

'Ewa 'Āina Education Initiative

Unit Plan: The Role of Lo'i in 'Āina Momona

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'Ewa 'Āina Site: Kuhiawaho

Hawaiian Culture-Based Lens	Cross Cutting Content	Instructional Design
<ul style="list-style-type: none"> • Mālama 'Āina: Land stewardship focusing on sustainability and a familiar connection • Ola Pono: Values and life skills that synthesize Hawaiian and global perspectives • Kōkua Kaiāulu: Community giveback embodying a core Hawaiian value 	<ul style="list-style-type: none"> • Mathematics (Comm. Core Thread) • Food production • Health-Total well-being 	<ul style="list-style-type: none"> • Debate/Perspective • Stewardship - Sustainability • Oral Presentation

Essential Question/s

- 1.) How do we create, test, and validate a model for the dimensions of a lo'i?
- 2.) How can I measure length, mass and capacity by using non-standard units?
- 3.) What is the most appropriate way of communicating a mathematical idea in a particular situation?

Unit Plan Descriptive Title: The Role of Lo'i in 'Āina Momona

Target grade: 9-12

Target subject: Mathematics

Background Information that includes cited use of the 'Ewa 'Āina Inventory

[Kuhiawaho Site Background](#) (Link:

https://drive.google.com/file/d/19T-wBHmm3_m4YPhjDwSV9jrpZk99tbl9/view?usp=sharing)

Cited use of the 'Ewa 'Āina Inventory (Link:

https://www.ksbe.edu/assets/site/special_section/regions/ewa/Halau_o_Puuloa_Full-Ewa-Aina-Inventory.pdf)

(pp 167-179)

- Ahupua'a: Waiawa
- Guardians: Ka'ahupāhau (Shark Goddess of Pu'uloa) and Kahi'uka (Shark Goddess' brother)
- Mo'olelo:
 - Will share with students this excerpt: [One of the most important figures in Waiawa is Kahi'ukā. This shark god, brother to the shark goddess Ka'ahupāhau, is famous throughout Pu'uloa for being one of the guardians of the people there. His home was said to be located in the ahupua'a of Waiawa. The following is an excerpt of Moses Manu's "He Moolelo Kaao Hawaii no Laukaieie," translated by Maly and Maly (2003): Looking seaward, Makanikeoe saw

the fin of a shark passing by, in front of a stone in the estuary of Waiawa, on the west side of Kanukuokamanu, next to Piliaumoa. Seeing the shark, Makanikeoe drew nearer and he saw that it was Kahiuka, a native of this estuary. His cave was comfortably situated on the side of the stone. Kahiuka was a good shark, and in his story, he is the guardian of Manana and Waiawa. (Maly and Maly 2003:84–91)] (p. 167)

- Will share with students this excerpt: [Another relevant mo'olelo, based on Moses Manu's "He Moololo Kaa Hawaii no Laukaieie," is that of Kāne and Kanaloa's naming various places in Waiawa. A portion of the translation provided by Maly and Maly (2003:89) is as follows: From this place, Makanikeoe then turned and looked to the calm waters of Kuhia Loko and Kuhia Waho. He went to the ponds and saw water bubbling out, and in the pond were many fish of the sea. It was of this pond, that Kāne and Kanaloa spoke, while in Kahiki, as heard by the prophet Makuakaumana, who crossed the sea and traveled to Hawaii: The mullet are at Kuhia-loko, The seaweed is at Kuhia-waho, The salt is at Ninauele, The nehu pala are at Muliwai The lone coconut tree stands at Hape, The taro leaves are at Mokaalika, The water is at Kaaimalu, The awa is gathered at Kalahikiola. Behold the land. All of these places named by the gods can be seen, extending from the sea of Waiawa, to Halalena at Waiawa uka.] (p.168)

- Map: (p. 175)

Sequential Unit Plan Lesson Outline

Lesson Title	Time Estimate in Hours
<p>Unit Intro - My Community</p> <ul style="list-style-type: none"> ● Pre-assessment free-write describing Pearl City and the students' connection to the Pearl City Community. ● Share with class pictures of Kuhiawaho and ask them to reflect on the pictures... What do you notice? What do you wonder? ● Reveal the location of Kuhiawaho on the map and share the Mo'olelo of Kuhiawaho and the video of stewards. ● Ask students to research and reflect on possibilities why lo'i were so important to Hawaiians and why the kalo/taro was a staple part of their diet (HW). 	<p>~0.75</p>
<p>Patterns To Kalo Growth - Areas/Shape of Lo'i</p> <ul style="list-style-type: none"> ● Share the dimensions of one of the shapes of the lo'i at Kuhiawaho and ask students to calculate the area of that particular lo'i (review area of a rectangle formula). ● Have students find the recommended diameter needed when planting kalo - does it differ per type of kalo? If so, group students based on this. Ask the students to calculate how many kalo you could plant in the lo'i based on lo'i dimensions and recommended growing diameter of the kalo (type). ● Introduce the first essential question, "How do we create, test, and validate a model for dimensions of a lo'i?" and follow that up with asking students to play around with other 3 shapes (anything that's not a rectangle) that would have the same area, and to find the dimensions (proving the area is equivalent) and how many kalo could fit when using that 	<p>.25 (15 mins)</p> <p>.50 (30 mins)</p> <p>.75 (45 mins)</p>

<p>particular shape.</p> <ul style="list-style-type: none"> Based on the number of kalo planted, students should be able to predict the best shape for a lo'i and defend their thoughts mathematically. 	<p>.25 (15 mins)</p>
<p>Patterns To Kalo Growth - Yield of a Lo'i</p> <ul style="list-style-type: none"> Discuss ways that Hawaiians measured to start students thinking about the second essential question, "How can I measure length, mass, and capacity using non-standard units?" Ask students to choose what they feel is the best shape for the lo'i to start. Students will research different types of kalo and try to predict for 2 months (Ex: Weeks, months) the yield of the lo'i (Ex: Leaves, taro corms that can be turned into kalo pa'a (cooked taro) or poi (cooked taro pounded)). When the students have the data for 2 months, ask them to find the function that would best represent their data (linear, quadratic, exponential). Use the three models to project out how much yield the lo'i produces in 6 months, 8 months, 10 months, 12 months. Ask students to research how much that particular type of kalo they chose would yield (and then proportion to the area of the lo'i) to see how close their predictions are. Have the students create the explicit and recursive functions of the linear and exponential yields and a discussion for which way they think is the most useful? Which do they think ancient Hawaiians used? 	<p>.20 (20 mins)</p> <p>1 (60 mins)</p>
<p>Patterns To Kalo Growth - Factors That Affect a Lo'i</p> <ul style="list-style-type: none"> After visiting Kuhiawaho and talking to the stewards, students should now be able to address the third essential question, "What is the most appropriate way of communicating a mathematical idea in a particular situation?": <ul style="list-style-type: none"> What other environmental factors affect the yield of a lo'i? What economic factors affect the field of a lo'i? What other factors could affect a lo'i? How do you convince an investor, skeptic, or ali'i (or boss) that you thought of all the factors that could affect a lo'i and that your idea (shape, type, etc.) is the best for their lo'i. Ask students to answer the prompt, more lo'i could end hunger on O'ahu (or Hawai'i) and defend their thoughts based on the prior lessons findings. 	<p>1 (60 mins)</p>
<p>All Things Considered</p> <ul style="list-style-type: none"> Students to create PSA's about persuading residents of Hawai'i to consider starting their own lo'i or volunteering their time at a site like Kuhiawaho. Students will put together a presentation that showcases 	<p>1 week of classes</p>

what they learned (video or slides).

- Students will present their information to a broad audience (video on youtube/FB/Instagram, etc or teacher to put together a panel of local stakeholders) **consider also building in the economic impact, using logical fallacies, infographics here**

Unit Assessment Plan

Formative Assessment Methods Used On a Regular Basis Throughout Unit

- Google form of prior knowledge (to be compared to post form).
- Daily work done on the area and number of plants able to plant in the lo'i based on dimensions
- Ability to make viable predictions in the table
- Desmos used for regression to calculate the linear, quadratic and exponential equations (but will focus on linear and exponential after a class discussion on why a quadratic may not be a viable model)
- Creation of recursive and explicit forms of linear and exponential functions
- Articulation of other factors that are not being used in the linear/exponential models that may affect the data

Summative Assessment/s

- Students will be prompted to create 2 different shapes (not any regular polygon or circle) with roughly the same area and estimate the number of kalo being able to be planted in the lo'i if it was a certain type of kalo that thrived with a certain diameter when planted. Students will be asked to show work for how they calculated the area needed for each kalo and how they decided to calculate the area of the shape (this is like a claim 4 item in SBA). Finally, students will be asked to speculate which shape would be best for the lo'i and defend their choice.
- Students do a PSA about connecting to their community and advocating for sustainability in culture and in food.