WAHI PANA AND LINEAR EQUATIONS

BY KEHAU SOUZA

How can change impact stewardship and sustainability?

DRIVING QUESTIONS:
What equations, written in slope-intercept form, will describe the lines in my (wahi pana) original drawing?
How can linear equations, written in slope-intercept form describe the lines in my wahi pana drawing?
How can your wahi pana drawing be described with linear equations?
How can the history and culture of place (wahi pana) be described using linear equations?
How does my relationship with people and places of Hawai‘i build cultural identity?

STANDARD BENCHMARKS AND VALUES:

NC SCOS 5.01c. Develop an understanding of function. Find, identify, and interpret the slope (rate of change) and intercepts of a linear relation.
NC SCOS 5.02 Write an equation of a linear relationship given: two points, the slope and one point on the line, or the slope and y-intercept.
F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of quantities and sketch graphs showing key features given a verbal description of the relationship.
F-IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph

STANDARDS FOR MATHEMATICAL PRACTICE:

SMP.1: Make sense of problems and persevere in solving them

• Use concrete objects or pictures to help conceptualize and solve a problem
• Continually ask themselves does this make sense
ENDURING UNDERSTANDING

- To gain a greater understanding of Native Hawaiian history and culture through place-based activities that incorporates school learning in collaboration with family and community members.
- 9th grade students visit four different sites [Kionakapahu, Koholālele, Keauhou Bird Conservation Center, and Pauka’a] in the districts of Hilo and Hamakua.
- These sites have been chosen for their historic, cultural, and curricular value. During the site visits, students will learn about the mo‘olelo of the location, perform service work, conduct research and data collection, all within the context of an immersive cultural experience.
- To this end, students will be working toward a hō‘ike, where they will demonstrate their knowledge and thinking around answering the essential question.

CRITICAL SKILLS AND CONCEPTS

LANGUAGE OBJECTIVE: The students will be able to create an original drawing and write equations in slope-intercept form using at least 12 lines from their drawings.

KEY VOCABULARY: Algebra, Linear equations, slope, slope-intercept form

INTRODUCTION:
You will use your knowledge of linear relationships and your creativity to design a picture (8.5×11). Your picture must contain at least twelve lines.
You must create a design, incorporating twelve distinct linear equations:
- Two horizontal lines
- Two vertical lines
- Two lines with positive slope
- Two lines with negative slope
- Two pair of parallel lines that are neither vertical nor horizontal
- Two pair of perpendicular lines that are neither vertical nor horizontal
You may use more line segments if needed to complete your picture.
ETHNOMATHEMATICS

AUTHENTIC PERFORMANCE TASK:
Use the information you gathered from 1 of the 2 sites you visited thus far to create a design that represent that special place (Honohononui, Pauka'a, Koholālele, Keauhou Bird Conservation Center)

1. Decide on the linear picture of your choice. Your design should be roughly centered at the origin and include all four quadrants.

2. The drawing must depict your special place “wahi pana”, researched issue/problem of “wahi pana”, historical and cultural background (mo'olelo, mele, etc) of chosen/place.

3. Using your laptop, access the links provided below to review how to find the slope of a line and how to write equations in slope intercept form.
   - How to find the slope of a line
   - Interactive slope of a line
   - Slope Intercept form
   - Parallel and Perpendicular lines

4. Create a rough draft using graph paper. As you draw, mark the lines and the points which you used to determine the slope. On the rough draft, label each line with a letter.

5. Use the table provided to show the math used to determine the equation of each line segment on your drawing. Be sure to include:
   - the letter of the line segment
   - the coordinates of the endpoints
   - slope calculation (show your work)
   - equation in slope-intercept form

6. Finally, trace your work from the rough draft onto plain white paper and carefully color it. Submit the rough draft, the final drawing and the table.

AUTHENTIC AUDIENCE:
Kula Kiʻekiʻe / High School Grade 9 Project Showcase
Freshman Academy 2015-2016 Hōʻike
Wednesday, May 11th, 2016 Koaiʻa Gymnasium
Teacher, student peers, parents
Invited community members from their chosen “wahi pana”

OTHER EVIDENCE:
Students were able to showcase their culminating projects which focused on the theme of wahi pana and incorporate ‘ike from English, Hawaiian Culture, Hawaiian Language, Health, Math, Science, & Speech.
LEARNING PLAN

ACTIVITY #1 - Listen to the stories and information shared by host groups to answer the following questions (Hawaiian Culture Interdisciplinary).

A. MOKU

1. What is the name of the moku (district) of the place you are visiting?
2. What is the meaning of the name of the moku?
3. ‘Ōlelo no’eau reference to the moku.

B. AHUPUA‘A

1. What is the name of the ahupua‘a you are visiting?
2. What is the meaning of the name?
3. What makes this wahi pana SPECIAL?
4. Brief mo‘olelo or information about this wahi pana.

C. KAHI

1. Ka makani: What is the wind of the place you are visiting? What is the meaning of the name?
2. Ka ua: What is the name of the rain of the place you are visiting?
3. What is the meaning of the name?
4. La ‘au: What plants are indigenous to this site?
## WAHI PANA

**ACTIVITY #2: RECORD NOTES TO ANSWER EACH QUESTION IN THE BOXES BELOW.**

<table>
<thead>
<tr>
<th>MOKU</th>
<th>AHUPUAʻA</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>MAKANI &amp; UA</th>
<th>MEAKANU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
WAHI PANA

ACTIVITY #3: SITE REFLECTION (LANGUAGE ARTS INTERDISCIPLINARY)

At each site you will need to complete a reflection. Therefore, while you are there, keep this reflection piece in the back of your head.

SITE: ______________________________

Insert a picture of a place that resonated with you (or draw a sketch of that place)

Write a description of the place that resonated with you using sensory imagery and other literary devices. The description should capture the essence of what you experienced.

Write an explanation as to why you felt a connection to this particular area.

Write two things that you learned from the host in each area. This could be related to the mo‘olelo of the place, cultural practices, historical information, current issue, issues etc. Share possible connections/relationships to your personal wahi pana.

NOTES FOR LANGUAGE ARTS
ACTIVITY #4: DRAWING LINES – LINEAR EQUATIONS (ALGEBRA 1 INTERDISCIPLINARY)

Use the information you gathered from 1 of the 2 sites you visited thus far to create a design that represent that special place (Honohononui, Pauka’a, Koholålele, Keauhou Bird Conservation Center)

1. ROUGH DRAFT DRAWING:
   Decide on the linear picture of your choice (completed on white paper).

2. CREATE A ROUGH DRAFT USING GRAPH PAPER.
   Keep in mind your design should be roughly centered at the origin and include all four quadrants. As you draw, mark the lines and the points that you used to determine the slope. On the rough draft, label each line with a letter.
   • Use geometric shapes, lines or patterns
   • Be attentive to detail
   • Explain the mana’o behind your design

USE THE TABLE PROVIDED TO SHOW THE MATH USED TO DETERMINE THE EQUATION OF EACH LINE SEGMENT ON YOUR DRAWING. BE SURE TO INCLUDE:
   • the letter of the line segment
   • the coordinates of the endpoints
   • slope calculation (show your work)
   • equation in slope-intercept form

ANALYSIS TABLE:

<table>
<thead>
<tr>
<th>GRAPH #:</th>
<th>TYPE OF LINE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENDPOINT #1 COORDINATES:</th>
<th>ENDPOINT # 2 COORDINATES:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Find the slope between the two endpoints:

Write the equation of the line in slope-intercept form:

<table>
<thead>
<tr>
<th>EQUATION:</th>
<th>CHECK:</th>
<th>Point #3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

3. FINALLY, TRACE YOUR WORK FROM THE ROUGH DRAFT ONTO PLAIN WHITE PAPER AND CAREFULLY COLOR IT. SUBMIT THE ROUGH DRAFT, THE FINAL DRAWING AND THE TABLE.
ASSESSMENT

DRAWING LINES - LINEAR EQUATIONS
The following rubric will be used to assess your understanding of the standards.

<table>
<thead>
<tr>
<th>SCORE</th>
<th>CRITERIA FOR MASTERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Drawing and table show correct equation for each of the twelve lines. Equations written in slope intercept form. Included are equations for: two Horizontal lines, two vertical lines, two negative-slope lines, two positive slope lines, two pair of parallel lines and two pair of perpendicular lines.</td>
</tr>
<tr>
<td>3</td>
<td>Drawing and table show correct equation for no less than ten lines. Equations written in slope-intercept form. Equations include at least one of each type of line: Horizontal, vertical, negative-slope, positive slope, parallel lines and perpendicular</td>
</tr>
<tr>
<td>2</td>
<td>Drawing and table show correct equation for no less than eight lines. Equations written in slope-intercept form. Equations include at least one of each type of line: Horizontal, vertical, negative-slope, positive slope, parallel lines and perpendicular</td>
</tr>
<tr>
<td>1</td>
<td>Drawing and table show correct equation for no less than six lines. Equations written in slope-intercept form. Equations include at least one of each type of line: Horizontal, vertical, negative-slope, positive slope, parallel lines and perpendicular</td>
</tr>
</tbody>
</table>

REFERENCES/RESOURCES:

Wahi Pana – Linear Equations Website:  http://wahipanalines.weebly.com/

Site locations visited in the Hilo and Hamakua districts:
Kionakapahu:  https://sites.google.com/a/ksbe.edu/kionakapahu/home
Keauhou Bird Conservation Center:
http://www.hawaiiforestinstitute.org/our-projects/keauhou-bird-conservation-center-discovery-forest/
Pauka‘a (Map):  http://www.maplandia.com/united-states/hawaii/hawaii-county/paukaa/

Interdisciplinary Connection Resources (Lesson Plans)
- Nā wahi pana o Lononuiākea:  http://wahipanalines.weebly.com/hawaiian-culture.html
- Research Brainstorm - Kingsolver Model
- Site Reflection