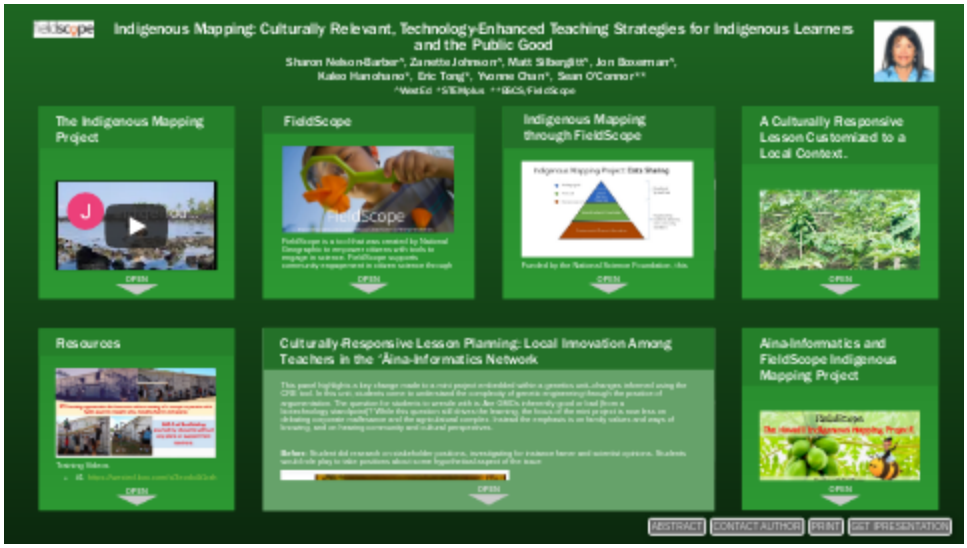
Indigenous Mapping: Culturally Relevant, Technology-Enhanced Teaching Strategies for Indigenous Learners and the Public Good



Sharon Nelson-Barber^, Zanette Johnson^, Matt Silberglitt^, Jon Boxerman^, Kaleo Hanohano*, Eric Tong*, Yvonne Chan*, Sean O'Connor**

^WestEd *STEMplus **BSCS/FieldScope





PRESENTED AT:

THE INDIGENOUS MAPPING PROJECT

[VIDEO] https://www.youtube.com/embed/Dii3_S5RlZ0?rel=0&fs=1&modestbranding=1&rel=0&showinfo=0

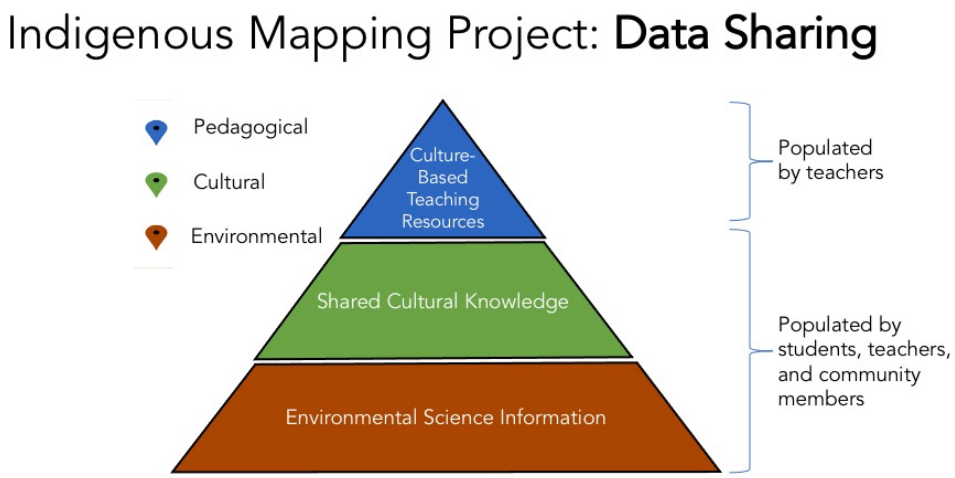
This project contributes new knowledge to inform both research and practice on how local contextual knowledge can be incorporated into a technological innovation. This study opens new doors for our understanding of how broad-reaching technology can enhance teaching and learning. The contextual and sociocultural aspects of testing in diverse indigenous communities is underexplored, and the work of this project promises to serve indigenous students as well as to enhance the educational advancement of all students in STEM areas.

FIELDSCOPE

(http://www.fieldscope.org/)

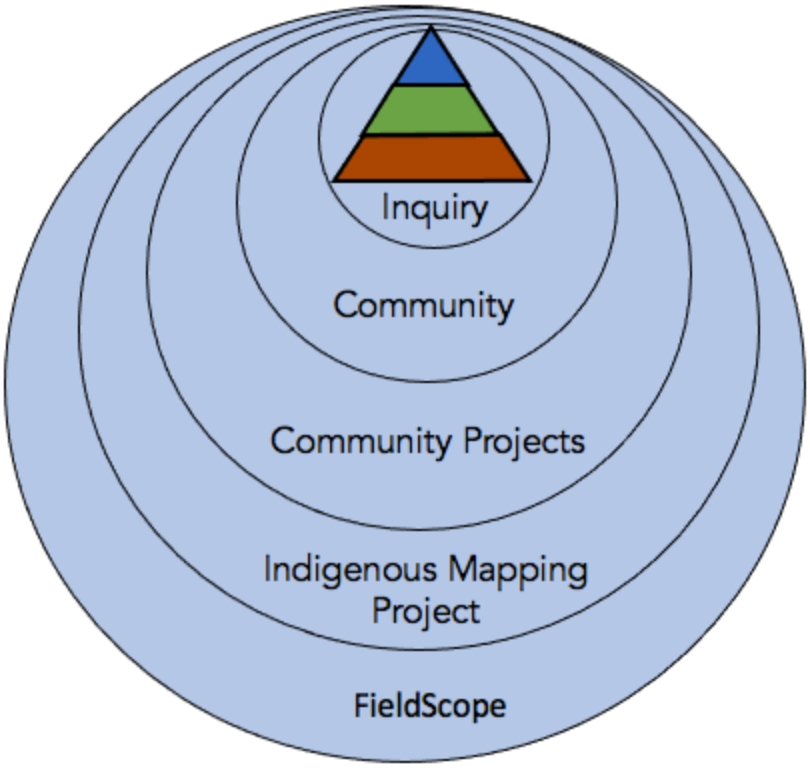
FieldScope is a tool that was created by National Geographic to empower citizens with tools to engage in science. FieldScope supports community engagement in citizen science through an interactive platform, which organizers of field studies can leverage to offer sophisticated graphing and mapping visualization tools and resources that can enhance existing and future science projects.

INDIGENOUS MAPPING THROUGH FIELDSCOPE



Funded by the National Science Foundation, this project has innovated on the FieldScope platform.
Our innovation can support teachers and students in gathering, sharing, and visualizing meaningful environmental, cultural, and educational information within and across Indigenous communities. We are working alongside Indigenous teachers and students in classrooms in Arizona, Alaska, Hawai‘i, and US islands in the South Pacific.

At the heart is a FieldScope Inquiry: A self-contained project on FieldScope that is set up for collecting data for meaningful purposes. Through projecs, learners can ask ponder: What is the real world purpose, essential question or valued human concern that will be explored through this inquiry? Why is it important to conduct this Inquiry?



Projects are nested within a larger FieldScope ecosystem. Data may be gathered by the entire community, groups

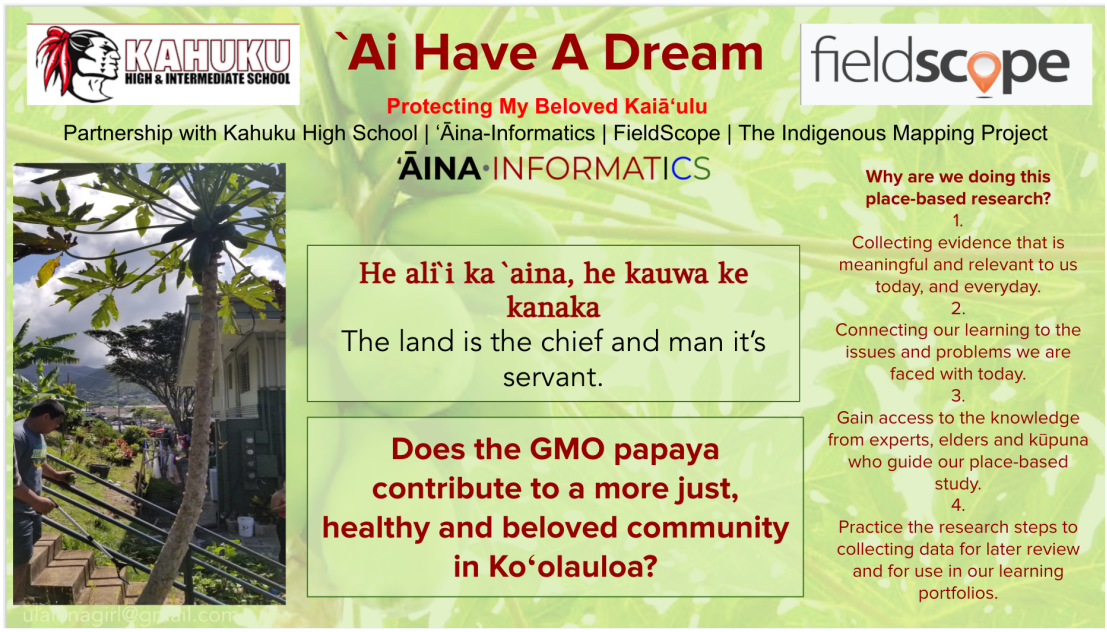
within the community, or individuals. Learners could consider a variety of questions while developing a line of inquiry.

An important modification we made to the FieldScope platform allows users with different levels of permission to upload, view, and share information including documents, media files, and environmental data.

Role & Permissions	Data Accessible for Viewing? Entered by?	Change Permission Levels?	Change User Roles?	Enter Data?
Administrator	Yes, Admin can view all data entered by members anyone	Yes	Yes	Yes
Indigenous Member	Only data entered by Indigenous and Local members can be viewed by Indigenous members	No	No	Yes, but Admin must grant access for each member on an individual basis
Local Member	Only data entered by Local Members can be viewed by Local Members	No	No	No, but Admin must grant access for each member on an individual basis

A CULTURALLY RESPONSIVE LESSON CUSTOMIZED TO A LOCAL CONTEXT.

In the fall of 2020, teacher/co-developer Kaleolani Hanohano presented the CRE Rubric to a diverse group of Hawai‘i teachers as a three-day workshop series. At these workshops, participants were encouraged to align, extend or develop their own curricula using the rubric's place-based standards. One of the collaborations that resulted from the workshops was a new, place-based distance learning project created in conjunction with another teacher, Eric Tong of ‘Iolani School's ‘Āina-Informatics Network (http://www.nawaiekolu.org /ainainformatics). This culturally-sustaining curriculum demonstrates a local use case which brought together genetics and bioethics content from the ‘Āina-Informatics Network (‘Iolani School), civics and Hawaiian studies at Kahuku High School and FieldScope's spatial and analytical capabilities.



This project teaches genetic ethics rooted in the students' home community of Ko‘olauloa on the north shore of O‘ahu. Students (while engaged in distance learning due to COVID-19) independently survey their respective neighborhoods for agroforestry products, including papayas, which in Hawai‘i exist as both genetically modified (GMO) and non-GMO varieties. Students collect samples of papayas throughout the community to be tested in the genetics lab by Eric Tong at ‘Iolani School. They observe the testing virtually using both synchronous and

asynchronous modes of instruction. The aim is to connect the GMO papaya data with family and community perspectives on GMOs in order to advocate for the wellbeing of their community. The data, stories and resources gathered throughout the project are then mapped onto layers in FieldScope by the students to serve as a knowledge repository for their community.

RESOURCES

Training Videos

- #1 https://wested.box.com/s/3eodx4t1rzhtfec0608urqta3dhzd8gh (https://wested.box.com/s/3eodx4t1rzhtfec0608urqta3dhzd8gh)
- #2 https://wested.box.com/s/8pn3nm16lwbdphakgmybo62beoj55ayh (https://wested.box.com/s/8pn3nm16lwbdphakgmybo62beoj55ayh)
- #3 https://wested.box.com/s/m028karo0by2103uwi7hkoos1ney7g70 (https://wested.box.com/s/m028karo0by2103uwi7hkoos1ney7g70)

Culturally Relevant Assessment Rubric

THEME	NONE PARTIAL FULL	CRITERIA
Contextualization		The learning
	○◑●	*is situated in a context (place, setting,*
	○◑●	*Is coherent with knowledge, perspectiv*
Critical Self-Reflection/Self-Determination		The curriculum provides for
	○◑●	*opportunities to recognize when there i*
	○◑●	*questioning the source of your knowing*
	○◑●	*activation of human capacities that ar*
	○◑●	*exploring the elements of the system th*
	○◑●	*reflection on the situatedness of self in*
Cultural Values		The instruction
	○◑●	*incorporates Indigenous knowledge sys*

(http://drive.google.com/file/d/10_7kTFCXUrIMjlbhJcW0cLI9ZE_GWInO/view)

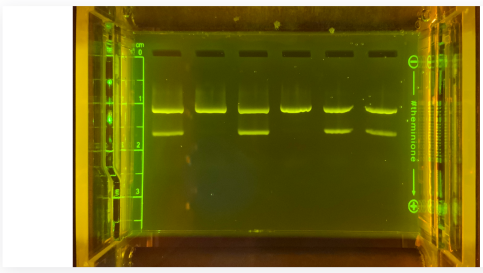
A note about the rubric.

Many nations globally have Indigenous educational initiatives including: Aboriginal Australia, The Ainu, Alaska Natives, The Bengali, Aotearoa (the Maori), Greenlanders, Kanaka ʻŌiwi (Hawaiʻi Natives), Diné (the Navajo Nation), Akwesasne (the Mohawk Nation), Saami, South Africa (multiple peoples), Taiwan (there are 3 tribes here need to name I will add). Common across these models is that they are rooted in Indigenous knowledge systems (e.g., Barnhardt 2005; Johnson 1992) that have been interpreted for application in formal learning settings by local communities, educators, academic researchers, and Indigenous elders. We developed a framework for teachers to help them make connections with students (that they can capitalize on-take out) through instruction and construction of lessons and assessments surrounding FieldScope. We based this framework on constructs that come from a variety of culture-based assessments and rubrics including those from the Alaska Native Knowledge Network, CREDE, Implementing Alaska Cultural Standards, and our knowledge and experiences. A reflective teacher can use this cultural relevance framework to aid planning and instruction by asking herself the ways different themes or facets were present in planning, in activities in and out of the classroom, and in assessment for the class.

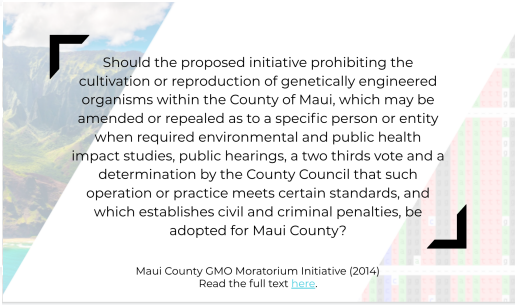
CULTURALLY-RESPONSIVE LESSON PLANNING: LOCAL INNOVATION AMONG TEACHERS IN THE ʻĀINA-INFORMATICS NETWORK

This panel highlights a key change made to a mini project embedded within a genetics unit–changes informed using the CRE tool. In this unit, students come to understand the complexity of genetic engineering through the practice of argumentation. The question for students to wrestle with is: Are GMOs inherently good or bad (from a biotechnology standpoint)? While this question still drives the learning, the focus of the mini project is now less on debating corporate malfesance and the agriculatural complex. Instead the emphasis is on family values and ways of knowing, and on hearing community and cultural perspectives.

Before: Student did research on stakeholder positions, investigating for instance famer and scientist opinions. Students would role play to take positions about some hypothetical aspect of the issue

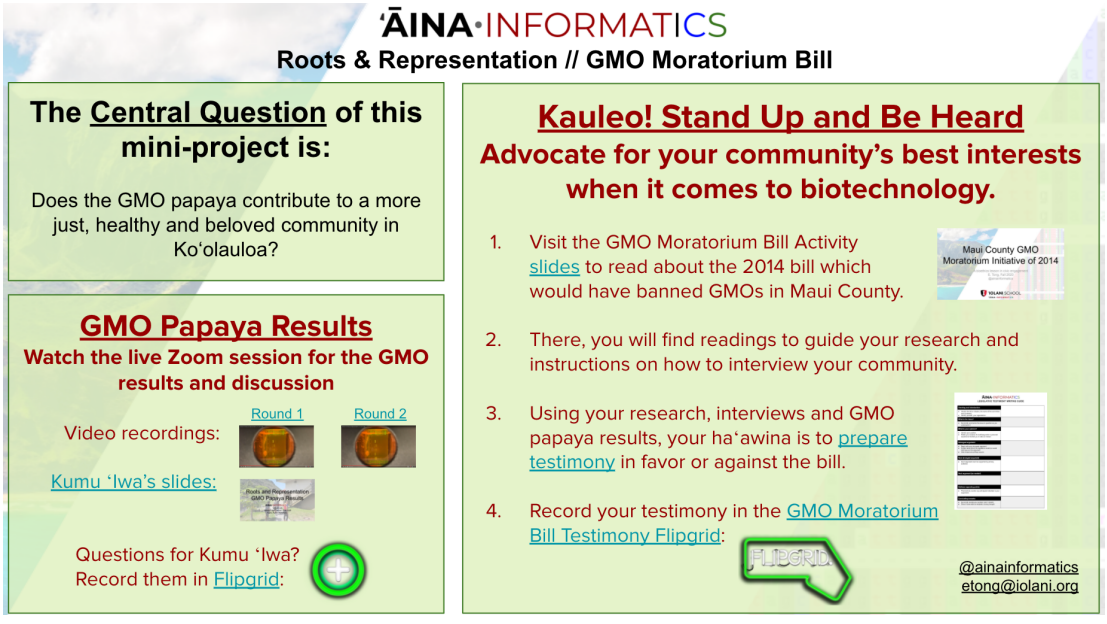


GM Papaya Gel Electrophoresis Protocol



The full unit on the gentics of papaya can be found here (https://studentcorner.io/projects/xNiVQvFQ4qOz) with supplementay slides here (https://docs.google.com/presentation /d/1AP2owMstZ9w7FaBNGEAr5OgkTPTnNsU2gxZ4QiQJt7Q/edit#slide=id.g742fff9795_1_7)

After: The learning has been personalized and humanized. Students seek out different sources and perspectives inlcuding religious values and beliefs. Family is explicitly part of the design. Students talk with family members and neighbors to see how they feel about the issue.



STEP 3 | **EXTEND** | Write testimony | **KAULEO** | **It is time to Advocate for your beloved community again!** What is legislative testimony? Your job is to prepare testimony to advocate for our community's position on a GMO ban. Learn more about when and how citizens testimony works to influence the legislative process in this video: OPEN HERE: **https://youtu.be/7_UnivBuVrM**
Writing Legislative Testimony: Use the Legislative Testimony Writing Guide as a way to organize your thoughts. | OPEN template here: **Legislative Testimony Writing Activity** • Personalized writing style • States a position(ality) • Series of logical arguments • Persuasive tone • Cites evidence for each claim made in support of an argument Legislative Testimony Writing Guide

Links to the lessons are here:

GMO Papaya Project: Lesson slides (https://docs.google.com/presentation /d/1sXGKkZVjwuxqRrUV0POPbEERSKv4vX2XHMp7M6fNjDE/edit?usp=sharing)

Lesson worksheets

Unit 13: 'Ai Have a Dream - Gathering Leaves (https://docs.google.com/document /d/1yCWiXME86eqhclXVNzgk5JOtYJZ0oAaqunOaepPWTWo/edit?usp=sharing)

Unit 14: 'Ai Have a Dream - The Discussion (https://docs.google.com/document /d/1LQffPNoLZlw852acvZsPHsaqYzh-hoEDbUB9Wd5sPtA/edit?usp=sharing)

Unit 15: Kaleo has this link

Unit 16: 'Ai Have a Dream - The Results (https://docs.google.com/document/d/1KxO4-QG77rLh4NCAEhBTrdJ1tqXzJ77aUtvkCTt5syc/edit?usp=sharing)

Unit 17: 'Ai Have a Dream - The Research (https://docs.google.com/document/d/15TnYnfiYwzTWZWgL-TjQAqfnjdWifYbHVc94WObCuEY/edit?usp=sharing)

Unit 18: 'Ai Have a Dream - The Testimony (https://docs.google.com/document /d/1Np6i2A27zl8K_qGQvCOkfktMUs_2NiqUbPArmjsNjC8/edit?usp=sharing)

Unit 19: 'Ai Have a Dream - Testimony Peer Review (https://docs.google.com/document /d/12VNBTiiWrzUsF1jNHRK06rtgAPGCPAr_eRwuxAteGuA/edit?usp=sharing)

Unit 20: 'Ai Have a Dream - The Scope (https://docs.google.com/document/d/16RrFrZJYIy9-WLHfuB5VVbCuk_hS-RWNxOR7OKEW-Lo/edit?usp=sharing)

Unit 21: 'Ai Have a Dream - The Mapping (https://docs.google.com/document/d/1-BUlgUWY2Vve1BpnzeZJxjAg0oFnivNoIIMkplcGFc0/edit?usp=sharing)

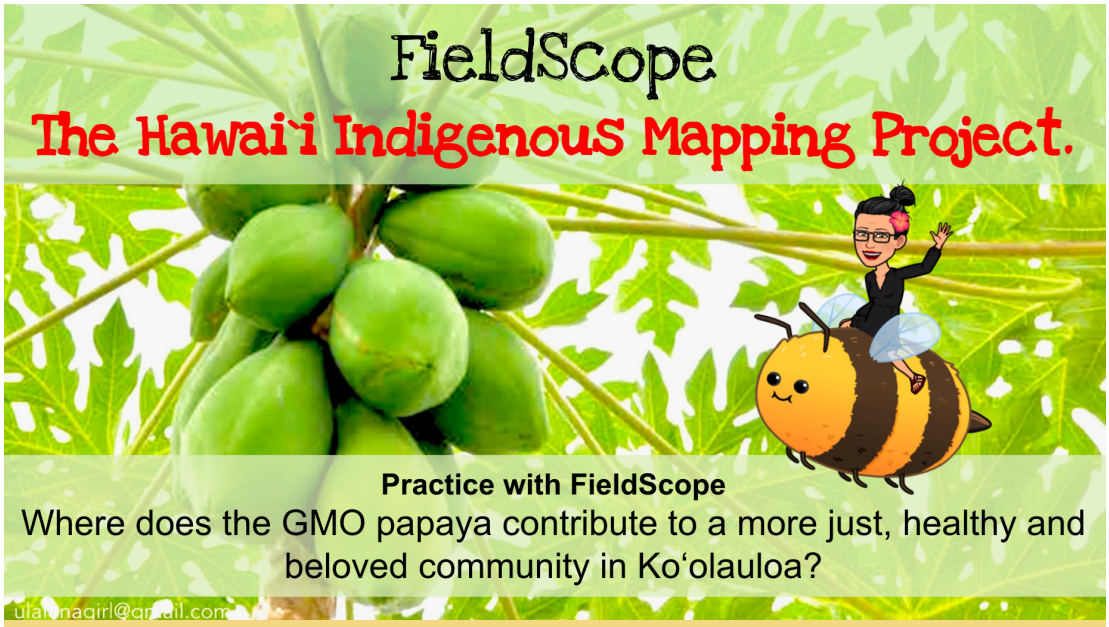
Both teachers relied heavily upon the CRE framework to optimize the lesson materials, including readings, videos, labs and assessments for cultural relevance and community contextualization. Below is the instrument the teachers used to modify their curriculum. The red font shows text which has been personalized.

PAGE 1 THEME	NONE PARTIAL FULL	comparative `anui`u waena		CRITERIA	PIKO `anui`u loa		
Contextualization				**The learning**	ʻĪ	ʻŌ	ʻĀ
A `A`o	○ ◗ ●	x	1	*is situated in a context (place, setting, learning environment, etc.) in which the requisite practices and knowledge are likely to be used.*	x	x	x
	○ ◗ ●	x	2	*Is coherent with knowledge, perspectives, and worldviews drawn upon.*	x	x	x
Critical Self-Reflection/Self-Determination				**The curriculum provides for**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*opportunities to recognize when there is or isn't overlap between perspectives to examine what will be most beneficial at this time, in this context, for this setting/audience.*	x	x	x
	○ ◗ ●	x	2	*questioning the source of your knowing—going beyond the mental and into the social-emotional/embodied/dreamt/intuitive/ritual practices.*	x	x	x
E `Eleu	○ ◗ ●	x	3	*activation of human capacities that are embodied and go beyond the mental realm: movement, dreaming, intuition and associated ritual practices. (Denzin, Lincoln & Smith 2008; Kovacs 2010; Smith 1999, 2013; Khalifa, Gooden & Davis 2016)*	x	x	x
	○ ◗ ●	x	4	*exploring the elements of the system that are inhibiting our self-determination.*		x	x
	○ ◗ ●	x	5	*reflection on the situatedness of self in context of communit(ies), bioregion, tribe, nation, economic system etc., along with the use of tools for reflection, self-study, and processes for active decolonization and healing from generational/cultural trauma.*		x	x
Cultural Values				**The instruction**	ʻĪ	ʻŌ	ʻĀ
I `ike	○ ◗ ●	X	1	*incorporates Indigenous knowledge systems (characteristic components and appearances and relationships are represented; dynamic relationships and functions may be present).*		x	x
	○ ◗ ●	X	2	*places value on Land, people, and/or history*		x	x
	○ ◗ ●	X	3	*fosters an appreciation for multiple models and perspectives through disambiguation of parallel worldviews, thereby placing value on the multiplicity of knowledge systems, and honoring beliefs.*		x	x

PAGE 2							
Place-based Learning Experiences				**Pedagogy primes learners to**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*interpret and extend existing knowledge.*		x	x
	○ ◗ ●	x	2	*think 'receptively and intuitively' (i.e., the practice of learning 'from' the land not just 'about' the land in order to tap into the history of a place to inform decision making).*		x	x
	○ ◗ ●	x	3	*recognize nature is spatially and temporally dynamic.*		x	x
O `Oni	○ ◗ ●	x	4	*pose real-world questions of community import.*		x	x
	○ ◗ ●	x	5	*foster respect and responsibility for the land.*		x	x
	○ ◗ ●		6	*be independent decision makers.*		x	x
	○ ◗ ●	x	7	*contemplate ancestral knowledge and present-day events.*		x	x
	○ ◗ ●	x	8	*build relationships, empathy, and knowledge that lead to purposeful action.*		x	x
Language Development				**Harnessing learners' prior knowledge and experiences, CRE pedagogy uses Native, heritage, and community languages to construct learning environments that emphasize**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*the implications of how and when an Indigenous/heritage/community/colonial language, dialect or register is used.*	x	x	x
	○ ◗ ●	x	2	*alignment and coherence between the languages, settings for a conversation/activity and the purposes of the communication or action (process)*		x	x
U Ulu	○ ◗ ●	x	3	*use of both oracy and written literacy skills at appropriate times.*	x	x	x
	○ ◗ ●	x	4	*the use of languages to introduce, reinforce, and establish coherence and internal consistency among cultural values and worldviews (belief systems).*	x	x	x
	○ ◗ ●	x	5	*the deliberate creation of a learning environment that is designed to transmit the interconnectedness of all elements of Indigenous knowledge systems*	x	x	x
Family and Community				**The learning environment employs a pedagogy that**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*Creates opportunities for participation and highly values intergenerational relationships that are the foundation of knowledge transmission(Nā Lau Lama 2006).*	x	x	x
H Huina	○ ◗ ●	x	2	*incorporates familial and social bonds, rather than ignoring them (in an effort to increase fairness).*	x	x	x
	○ ◗ ●	x	3	*relationships within the broader community (place/land, people, heritage knowledge) are recognized as key sources for reciprocity.*	x	x	x
	○ ◗ ●	x	4	*supportive, collaborative, and social/community, intergenerational, familial community-based pedagogy.*	x	x	x

PAGE 3							
Cognitive Complexity				**Learners are given opportunities to interpret information in multiple ways, co-construct meanings, perspectives, theories, and frameworks by**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*drawing upon multiple ideas of varying complexity.*	x	x	x
K Ka`a	○ ◗ ●	x	2	*extending inquiry of academic knowledge to students' individual, family, and community knowledge.*	x	x	x
	○ ◗ ●	x	3	*providing opportunities for learners to achieve mastery of a concept or practice while fluidly assuming multiple roles, including learner and teacher.*	x	x	x
Authentic Indigenous Assessment				**Authentic Indigenous Assessment aims to:** • **deepen, confirm, contextualize, and extend learning** • **support the growth of teachers and schools, for purposes of furthering Indigenous community learning** • **make learning "visible"** • **understand and respond to student thinking** • **produce data for purposeful action and empowering activism, contributing to the greater good.**	ʻĪ	ʻŌ	ʻĀ
	○ ◗ ●	x	1	*be formative, using assessment for learning rather than about learning*		x	x
L Lama	○ ◗ ●	x	2	*engage learners in building meaningful relationships among students, community members, ancestors, places, land, history, etc.*	x	x	x
	○ ◗ ●	x	3	*give learners ways to take ownership.*		x	x
	○ ◗ ●	x	4	*ask students to relate the results of their own work to concerns and values of their community.*	x	x	x
	○ ◗ ●	x	5	*allow recent evidence of learning to inform the next cycle of instructional choices.*		x	x
	○ ◗ ●	x	6	*tap diverse representations of cultural and scientific reasoning.*	x	x	x
	○ ◗ ●	x	7	*stimulate reflection on both teaching and learning processes.*		x	x
	○ ◗ ●	x	8	*ground learning in real community questions, allowing students to demonstrate their knowledge in a variety of ways, and for real-world purposes.*	x	x	x

AINA-INFORMATICS AND FIELDSCOPE INDIGENOUS MAPPING PROJECT



FieldScope

The Hawai`i Indigenous Mapping Project.

- FieldScope will allow us to select desired areas of our neighborhood and track changes over time.
- We can compare our neighborhood to other neighborhoods/
- If other students or schools in Ko`olauloa are monitoring other things like rivers, ocean debris, sea level rise, or the ULU tree, we can compare these
- We can take the data and create a comparison of data throughout the Ko`olauloa region.
- We can create maps and graphs to share our data t learn from and share with others.
- If our team discovers something interesting or unexpected, we can map it in FieldScope and have others connect to our new learning.

What are Some of the features of FieldScope?

Once you upload data into FieldScope, there are powerful built-in tools to map and graph data. The best thing is for us to create our **monitoring station**

Our class will be able to see not only our data upload, but other program participants and their information too.

What type of data can be uploaded to FieldScope?

Basic observation information, including photo uploads and KILO journals

- Photos,videos, documents - multimedia data linked to a place
- Environmental data
  - Atmospheric conditions (what are the conditions at the time of collection)
  - Chemical parameters (soil sampling, moisture and nutrients)
  - Biological parameters (pollinators; bees, birds and worms)
  - Macroinvertebrates (helpful and not so helpful animals)
  - Physical parameters (including habitat, erosion and presence of pollution)

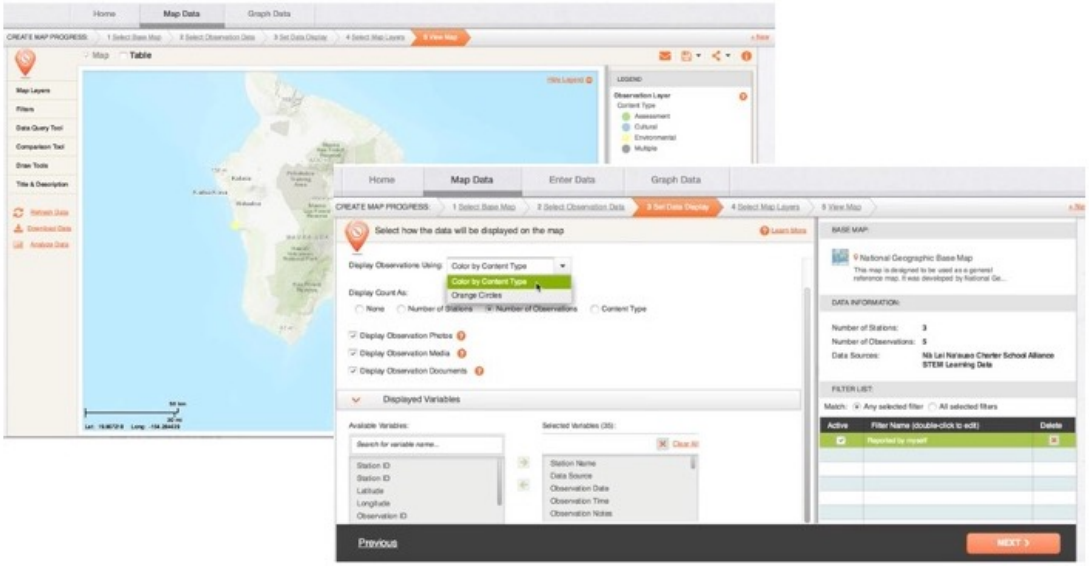
GO TO: https://hawaii.fieldscope.org/v3

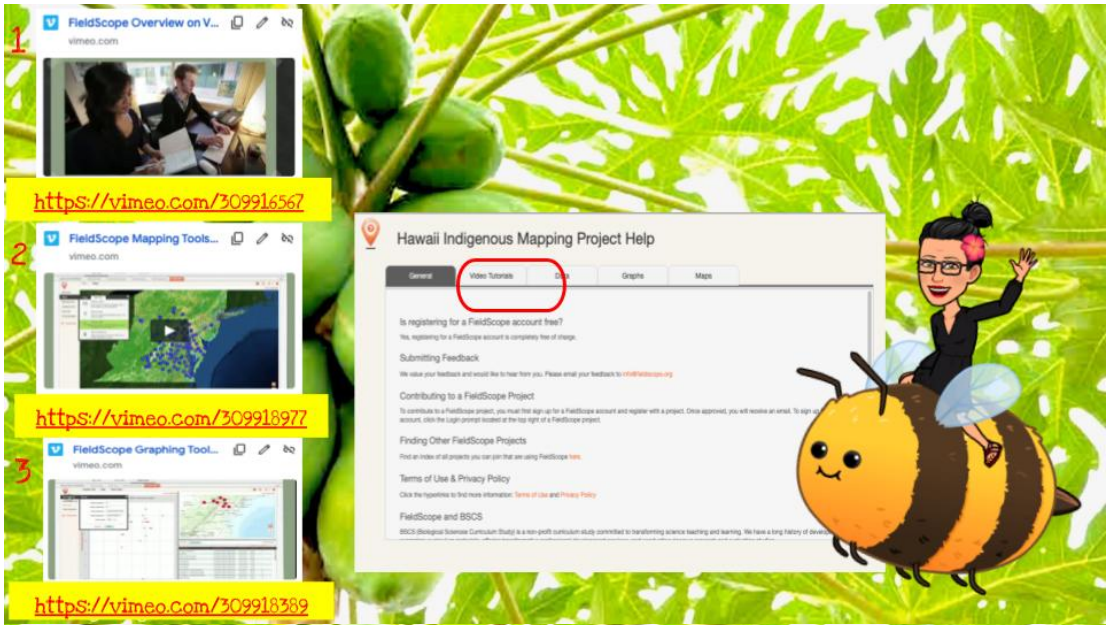
CREATE: Your account; Use your personal email to bypass the firewall.

- When creating your **PASSWORD** Follow these steps:

Password: RED___ ____ ____ ____

Mapping and Visualizing Data





ABSTRACT

This paper discusses the development of a field-based technology that supports teachers and students in gathering, visualizing, and sharing environmental data, and importantly, cultural data such as videos of elders, historical maps, and lesson plans. More than one dozen Indigenous teachers and their students are using this new technology. Data collection includes surveys, participant observations, teacher work products, and student performances on science assessments aligned to the fieldwork practices and to the new NGSS. Findings derived through the field learning experiences and supporting classroom activities will illuminate strategies and adaptions teachers make while providing culturally-relevant, technology-enhanced science instruction and tools for assessment.