bowl until you reach the rim.
3. Flip the bowl over and swirl glue in a circle on the outside bottom of the bowl. Wrap yarn around in a circular pattern until you reach the outer rim of the bowl.
4. Flip the bowl over and use a piece of yarn to finish off the rim of the bowl. Let this dry.
5. Remind students that although their baskets are not woven Tlingit baskets, they will be painting their own patterns on the baskets, once they are dry.
6. Once the bowl has dried, ask students to take out the pattern they wish to transfer to their basket. Students recreate their design by counting the squares on the quarter inch grid paper. Each square represents one line of yarn on the basket. Students carefully count and transfer their entire design in black ink, using dots. Next, have students go back and fill in their design with a color scheme.

## Assessment:

Have students share their baskets with classroom members. Take note of students who were able to use mathematical reasoning to accurately transfer their pattern. Assist those who may need extra help in these concepts.

## Classroom and Unit Extensions:

### Classroom Extensions:

- ❖ Have a gallery walk once all bowls are completed. Have each student name his/her basket and provide a 30-minute period where families and other classes can come to view the baskets and learn about the process.
- ❖ View the attached literature connection to gain ideas about how literacy is an integral part of this unit.
- ❖ Have students research how the roots were harvested and treated.
- ❖ Have students create a multimedia project based on their basketry stories.

### Unit Extensions:

- ❖ Next year, contract with Dirk and Monika to create a web page showing samples of student work, including lesson plans for each segment of the unit.
- ❖ Next year, contract with Dirk and Monika to work with Nora and Richard on teaching students the correct pronunciation of Tlingit basketry terms and language. Use digital video technology to make the information easily accessible.