MĀLĀ POSITION SYSTEMS

BY LILYMARLEEN UTAʻI

Why is it important to know our traditional practices and the ways of our ancestors? How can we manage the growth and production of various plants in our mālā?

ELEMENTARY FIFTH GRADE

TIMEFRAME 4 TO 5 (60 MIN.) PERIODS

STANDARD BENCHMARKS AND VALUES

NĀ HOPENA AʻO LEARNING OUTCOMES

• BELONGING: Students will understand the foundation in which modern-day cultural practices originate from. Students will be able to formulate their own opinions based on experiences and histories of lauhala weaving.

• RESPONSIBILITY: Students will understand traditional Hawaiian education practices such as “Nānā Ka Maka, Hoʻolohi Ka Pepeiao, Paʻa Ka Waha”; Watch with the eyes, Listen with the ears, and the Mouth is shut. Thus, students will understand the importance of their education and the need to be patient.

• EXCELLENCE: Through hands-on techniques with weaving, students will start to shine individually. Some will pick up weaving patterns easily; some will show their leadership skills to assist others; and some will show their weakness, but will be able to use this as a reflection piece.

• ALOHA: Students will appreciate an art form they will be foreign to. Students will fill the need to mahalo, or to give gratitude, for such traditional knowledge.

• TOTAL WELL-BEING: Weaving will test your patience and the students that pick it up, they will be elated; and the students that struggle, this will be a perfect opportunity to teach them perseverance and urgency.

• HAWAIʻI: Hawaiian students and non-Hawaiian students alike will learn an art form that has been passed down from generation to generation for hundreds of years. They will learn Hawaiian vocabulary associated with this precious art form.
STANDARD BENCHMARKS AND VALUES

MATH MEASUREMENT AND DATA (5.MD)
Convert like measurement units within a given measurement system.
- Math.5.MD.1 - Convert among different-sized measurement units within a given measurement system (e.g., convert 5cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

MATH MEASUREMENT AND DATA (5.MD)
Graph points on the coordinate plane to solve real-world and mathematical problems.
- Math.5.G.1 - Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
- Math.5.G.2 - Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

NEXT GENERATION SCIENCE STANDARDS
ESS3 Earth and Human Activity
5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environments.

HCPS III CAREER AND TECHNICAL EDUCATION
- STANDARD 1: TECHNOLOGICAL DESIGN: Design, modify, and apply technology to effectively and efficiently solve problems
- Invention and Innovation
- CTE.5.1.1 Examine how different innovations have developed/evolved in various cultures over time to improve life and solve problems.

ENDURING UNDERSTANDING:
We will examine how different advances have developed/evolved in various cultures over time to improve life and solve problems from old traditions to modern technology. Measurement systems are progressing to assist us effectively in farming and agriculture to allow us to save time and utilize our spaces efficiently.

CRITICAL SKILLS AND CONCEPTS:
1. Students must have a deep understanding of the importance of being landowners and stewards of the ‘āina (land) in using the Earth’s resources effectively and protecting it for future generations.
2. They will practice using their ancestral Hawaiian anthropic measurements, called “anakahi kino,” as a given measurement system.
3. Geometry skills of graphing and naming coordinates is valuable to this lesson to encourage students in creating a coordinate system to their school mālā (garden), so they would have had previous math lessons on these skills.
4. Students will need to know how technology works to determine locations using a Global Positioning System (GPS), that is used often in the real-world, by practicing with Desmos.com.

AUTHENTIC AUDIENCE:
1. Practice traditional Hawaiian anthropic measurements, called “anakahi kino,” as a given measurement system. (Traditional Practice)
2. Using digital math tools like Desmos.com, students will transform their Ka Mālā Lani aerial picture into a Mālā Positioning System (MPS). Digitally creating a coordinate grid, students will plot points to locate various plants and items in their mālā. (Modern Practice)
3. Compare and convert traditional anakahi kino measurement system with modern technology Desmos grid. (Bridge)
AUTHENTIC PERFORMANCE TASK RUBRIC:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>3- ME (MEETING EXCELLENCE)</th>
<th>2- DP (DEVELOPING PROFICIENCY)</th>
<th>1- WB (WELL BELOW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy of Graphing Points</td>
<td>All points are plotted correctly on coordinate plane and are easy to see in the image using the desmos computerized graphing program.</td>
<td>Some points are plotted correctly in the image using the desmos computerized graphing program.</td>
<td>Points are not plotted correctly or extra points were included in the image using the desmos computerized graphing program.</td>
</tr>
<tr>
<td>Labeling of X-axis and X-coordinate</td>
<td>The X-axis and X-coordinate has a clear, neat label that describes that the first number indicates how far to travel from the origin in the direction of one axis.</td>
<td>The X-axis and X-coordinate has a label that is not a clear indication of how far to travel from the origin in the direction of one axis.</td>
<td>The X-axis and X-coordinate is not labeled clearly and accurately.</td>
</tr>
<tr>
<td>Labeling of Y-axis and Y-coordinate</td>
<td>The Y-axis and Y-coordinate has a clear, neat label that indicates how far to travel in the direction of the second axis.</td>
<td>The Y-axis and Y-coordinate has a label that is not a clear indication of how far to travel from the origin in the direction of the second axis.</td>
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<th>CATEGORY</th>
<th>2- MP (Meeting Proficiency)</th>
<th>1- DP (Developing Proficiency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anakahi Kino measurement system</td>
<td>The student accurately uses the Anakahi Kino measurement system to convert among different-sized objects in their mālā (garden).</td>
<td>The student inaccurately uses the Anakahi Kino measurement system to convert among different-sized objects in their mālā (garden).</td>
</tr>
</tbody>
</table>

AUTHENTIC AUDIENCE:
1. Growing Pono Schools Kumu Laurie, Kumu Sarah, Mrs. Kaneakua, and Kumu Beau
2. Waimānalo Family and Community

OTHER EVIDENCE:
Students will be able to make comparisons of traditional and modern methods and practices of agriculture to determine what is the best in making real-world decisions, like that of a Mahi’ai (farmer) in how to better-use their land and space.
LEARNING PLAN

In the South Pacific of Polynesia, land divisions and spaces were distributed to a family or group of people to live and cultivate on for survival. It was important to utilize each piece and part of the land productively, especially for agricultural providing the necessities for their families and community. The Polynesians created their own measurement system, identification markings, or plot system locating the placement of agriculture to efficiently use their ecological spaces. Today modern technology allows us to create various graphs to plot our use of land spaces. In this lesson, we will bridge ancient and modern measurement systems in solving real world problems.

DAY 1: STARTER ACTIVITY (HOOK)
1. Teacher will distribute an envelopes to each student with their name on it, enclosed is a “Pretend Letter” from the Department of Hawaiian Homelands, sharing their congratulations to the individual who is eligible to own land in Hawai‘i.

2. Students will immediately document in their Journals an entry about how they felt after reading the letter, then share it amongst their peers and class.

3. Have a class discussion on Kuleana (responsibility) in connection to being a landowner. Ask if any students are or know of anyone who own land, and share their experiences.

4. Students draw a sketch of how they would use their land.

5. Teacher will reiterate students sharings and emphasize the importance of being landowners and stewards of the ‘āina (land) in using the Earth’s resources effectively and protecting it for future generations.
DAY 2: LESSON

1. Using a Know-Want-Learn Chart, students will make predictions or contextualize (what they know/connect with) in ways of measurement practices used by the ancient Hawaiians of old Hawai‘i.

2. Teacher will introduce Anthropic Measurements and Hawaiian Anthropic Measurements Anakahi Kino. (Reference Material: Darienne Dey’s PD #1 PowerPoint).

3. In small groups of 3, students will practice using Anakahi Kino in their mālā (garden) selecting about 10 objects, such as their garden bed, plants, trees, fenced perimeter, area, etc., and logging their results in their journal books.

4. Then, students will compare their findings to other groups and find similarities and differences and explain with reasonings of their findings.

5. Debrief with the entire class about their experiences, make connections to their ancestors and how they feel using their methods and practices today.

* HW/Additional Practice: Students will measure their garden or yard at home using Anakahi Kino with their families and share their experiences the following day.

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**Nā Anakahī Hawai‘i (Hawaiian Units of Measurement)**

![Image of Hawaiian Units of Measurement]

2014 by Samo Oliu Gera El, after a figure by Nani Haope
**DAY 3: LESSON**

1. Students share their HW assignment, emphasizing their experiences with using Hawaiian anthropic measurements with their family.

2. Teacher explains, yesterday was a traditional/ancestral measurement system, and today we will use technology digital tools to measure our mālā (garden) in a modern way.

3. Teacher poses a round robin of questions as students respond: Has anyone used a Global Position System... also known as a GPS? How? When? Why? For what purposes?

4. Teacher explains that farmers use Global Position System (GPS) and Geographic Information System (GIS) to accurately determine positions using technology. These are computer systems for managing, analyzing, and displaying geographic information and data to assist farmers. (Students should have prior knowledge of coordinate graphing from previous Math lessons)

5. Teacher reveals that today we will be working with digital tools to learn how to transform Kumu Dalen’s aerial photo of our Ka Mālā Lani (Heavenly Garden) into a Mālā Position System (MPS), plotting points and locating coordinates of various plants and items in their mālā.

6. Using a projector, teacher will introduce students to desmos.com, while students are interacting and following on their own technology device.

7. Together we will make discoveries of the site and play interactive games provided from desmos.com and mathnook.com Coordinate Games, focusing on 1 Quadrant for review, then increasing to 4 Quadrant practices.

8. Debrief as a class, sharing their thoughts on the use of modern technology-digital tools as measurement systems.

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**DAY 4: LESSON**

1. Review our traditional and modern measurement systems we learned from previous lessons.

   - Desmos.com is a valuable website and as you move on to the next part of the lesson focusing on modern technology of measurements, I recommend you becoming familiar with the site by researching http://learn.desmos.com/. This page highlights some effective intro-to-Desmos that will allow you to use all its benefits to bring graphing fun in to the classroom. You will learn to Create with Activity Builder and Explore the Dashboard. Teacher must set up Desmos account on teacher.desmos.com to create pre-made graph of garden with just a picture.

2. Teacher clarifies that now they have an understanding of using desmos.com. They will work individually on digitally completing a coordinate grid, plotting points to locate various plants and items in their mālā from their Teacher Made Template of the aerial view of their Ka Mālā Lani Garden.

3. Teacher will assist and supervise as students seek for help, yet monitor them using desmos account.

4. When students have completed their desmos.graph of their garden. Teacher will print them, so they can move on to comparing and converting measured units from their Day 1 Logs that they practiced with anakahi kino in the mālā.

5. Students will recognize the use of these conversions in solving multi-step, real world problems that they may encounter in their mālā.

6. As a class we will share our findings explaining with reasonings, especially highlighting their experiences on how purposeful it is to use these practices as a mahi’ai (farmer).
DAY 5: LESSON
1. Students will be mentors in teaching their peers their two practices of traditional and modern measurement systems, and explain what is the best practice, or maybe both, but emphasize the importance of learning their ancestral ways.

EXTENDED LESSON
2. Students will connect to other projects that they have worked that could incorporate these practices (ex: Art Project, Science/STEM, and other content areas) and create a Lesson to share amongst their family and community.

REFERENCES/RESOURCES:
- Kumu Dalen Kahiapo of Growing Pono-LDM Drone Photographer
- Darienne Dey PD Workshop #1 Powerpoint Laulima Resource
- https://www.agintheclass.org/Portals/0/LessonFiles/mathematics_agtivities.pdf
- http://education.nationalgeographic.org/encyclopedia/geographic-information-system-gis/
- http://www.hawaiihistory.org/index.cfm?fuseaction=ig.page&CategoryID=299
- http://dhhl.hawaii.gov/applications/applying-for-hawaiian-home-lands/
- http://desmos.com
- http://student.desmos.com
- http://learn.desomos.com
- http://teacher.desmos.com
- https://s-media-cache-ak0.pinimg.com/originals/73/d3/20/73d320483a64fd5f367ef13c42c89da0.jpg

REFERENCES/RESOURCES: ANAKAHI KINO (HAWAIIAN ANTHROPIC MEASUREMENTS)
- ‘Owâ = ½ finger’s width
- Mâkahi = 1 finger’s width
- Mâlua = 2 fingers’ width
- Mâkolu = 3 fingers’ width
- Mâhâ = 4 fingers’ width
- Kiko’o = the diagonal distance from tip of pointer finger to tip of thumb (on same hand)
- Pi’â = from tip of middle finger to heel of hand (or bottom of palm)

- Kaulua = from tip of thumb to tip of pinky finger outstretched (i.e., a span or “shaka”)
- Ha’ilima = from tip of middle finger to elbow
- Iwilei = from tip of middle finger to center of collar bone
- Muku = from tip of middle finger to elbow of opposite arm
- ‘Anana = from tip of middle finger to tip of other middle finger (i.e., a wingspan or fathom)