STEM Professional Development in Hawai‘i and American Samoa: Two case studies using three strategies and a survey

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Theoretical Framework: Developing Teacher Expertise/Agency through Intersecting Three Knowledge Domains

Theory of Learning: situated. legitimate participation in communities of practice (Lave & Wenger 1991).

Cultural landscape: a geographic space… in which nature and culture co-evolve (Wu 2010)

Implications: **Place** as a cultural construct in a space-time continuum with diverse resources for STEM PD

1. Place-based human and physical resources;
2. Cultural resources: values, practices, language (Moll *et al* 1992), metaphors (Lakoff & Johnson 2003);
3. Historically, culturally diverse STEM practices and knowledge.

Teacher expertise and agency develop via partnerships (networks) intersecting students' places, cultures with compelling STEAM issues (Sewell 1992, Yosso 2005, Gonzalez *et al* 2005)

Application: PD develops local STEM expertise by "identify(ing) the specific trends most relevant to such places and the ways in which local populations can contribute to altering the trends that affect them" (p. 8066, Kates & Parris 2003)

Three PD strategies:

1. Community mapping to identify historical resources and issues
2. Curricular mapping to incorporate resources into STEAM curriculum.
3. Place-based, culturally responsive pedagogies.

Systems-oriented, experiential knowledge

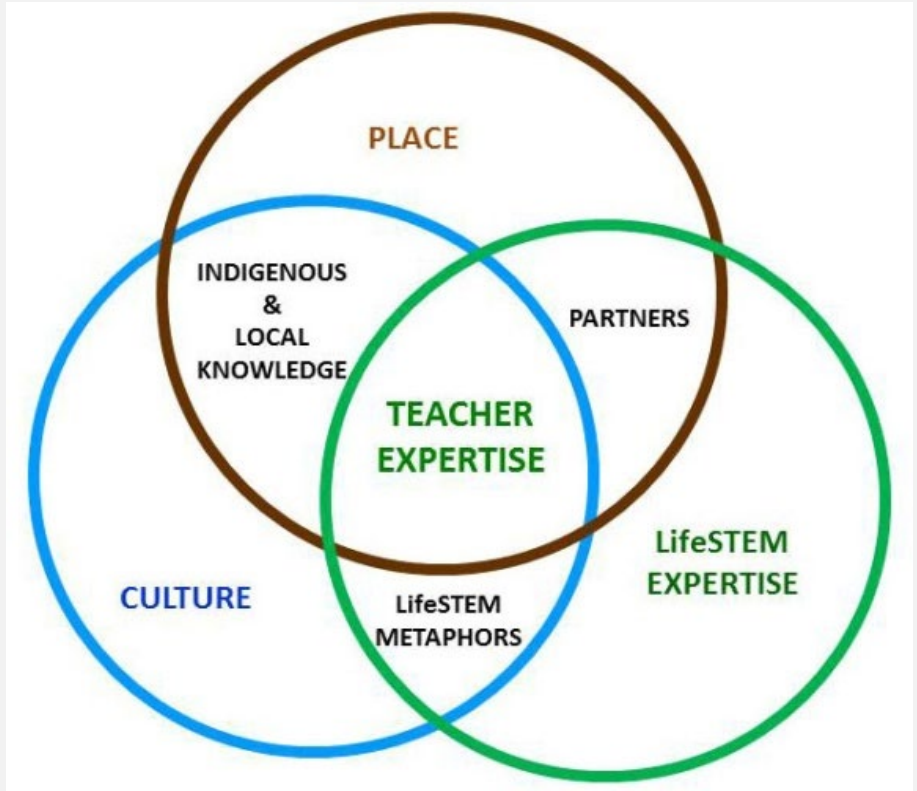


Figure 1. Chinn 2017

Case Study 1. American Samoa

Source: Pritchard-Sua & Savali

1899 Unincorporated US Territory

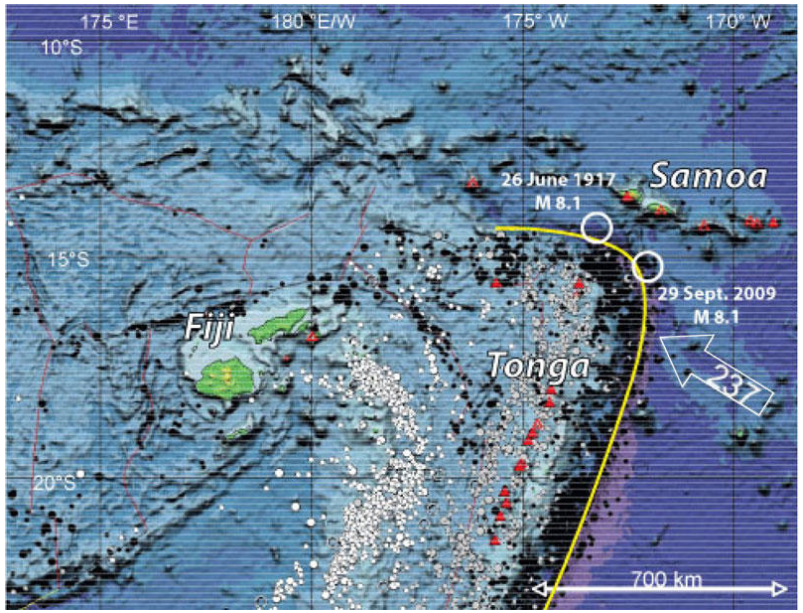
- Volcanic archipelago of 7 islands, 14.3 S, 170.7 W
- 199 square miles
- Pop. 55,500, 90% Samoan (US Census 2010)
- Languages: English in school, Samoan at home and community

PD: EDCS 640P(SUST) Place-based Education

- 23 Elementary – high school teachers
- 22 Samoan speakers
- Tutuila public schools

Teachers identify place-based issues for potential curriculum development:

1. Climate change: severe weather, drought, threats to unique ecosystem;
2. Geohazards: earthquakes, tsunami, volcanism;
3. Urbanization: erosion, run-off, ground water pollution, loss of mangroves;
4. Diet: 95% food imported, processed (long shelf life), food desert;
5. Health/lifestyle: obesity, diabetes, 70-year ave. life span;
6. Loss of traditional knowledge, practices, language:
   2003 Interviewees at bus stop name 46 cultivars (Rangone et al 2004)
   2018 Chinn's EDCS 640P students name 7 cultivars



2017 & 2009 8.1 magnitude earthquakes at Tonga Trench
Source: USGS

Indigenous STEM Story: Adze production, springs, trade with Cook Islands

Strategy 1. Community mapping: identify place-based resources

- Quarry and fortified site above Leone Falls learned through interview with community elder/archeologist Epifania Suafoa-Taua'i
- Facets, depressions on rocks by streams and coasts created as stone tools are polished become resources for archeology lesson.

Strategy 2 Curricular mapping: Transdisciplinary cross-cutting concepts

- Archeologist Epifania Suafoa-Taua'i shares ancestral story with teachers.
- Teachers Iutita Savali, Sarah Su'a anchor curriculum unit in story of Cook Islands family sailing to Leone to trade for adzes. Sons wander off, remain in Samoa. When parents return, they hear sons calling and find them transformed into springs--Puna Loa (above) and Puna Mai (below).

Strategy 3 Place-based pedagogy:

- Teachers and archeologist create field trip integrating earth science landscape with cultural landscape of ancestral story of voyaging and connectedness of humans and natural features.

Puna Loa Spring, Source: P. Chinn

Puna Mai Spring, Source: P. Chinn

Geocience story: Impact on Leone Village of 2009 Earthquake & Tsunami

Strategy 1. Community mapping-identify partners, issues, resources

- Primary/secondary sources: archeology, archives, geoscience resources, traditional stories, interviews with elders and experts.

Strategy 2; Curricular mapping: Geology curriculum

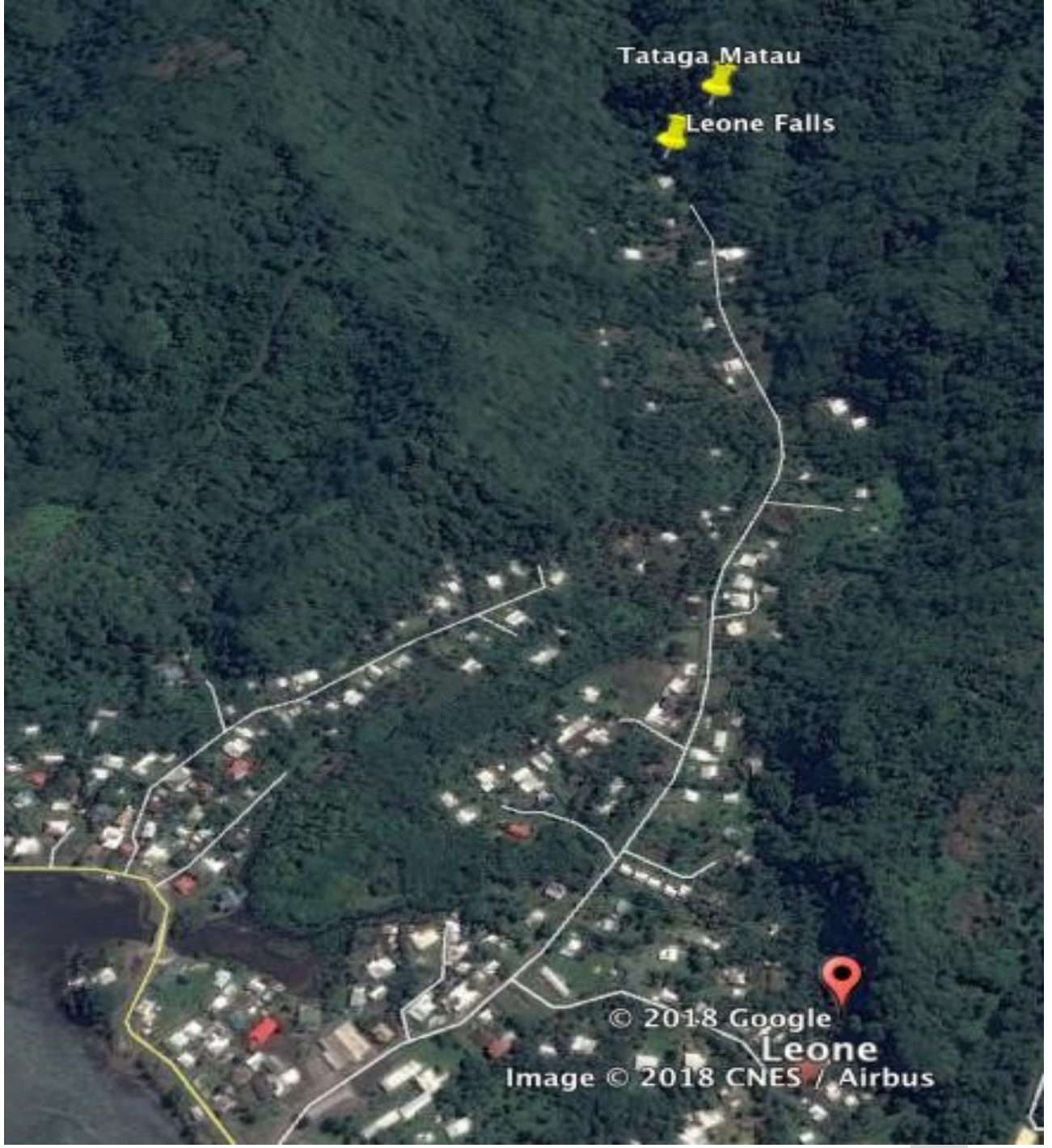
- 8.1 magnitude EQ in Tonga Trench 120 miles away triggered tsunami killing 11 Leone villagers, a third of deaths in American Samoa.

- 10 meter tsunami swept up streams to base of Leone Falls.

Strategy 3. Place-based pedagogy:

- Students created personal escape plans for their places at different times in a typical 24 hour period.

Google Earth map, courtesy of Iutita Savali, Sarah Su'a, Epifania Suafo'a-Taua'i.



Case Study 2. Hawai‘i: Place & Culture-based COVID-19 Curriculum

1893 Hawaiian Kingdom overthrown by American businessmen
1898 Hawai‘i illegally annexed by US

- Volcanic archipelago extends1,522 mi (2,450 km) NW-SE
- 28,311 km²
- Population 1,431,603 (2015)
- Official languages: English, Hawaiian

PD: EDCS 699 Directed Reading/Research

- Kaleolani Hanohano, 15+ years teaching experience, Native Hawaiian
- Teaches Social Studies/Hawaiian Studies, Hawaiian language
- Demographics: rural school, 60% Native Hawaiian/Pacific Islander

Feb. 2020 Hanohano identifies COVID-19 as threat to Hawaii's economy and health

1. Cultural practice: *Kilo*-to observe closely, Indigenous science and engineering practice
2. Develops COVID-19 lessons in Feb. 2020
3. Feb. 26 , 12:26 am receives email from Chinn: Queen Lili'uokalani's writings about her 1881 lockdown of Honolulu to control smallpox epidemic
4. Feb. 26, 7:33 am writes "I have a whole curriculum built for my entire Academy on the coronavirus for next Thursday. SO, I am now going to add this piece as *kupuna ‘ike* (ancestral wisdom) that departs from [today's] common technologies into the past for simple but profound solutions!!

Princess Regent Lili‘uokalani,
Source: Queen Lili‘uokalani Trust

Hawaiian Story: History of Infectious Diseases in Hawai‘i

Strategy 1. Community mapping-identify partners, issues, resources

- Primary/secondary sources: Hawaiian newspapers, archives, traditional stories, interviews with elders, experts.

Strategy 2. Curricular mapping

Lessons address U.S. Social Studies, NGSS, Common Core, Health standards, Hawaiian cultural standards

Nā Hopena A‘o

- To develop a sense of Wellbeing | To develop a sense of Belonging | To develop a sense of Aloha | To develop a sense of Hawai`i | To develop a sense of Responsibility | To develop a sense of Excellence.

Nā Honua Mauli Ola:

- Promote personal growth and development to strengthen cultural identity, academic knowledge and skills, pono decision making, and the ability to contribute to one’s self, family, local and global communities.

Strategy 3. Hanohano’s 2021 place-based, culturally sustaining curriculum and pedagogy: Slide 8

Students choose and research an introduced disease listed in Timeline (Slide 9), use readings provided in Module 1

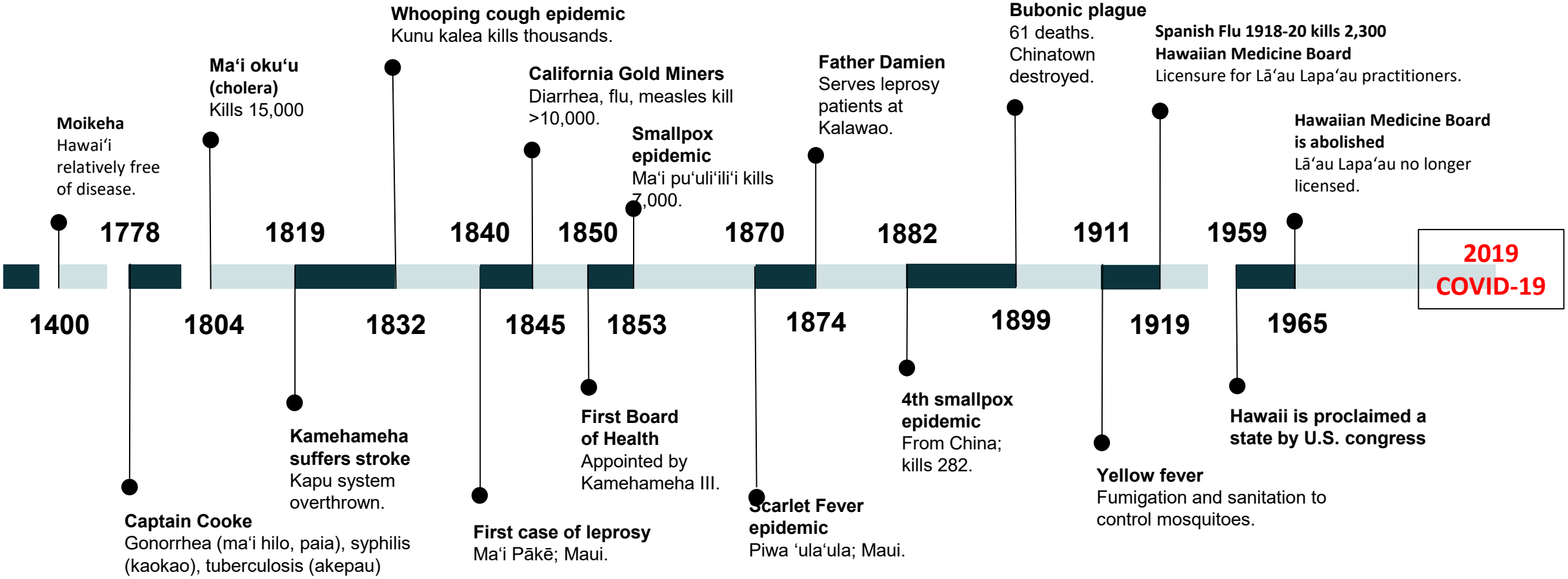
- Students interview a family elders about a disease listed in Timeline of introduced diseases.
- Students post and share research and interviews (Slide 11)

Kaleolani Hanohano's Modern History of Hawai'i lesson based on diseases mentioned in Module 1 History of Infections Diseases in Hawai'i and the Pacific for her rural, majority Native Hawaiian and Pacific Islander high school students.

	ACTIVITY **Hawai'i's historical relationship with introduced disease**
1	**Preparation Steps:** **1. Select a blank slide (see slide 10) and put your name on the slide** **2.Investigate the disease and various pieces of information**
2	**Action Step 1:** Research all the questions and the data boxes on the slide as directed. Obtain your information from the hyperlinks that are on Timeline slide or do research on your own.
3	**Action Step 2 - Add 2 photographs** **Picture 1** of the infectious agent as a cell **Picture 2** of the infectious agent and how it can physically appear on the body.
4	**Action Step 3:** **Interview your `ohana (family: parents, grandparents, aunties and uncles) to share a family story (mo`olelo) about a memory about infectious agent** and document the effects that this infection had on them and the `ohana.
5	**Action Step 4:** **1.Deadline** - Complete this activity by: _____ **2.Required** - Presentation: _____

Hawai‘i’s historical relationship with introduced disease

Centuries of isolation left Native Hawaiians with no immunity to introduced diseases.
La‘au lapa‘au, traditional herbal medicine, worked for familiar illnesses but was ineffective against introduced diseases.
Learn more about cholera, measles, smallpox, leprosy, Spanish flu, whooping cough, bubonic plague, scarlet fever.



“Hawaiian Health Timeline and Events.” Kekuni Blaisdell, 1998. Updated by Papa Ola Lokahi, 2016, updated 2020 Chinn

_____ In Hawai`i

Name _____

Per. _____ Date: _____

What is _____?

Where was it first discovered?

Where is _____ found?

Why is this a problem for Hawai`i?

How does a person contract the disease?	**What are the symptoms?**	**What is the treatment?**
What are the health risks, long term risks and risks to children?	**How can I avoid getting sick?** **Is there a vaccination?**	**How is it monitored in the US?**

Picture #1 of the infectious agent

Picture #2 of the infectious agent

REQUIRED: Hawaii Health Timeline

Numbers of infected & deaths in Hawai`i

Number of infected & deaths in the United States

Number of deaths Worldwide:

Interview a family member to share a memory or story about the Infectious agent:

COVID-19 In Hawai`i

Lani N.

What is **COVID-19** ?

It's an infectious disease caused by a newly discovered coronavirus.

Where is **COVID-19** found?

First found in China in 2019

Why is this a problem for Hawai`i?

This is a problem because we are isolated on a little island which makes it easier to spread the virus

How does a person contract the disease?

If someone else they have been in contact with physically has had covid or has had contact with someone in covid might have past it on to you.

What are the symptoms?

Fever, Coughing, sneezing, cannot breathe, nausea, vomiting, headaches, sore throat, fatigue

What is the treatment?

Hospitalization, Get rest, stay hydrated

What are the health risks, long term risks and risks to children's?

Affects most of the time, the elderly due to weak immune systems. Breathing and digestion problems long term. Children can get it but can be asymptomatic (no symptoms) and can give it to elderly

How can I avoid getting sick?

Stay at home and leave only when necessary. Always wear a mask out side of home and quarantine when needed.

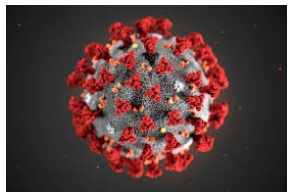
Is there a vaccination?

Yes there is. 2 parts to it.

How is it monitored in the US?

Having a case definition to make sure cases are counted the same way everywhere in the US. CHarts and numbers are checked regularly.

Picture #1 of the virus



Picture #2 of the virus

Numbers of infected & deaths in Hawai`i

26456 infected

415 deaths

Number of infected & deaths in the United States

27.2 M infected

468K deaths

Number of deaths Worldwide:

2.35 M

Interview a family members to share a memory or story about the disease:

My uncle had covid. He is a pilot and had to take a leave for almost 1 month until he fully recovered. His wife would have to bring meals to the door and one day his kids surprised him with a 5 course meal of the worst combinations of foods from turkey burgers with crickets and some exotic foods because he lost his sense of taste.

Outcomes:

Teachers American Samoa

1. **Outcomes:**

- Increase in numbers of places and people serving as resources for STEM (all report increase, 3-5 times)
- Agency: STEM in traditional stories and practices increased interest in outdoor active learning oriented to sustainable, resilient communities
- Identity: Samoan identity and connections to lands and culture strengthened

2. Supportive Cultural Factors:

- Strong family and village relationships
- Cohort formed a community of learners with network of community resources and shared sites
- Colleagues are recognized as resources

3. Unsupportive cultural factors:

- Access to many sites controlled by villages
- American lifestyle: reduction of Samoan language, practices, cross-generational communication,
- American diet: poor health, food insecurity, inactive lifestyle
- Adoption of US curricula, tests, pedagogy

Kaleolani Hanohano's Students

1. **Results of Module 1 study spring 2021**

- Students (n=77) show positive shifts on Likert Scale Survey based on Na Hopena A'o Hawaiian cultural values and attitudes:
  To develop the senses of Total Wellbeing, Belonging, Excellence, Responsibility, Aloha, and Hawai`i.
- 30% of students expressed Interest in health science related courses and careers:

2. **Hanohano's reflections:** Quote edited for brevity

When the school community experienced deaths due to travel the idea for creating the slide assignment around infectious diseases was born. The point was to construct a tool that utilized the Timeline as a secondary and primary resource. The tool needed to provide depth as students chose a disease, explored the severity of these infectious agents, and learned about problems they'll need to solve in the future.

Most realized that gathering information, talking to family and elders played a vital part in their understandings about the world, Hawai`i, and community.

3. Supportive Cultural Factors:

- Polynesian, Asian, local cultures: strong family relationships
- Hanahano's pedagogy shaped by her Hawaiian family
- Hanohano's curricular design shaped by *kilo*, to observe closely.

Questions to consider:

1. What stories in your place could serve as anchoring phenomena and contexts for science lessons?

2. What past and present phenomena in your place could be sources for science lessons?

2. What under-utilized, over-looked, marginalized Indigenous and/or local resources in your place could establish a sense of place and the cultural and ethical contexts for science lessons?

Polishing facets, I. Taua'i, Leone, American Samoa Source: P. Chinn

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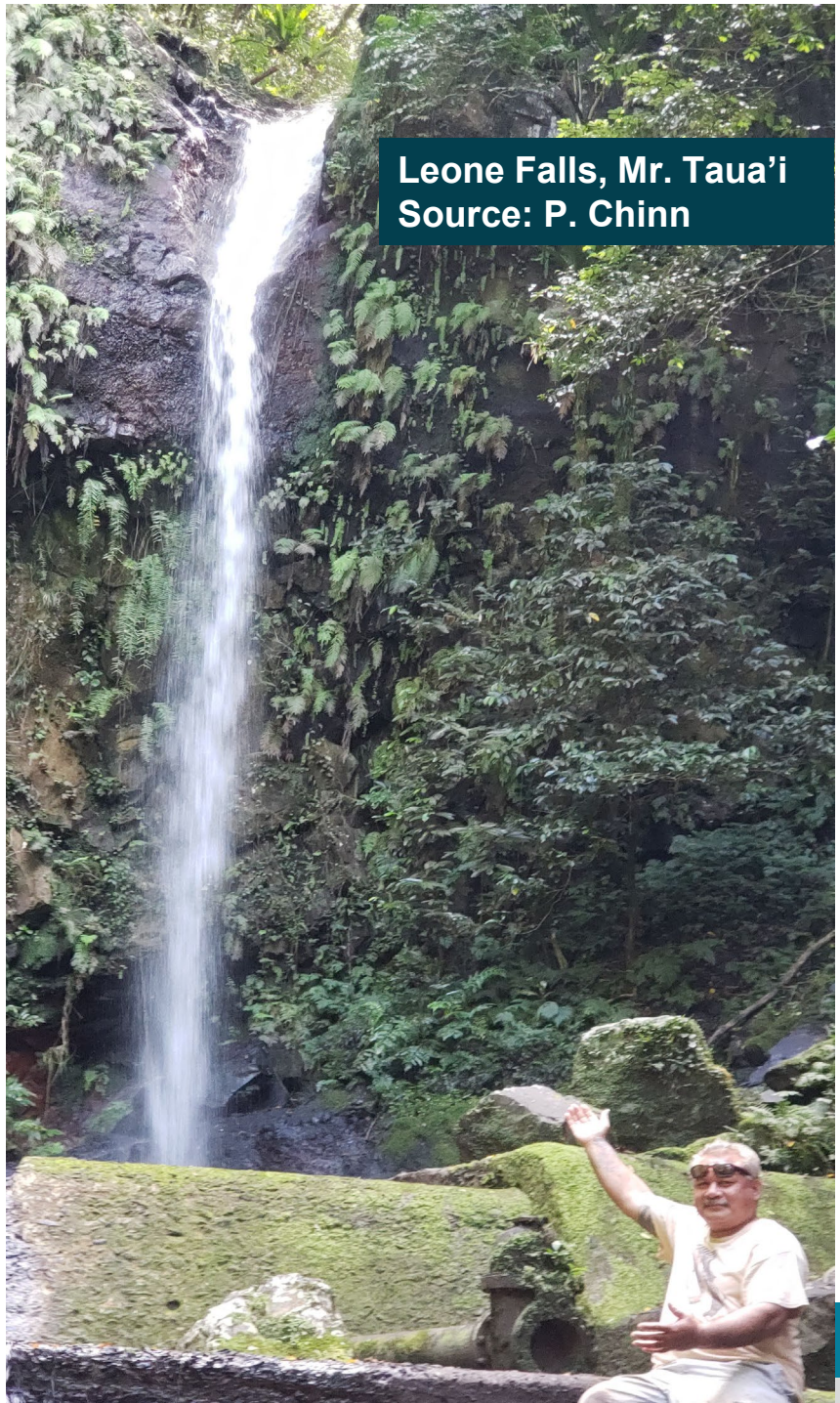

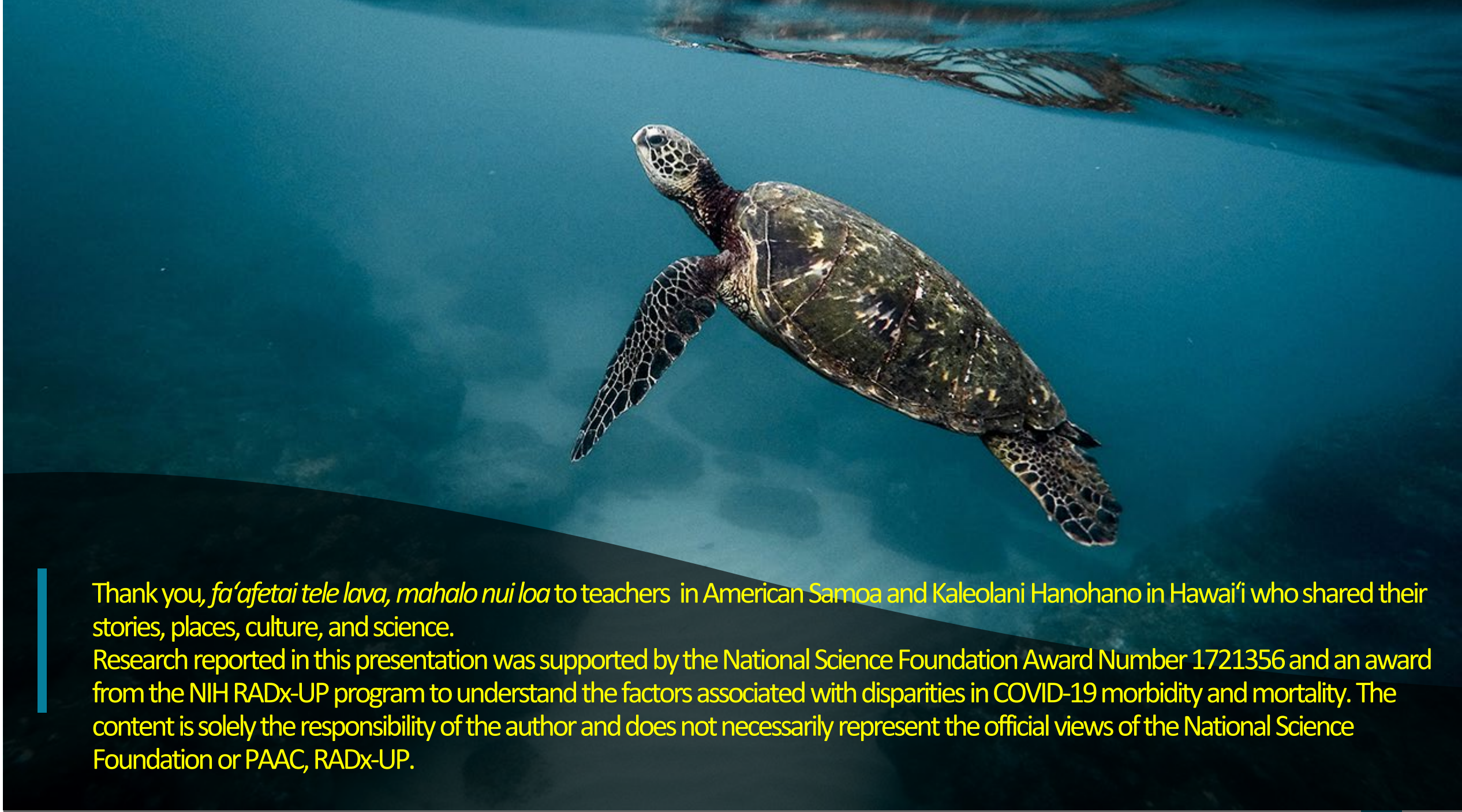

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