

'Ewa 'Āina Education Initiative

Unit Plan: Loko Pā'aiiau (Link:

https://drive.google.com/file/d/1oMcMc12CD5nvhpR_reAlqipPrv9raOgg/view?usp=sharing)

Created by: Traci Kobayashi

'Ewa 'Āina Site: Loko Pā'aiiau

Detailed Lesson-Project Plan #2

Descriptive Lesson Title: Research on Ancient Hawai'i Fishponds and Ancient Hawaiian Engineering of Fishponds

Essential Unit Questions Addressed:

- How were ancient Hawaiian fishponds designed, created, and operated? (Day 1-2)
- How will you determine the area of an irregular shape? (Day 3)
- How will you measure to create a scale drawing of Loko Pā'aiiau? (Day 4)

Educational Standards

CCSS.ELA-LITERACY.CCRA.W.7

Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

CCSS.ELA-LITERACY.CCRA.W.8

Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CCSS.ELA-LITERACY.CCRA.W.9

Draw evidence from literary or informational texts to support analysis, reflection, and research.

CCSS.MATH.CONTENT.8.G.C.9

Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Engineering Foundations - Standard 12

Create accurate technical drawings with single-view, geometric dimensions.

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Engineering 2 - Standard 3

Examine the principles of statistics and its application to engineering.

HĀ framework and/or Hawaiian Culture integrated into this lesson

- Strengthened Sense of Belonging
- Strengthened Sense of Responsibility

- Strengthened Sense of Excellence
- Strengthened Sense of Aloha
- Strengthened Sense of Total Well-being
- Strengthened Sense of Hawai'i

Materials needed

Media, Videos, Lesson Presentations/Resources

- [LOKO I'AA Manual on Hawaiian Fishpond Restoration and Management](https://www.ctahr.hawaii.edu/oc/freepubs/pdf/Loko%20I%27a%20Full%20Publication.pdf) (Link: <https://www.ctahr.hawaii.edu/oc/freepubs/pdf/Loko%20I%27a%20Full%20Publication.pdf>)
- Resource video for teacher [Using Desmos to find Standard Deviation and Mean](https://www.youtube.com/watch?v=6OXfy_TCB5A) (Link: https://www.youtube.com/watch?v=6OXfy_TCB5A)
 - "Using Desmos to find Standard Deviation and Mean." *YouTube*, uploaded by Laura Lindell. 23 May 2018.
 - [Desmos Graphing Calculator](https://www.desmos.com/calculator) (Link: <https://www.desmos.com/calculator>)

Student Assessments and Worksheets

- [Nā Ana Hawai'i Hawaiian Units of Measurements](https://papahanakuaola.org/wp-content/uploads/2021/03/naanahawaii-1024x769.jpeg) (Link: <https://papahanakuaola.org/wp-content/uploads/2021/03/naanahawaii-1024x769.jpeg>)

Supplies

Day 1-2

- Internet access
- Computer/device

Day 3

- Graphing paper
- Scratch paper
- Scissors
- Calculator

Pedagogy (methods) Used to introduce, teach and close/review lesson

Lesson Introduction

- Did you know there once was 22 fishponds in the Pu'uloa area? (Day 1-2)
- How can you determine the area of your irregular shape like a loko i'a? (Day 3)
- How did ancient Hawaiians measure? (Day 4)

Instructional Sequence

Teacher will...	Students will...
<p>Day 1-2</p> <p>Ask the essential questions How were ancient Hawaiian fishponds designed, created, and operated?</p>	<p>Day 1-2</p> <p>Research and create a presentation of their findings on ancient Hawaiian fishponds.</p> <ul style="list-style-type: none"> ● Design engineering of the fishpond from ancient Hawaiians. ● How were fishponds maintained? ● How do fishponds operate? ● Why were fishponds created? ● What was the purpose of fishponds during ancient Hawai'i? ● Who is Kalanimanu'ia?

	<ul style="list-style-type: none"> • Society of ancient Hawaiian engineers/Traditional Hawaiian engineers
Day 3	Day 3
Have the students grab the materials needed.	Grab a scratch paper and scissors.
Instruct students to cut a random irregular shape (not a regular polygon) from the scratch paper. *Have some irregular shapes prepared for students who don't create an irregular shape.	Cut an irregular shape.
Think-Pair-Share "How can you determine the area of your irregular shape?"	Think individually on how they could determine the area of the irregular shape. Each student will share their idea with a partner and have a discussion. One person from their pair will share out to the class their idea, their partner's idea, or a new idea they collaborated with each other.
Class Discussion: "What if I allowed you to use a graphing paper to determine the area of the irregular shape?" <ul style="list-style-type: none"> • Possible answer: Trace the irregular shape on the graphing paper. Count how many whole squares you have and part squares. • Discussion: "How could you minimize your margin of error" <ul style="list-style-type: none"> ○ Possible answer: Count quarter squares, half squares, $\frac{3}{4}$ squares, and whole squares. 	Discuss as a class on "How they could determine the area of an irregular shape with a graphing paper?"
Model how to calculate the area of an irregular shape.	Watch the teacher demonstrate how to calculate the area of an irregular shape.
Optional: Discussion and/or they could really cut out a piece of their irregular shape. "What if you cut a piece out of your irregular shape?" "How would you determine the area of your shape?"	Participate in discussion. Students will cut out a piece from their irregular shape.
Day 4	Day 4
Teach Nā Ana Hawai'i (Hawaiian Units of Measurement).	Be attentive during the lesson.
Nā Anakahi Hawai'i Practice: Measure common objects and share.	Measure an object in the classroom.
Facilitate discussion on "best measuring tool".	Participate in discussion.
Think-Pair-Share: Design and create measuring implements based on Nā Ana Hawai'i.	<ul style="list-style-type: none"> • Individually design and create how they will use Nā Anai Hawai'i • Discuss with a partner their ideas and collaborate how they would use Nā Ana

	Hawai`i
Have pairs measure the same object using their system of measurement based on Nā Ana Hawai`i	Measure object teacher provides, using their method of measurement based on Nā Ana Hawai`i.
Input measurements into a spreadsheet and help students create a quick graph to discuss range/mean or/and use desmos graphing calculator. *Resource: Using Desmos to find Standard Deviation and Mean	Watch teacher demo.
Facilitate discussion on “margin of error”.	Participate in discussion.
Refer back to graph and providing the actual measurement of the object.	
Facilitate discussion on comparing Nā Ana Hawai`i with other measurement units; merits of multiple measuring systems.	Participate in discussion. -Discuss similarities, differences, and some of the benefits and challenges of using multiple measuring systems.
Think-Pair-Share: Redesign and create measuring implements based on Nā Ana Hawai`i.	Redesign their method of measuring based on Think-Pair-Share: Redesign and create measuring implements based on Nā Ana Hawai`i. <ul style="list-style-type: none"> • Think how they could minimize their margin of error if they used Nā Ana Hawai`i. • Discuss with a partner their ideas and collaborate how they would use Nā Ana Hawai`i in daily life. • Share with the class their idea of how they would implement Nā Ana Hawai`i.
Students will use Nā Ana Hawai`i to create a scale drawing of the fishpond at Loko Pā`aiou.	After site visit, students will use their method of measurement based on Nā Ana Hawai`i to create a scale drawing of the fishpond at Loko Pā`aiou

Closure

- Students will create a presentation of their research. (Day 1)
- Students will calculate the area of their irregular shape. (Day 2)
- Students will determine the length and width of the classroom using Nā Anakahi Hawai`i. (Day 3)

Accommodations for at least 3 types of diverse learners

- ELL students provide or assist with understanding vocabulary words
 - **loko i`a** - fishpond
- SPED accommodations provide resources to help students research about Hawaiian Fishponds
 - LOKO I`A Manual on Hawaiian Fishpond Restoration and Management
- Distance Learning Modifications:
 - Print resources for students to use for their research (students without technology)
- ELL students would have the vocabulary words and definitions for irregular shape, volume, area, fishpond.
- Kinesthetic learners could simulate a water/oil spill on a napkin to create an irregular shape.
- Distance Learning: Students can find an irregular shape at home, trace it on a graphing paper to

calculate area.

- Kinesthetic learners will get to use their hands and arms to measure.
- ELL learners have them share how they would say each Nā Ana Hawai`i measurement in their own language.
- Distance learning - Have students measure their rooms using Nā Ana Hawai`i.

Suggested Formative Assessment Method/s For This Lesson

- Students will create a presentation of their research.
- Students will create their own irregular shape and determine the area.
- Students will take an accurate measurement (length and width) of the classroom using Nā Ana Hawai`i.

Explain How This Lesson Relates To the Unit Summative Assessment

Students will learn how the ancient Hawaiians created fishponds and how they operate as they create their 3D scale model in AutoDesk Inventor.

Now that the students have an idea on how to calculate the area of the irregular shape, they will utilize their knowledge to determine a method of finding the area of Loko Pā`aiāu fishpond.

After site visit to Loko Pā`aiāu, students will use their method of measurement based on Nā Ana Hawai`i to create a scale drawing of the fishpond at Loko Pā`aiāu.