Introduction

SAMOAN DESIGNS AND GEOMETRY

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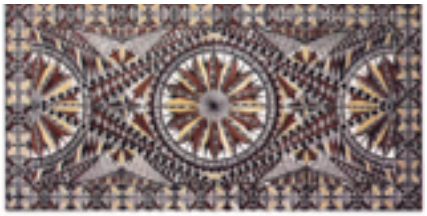
*Samoan cultural designs are commonly found in **siapo**, or painted tapa cloth, and in pe'a, which are a special tattoo worn by men.*



*Having a designed **pe'a** is a very popular trend with teenagers and adolescents in American Samoa. During art sessions in schools, most of the drawings and art work students present is a design they created out of the various motifs they have seen from a **pe'a** or **siapo**.*

*This lesson asks students to work with traditional motifs or designs called **mamanu** to create their own designs that reflect knowledge and skills of ancient art forms. The students learn about and use geometry such as line, line segment, angles, and their properties as well as line of symmetry and transformation of shapes (flips, turns, slides).*

Unit Overview

SAMOAN DESIGNS AND GEOMETRY

Enduring Understandings

Concepts of line, line segment, and angle

Some components of symmetry

Concepts of transformations (rotation, reflection, translation)

Knowledge

Traditional motifs used in *siapo* and *pe'a* designs

Specific properties of line, line segment, and angle

How shapes rotate (turn), reflect (flip) and translate (slide)

Skills

Making a simple symmetrical design

Rotate, reflect and slide shapes

Learning Strategies

Exploring and discovering

Modelling and observing

Participating in a group

Rationale

In examining and working with Samoan cultural designs, students will gain knowledge and skills of ancient art forms as well as mathematic concepts and principles involved in the creation, process and production of pattern-making.

Goals

Students will understand different Samoan motifs and their cultural meaning and create a ***siapo*** or ***pe'a*** deign of their own. They will make connections to specific mathematical concepts and properties of lines, line segments, and angles, as well as geometric symmetry and transformation.

Essential Questions

What is the artist's process in performing a *siapo* or *pe'a* design?

How are the motifs laid out in a design, and where does a pattern begin and end?

What concepts of geometry are used in a creation of a design?

Assessment

The teacher observes students' participation, process and progress as they develop and apply specific skills and knowledge. The teacher asks specific questions to confirm learning and assigns writing and initiates conversations to support learning process (e.g., reflection, knowledge).

Lesson One

INTRODUCING SAMOAN DESIGNS

Focus

Samoan designs and their geometric components

Objectives: *Students will*

- pay attention to the Samoan cultural designs of *siapo* and *pe'a*.
- use their own words to describe and explain what they see (without necessarily using geometric terminology).

Materials Needed

Video *"O Le **Siapo** o **Samoa**"*

Actual examples (or pictures) of *siapo mamanu* or *siapo elei*

Chart paper and pens

Notebooks/paper and pencils/pens

Teacher Activities

1.1. Introduce the unit by showing students real samples or pictures of *siapo* or *pe'a*.

Ask students what they know about this art form.

Record students' responses.

1.2. Play the video of the making of *siapo* or *pe'a.*

Facilitate a discussion about students observations.

Sample Discussion Questions

What are some of the things you noticed in the video?

What are some of the motifs that you noticed?

What some of the cultural aspects of *siapo*? *Tatau*?

Do you have any questions?

1.3. Invite students to create a list of what they now know or think about *siapo* or *pe'a* and about the design making.

Record key words to make the list.

Encourage students to describe the designs (shapes, lines, angles) and explain the process, using their own language (words and phrasing) to tell what they have noticed.

Invite them to notice how designs repeat and are same or different, e.g., symmetry and transformation (rotation, reflection, translation).

Student Activities

1.1. Make comments and ask questions.

Listen and make notes.

1.2. Watch the video and make observations.

Participate in the discussion by answering and asking questions.

1.3. Give ideas, describing and explaining using whatever words or phrases best explain what they see or notice.

(It is not necessary that they know all terminology yet.)

Lesson Two

SIAPO MOTIFS

Focus

Descriptions of *siapo* designs and motifs

Objectives: *Students will*

- read *siapo* designs to show understanding of the different Samoan motifs within.
- describe motifs in terms of geometry: line, line segment, and angle, including symmetry and transformation.

Materials Needed

Examples of *siapo* designs (various pictures, artifacts or handouts)

Paper and pencils

Chart paper (if no board)

Colored markers

Math journals

Teacher Activities

2.1. Pass out handouts, pictures or artifacts of *siapo* designs or motifs. Direct students to examine their motif carefully for five minutes.

2.2. Lead a discussion of each motif and make connections to geometry. Model the drawing on the board, pointing out geometric details. Ask questions and stimulate exploration and understanding.

Sample Prompts and Questions

Name the design of this motif, and describe what it looks like.

What shapes form the design (triangles, squares, circles)?

Explain how you would draw the motif, identifying the geometry, e.g.,

- which ones have 1, 2 or 3 line segments? long or short lines? curved or straight lines? angles (1, 2 3 or more)?
- which ones have symmetry ("sameness")?
- which have designs that are turned or flipped, or have slid?

2.3. Direct students to make definitions based on the examples:

- A line (fundamental idea) extends in both directions.
- A segment has a beginning and an end.
- An angle is formed by rotating part of a line.

Ask students to explain to each other their different motifs using their definitions as well as knowledge of (and the language of) geometry.

Student Activities

2.1. Examine the motif and prepare to describe or explain it.

2.2. Participate in the discussion, responding to the teachers' prompts and answering questions.

Determine or guess answers, and use their own words or ask for vocabulary to express what they notice about geometric concepts.

2.3. Identify motifs with straight/curved lines, short/long lines, angles.

Share motifs, describing the kinds and number of lines and angles.

Teacher Activities	Student Activities
2.4. Introduce the students to the project for this unit. Explain that they will design and draw their own *siapo* motif. Ask them to begin thinking about and planning their designs, but explain that there will be a guest speaker who is a *pe'a* artist (traditional tattoo artist) so they can learn more about culture and process of designing with lines, line segments and angles.	*2.4. Listen and ask questions as needed.* *Begin thinking about the project.*
2.5. Invite students to review their learning by reflecting on the lesson. Ask them to write in their journals to describe, explain and question. Ask them to make a first rough draft drawing of their own motif.	*2.5.Write in their journals, creating comments and questions related to the geometry and culture of traditional Samoan designs.* *Draw a first draft of a possible siapo motif.*

Lesson Three

PE'A MOTIFS: AN ARTIST'S VIEW

Focus

Learning the culture and geometry of motifs from an expert

Objectives: *Students will*

- explore and understand Samoan motifs in *pe'a* designs, and understand the geometry and culture of motifs.
- apply prior knowledge and experiences in *siapo* designs to compare and extend learning.

Materials Needed

Math journals (or paper and pencil)

Chart paper/board and markers

Camcorder

Paper and pencils (for projects)

Arrange for a master pe'a artist to be a guest speaker.

Teacher Activities

3.1. Review the previous lesson.

Ask students to share their journal entries.

Record key ideas and any questions students came up with.

3.2. Introduce the guest speaker.

Record the presentation for use with students later.

Encourage students to ask questions to ensure they understand the origins of Samoan motifs and the process of creating Samoan designs.

3.3. Facilitate interactions between the guest and students.

Talk about ancient designs and explore the process of creating designs.

Lead discussions on the mathematical aspects involved in *pe'a* designs, and encourage comparisons between *siapo* and *pe'a* designs.

Sample Prompts and Questions

What is the significance in *siapo* and *pe'a* of various kinds of lines, angles and shapes and of the use of symmetry and transformation?

How do we tell where a design begins and ends?

Explore what makes a line, e.g.,

- How is a line segment different from a line and a ray?
- Does *pe'a* (or *siapo*) distinguish between a line and a line segment?

How do line of symmetry and transformations (rotation or turning; reflecting or flipping; translating or sliding) impact the designs?

Student Activities

3.1. Respond to questions and prompts by the teacher.

Share journal entries.

3.2. Listen and take notes by recording information, making observations, and creating questions.

3.3. Participate in the discussion.

Listen and take notes.

Offer ideas and ask questions to ensure understanding of both the culture and the mathematics involved in Samoan designs.

Teacher Activities	Student Activities
3.4. Review and reinforce learning of mathematics (geometry), for example, • the properties of line, line segments and angles • the presence of symmetry within patterns and overall design • how rotation occurs when a shape is repeated but is turned so it looks different. • how reflection occurs when one shape is repeated but is turned in such a way that it 'mirrors' the original shape • how translation occurs when one shape is repeated, but 'slides' to a slightly different position so it is different	*3.4. Review the learning. Listen and take notes as needed.* *Respond to questions and prompts.* *Make comments and ask questions*
3.5. Invite students to reflect on and respond by writing and applying what has been learned in this lesson, and in the unit so far. Ask students to write a math journal entry. Ask students to continue to work on the *siapo* project. Make paper available so that the final design can be put up on the wall. Encourage them to think about what effect they hope to create and to consider how geometry will help them to fulfill their ideas.	*3.5. Reflect on the learning in this unit.* *Write a journal entry including information, observations, feelings and questions.* *Work on the design for the project.*

Lesson Four

MATHEMATICS OF SAMOAN DESIGNS

Focus

Review of mathematics learned through Samoan designs

Objective: *Students will*

- analyze and apply mathematical knowledge learned by comparing *siapo* and *pe'a* designs with designs found in Micronesia and/or Melanesia.

Materials Needed

Math journals

Slides (projector) or photos (computer) showing designs from Micronesia and/or Melanesia

paper and pencils (for group work)

Colored markers (for chart paper/board)

Teacher Activities	Student Activities
4.1. Review the previous lesson. Encourage students to comment on their reflections from the guest speaker and from their math journal entries. Review by asking questions related to what students have been learning.	*4.1. Participate in the review of the learning.*
4.2. Introduce the slide show (or computer projected photos). Direct students to use their knowledge to observe the designs displayed. Divide students to move into groups. Ask the groups to share observations and record findings and ideas. Invite them to analyze the various designs using knowledge of culture and geometry: point, line, line segment, ray, angle, symmetry, rotation, reflection, sliding.	*4.2. Watch and observe, noting key features.* *Work in groups, sharing ideas and information to analyze the designs using knowledge of culture and geometry.*
4.3. Facilitate a discussion about Polynesian, Melanesian and/or Micronesian designs, and record the conversation (post key ideas). Ask groups to share their findings, analyses, and views. Encourage interactions between groups.	*4.3. Participate in the discussion as part of the group.*
4.4. Ask students to write a journal entry. Ask students to continue working on their individual projects. Encourage them to share their projects with each other, giving feedback and support. Announce that they will give presentations in the next lesson. Explain that their presentations should reflect knowledge of culture and geometric principles, and include their own personal views and ideas.	*4.4. Write reflections and ideas in math journals.* *Work on their siapo projects. Share the process with others to learn and give support.* *Prepare to present.*

Lesson Five

SIAPO PROJECTS

Focus

Student projects: *siapo* designs

Objectives: *Students will*

- be able to describe their design choices using mathematics concepts and language.
- be able to synthesize their knowledge of culture and geometry.

Materials Needed

Students' *siapo* designs

Math journals

Chart paper/board

Colored markers

Tape (optional, if posting designs)

Teacher Activities	Student Activities
5.1. Explain the purpose, goals and plan for the final lesson. Determine an order of presenters. Remind students they are expected to give explanations that reflect knowledge of culture and geometric principles and to share their own personal views and ideas. Explain how feedback will be given, e.g., • students can give peer feedback • teacher gives comments (based on a rubric, if available)	*5.1. Listen, asking questions if needed.*
5.2. Invite each student to show his or her project and explain design choices. Give evaluative feedback and invite peer interaction. Post designs, if possible [optional: add sticky notes for comments].	*5.2. Listen/Present.* *Give/Receive feedback.* *Interact or discuss with peers.*

Plenary for Unit: Samoan Designs and Geometry

Have students discuss what they now know about geometry and their Samoan culture through the unit on *siapo* and *pe'a* designs.

If designs were posted, invite students to look at all the designs and make general as well as specific observations and comments.

Ask students to write a summary of the most important aspects of their learning in this unit.

Discuss learning by sharing information and ideas.

Express how the knowledge is important (including how ideas of design and geometric concepts are part of daily life).

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