Developing Place-Based, Culturally Sustaining Earth Science Teachers: Strategies To Integrate Traditional Ecological Knowledge Into Geoscience Instruction

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#274-6

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Research Questions

What is the evidence that PD strategies support:

1. **teacher agency**, defined as creating and teaching culturally sustaining, place-based earth science lessons that support Native Hawaiian students’ learning and engagement?

2. **capacity building** of teachers able to create and teach these earth science lessons?

Ahupua‘a, Kamehameha Schools-Bishop Estate.
~ 800 CE Polynesians arrive ~28 plants, dog, pig, chicken, rat

~1300 CE unique to Hawai‘i: *ahupua‘a* ridge to reef, *mauka-makai*, sustainable geopolitical resource units.
Teacher Expertise/Agency: Ability to Intersect Three Knowledge Domains

Domains of place-based knowledge (Sewell, 1992):

1. Science
2. Place-based resources
3. Knowledge of culture, values, practices, metaphors.

Figure 1. P Chinn
Teachers’ challenges

• Low knowledge of cultural values, practices, places, language (Moll et al, 1992)

• Limited knowledge of place-based, Hawaii-relevant science;

• Weak place-based knowledge & networks with local science and cultural experts.
Barriers to integration of western science and Traditional Ecological Knowledge/Indigenous/Sustainability Science

1. **Western categories**: Dewey Decimal Classification System 1876
2. **“Pure” science** (500) vs. **science-in-use** (600) TEK/Indigenous/Sustainability Science
3. Instruction in Hawaiian forbidden 1896-1978
4. Academic tracking K-16
5. Policies: NCLB 2001-15, high stakes testing
6. Teachers: lack Hawai‘i/Pacific sciences
Traditional Ecological Knowledge

The evolving body of knowledge acquired by indigenous peoples through direct contact with the environment evolving by adaptive processes about the relationship of living beings (human and non-human) encompassing a world view including ecology, spirituality, human and animal relationships.

U.S. Fish & Wildlife Service (n.d.)

Indigenous Science:

System of thought, action and orientation applied by an Indigenous people through which they interpret how Nature works in ‘their place’ including classifying, inferring, questioning, observing, interpreting, predicting, monitoring, problem solving, and adapting. Perceives from a ‘high context’ view including all relational connections in its considerations (Cajete 1999).
Participants

EDCS 640P(S) Seminar
Place-based Education, Sustainability

Two classes, 33 educators
• 2016-17: 15/19 completed
• 2017-18: 13/14 completed
• Formal and informal STEM educators
• Two from American Samoa

Right: June 2017 Immersion, Hilo, Hawai‘i

Above: Seabird translocation: James Campbell Wildlife Refuge, O‘ahu.
Strategies to develop culturally sustaining, place-based Earth Science curricula

1. Personal reflection on place, learning, and identity
2. Community-based PD
3. Community/participatory mapping
4. Curricular mapping: NGSS, HĀ
5. Intersect place, culture, STEM
6. Academic year to teach and assess
7. Place-based immersions
8. Teachers host at sites: kīpuka on Mauna Loa
Community and curricular mapping: Timelines & techniques (Georeferencing)

Case Study: Fall 2015 Wai‘anae Intermediate: rural, high poverty, majority Native Hawaiian, 38% chronic absenteeism, 25% teacher turnover/yr.
Steps to transforming Science Curriculum

Indigenizing: *Ola o Waiʻanae i ka makani Kaiāulu.* Waiʻanae is made comfortable by the Kaiāulu breeze. (Modified from slide by Kekaha Spencer.)
Kaʻena Point – Culture, Place, Practice, *Partners

*Adopt-a-Park, DLNR
Waiʻanae Ahupuaʻa Models (courtesy Brigitte Russo)
Ka‘ena Pt. & Climate Change: High island translocation site for Laysan and Black-footed Albatrosses, Bonin Petrels and Tristram's Storm-petrels from atolls of Papahānaumokuākea.
Culturally Responsive Geoscience Mural: Art as Curriculum

Wai‘anae Intermediate: Brigitte Russo’s students read *mo‘olelo* about Wai‘anae to create a mural. Students’ hand prints underly painting.
Comments from community

- “We are letting everybody know that Waiʻanae is not the bottom of the barrel, we have pride, we are not the stereotypes they say we are.” - Security Guard

- “My kid came home and told me about the moʻolelo in our ahupuaʻa; I wish I had those opportunities when I was in school.” - Parent

- “Thank you … what a better way to instill pride of our culture, community, and campus to our students.” - Teacher

- “I can’t wait to share the moʻolelo in this mural with my kids and grandkids. I hope this stays here forever.” - Student


- “I still see my handprint.” - Student
Interest Survey Data, 5 Point Likert Scale: Left Native Hawaiian, Right Not Native Hawaiian

<table>
<thead>
<tr>
<th>Interest</th>
<th>Interest Survey 2015-2016</th>
<th>Interest Survey 2016-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>NH Mean All &gt;3.8 (n=76)</td>
<td>NH Mean All &gt;3.9 (n=61)</td>
</tr>
<tr>
<td>Q2</td>
<td>Non NH Mean All &lt;3.4 (n=15)</td>
<td>Non NH Mean All &lt;3.7 (n=26)</td>
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<tr>
<td>Q3</td>
<td></td>
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<tr>
<td>Q4</td>
<td></td>
<td></td>
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<tr>
<td>Q5</td>
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**Interest**

1. Interested in participating in service projects through school or community activities or on my own.
2. Interested in taking science, technology, engineering, and math courses... in High School, In College
3. Interested in taking Hawaiian language and/or Hawaiian studies courses... in High school, In College
4. Interested in work and careers related to sustainability
5. Interested in work and careers related to Hawaiian culture and language.
<table>
<thead>
<tr>
<th>% Students scoring Proficient on Hawaiʻi Science Assessment</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
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</thead>
<tbody>
<tr>
<td><strong>School</strong></td>
<td>13%</td>
<td>21%</td>
<td>25%</td>
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<tr>
<td><strong>State</strong></td>
<td>38%</td>
<td>43%</td>
<td>44%</td>
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<table>
<thead>
<tr>
<th>Interest 2017-18</th>
<th>1 Service projects School, community</th>
<th>2 STEM courses</th>
<th>3 Courses Hawn Language/ culture</th>
<th>4 Work Sustainability</th>
<th>5 Work Hawn. Language/culture</th>
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<tbody>
<tr>
<td>Native Hawaiian</td>
<td>4.1</td>
<td>4.0</td>
<td>4.4</td>
<td>3.9</td>
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<tr>
<td>Non-NH</td>
<td>3.5</td>
<td>3.7</td>
<td>3.1</td>
<td>3.7</td>
<td>2.8</td>
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<table>
<thead>
<tr>
<th>Na Hopena Aʻo 2017-18</th>
<th>1 Belonging</th>
<th>2 Responsibility</th>
<th>3 Excellence</th>
<th>4 Aloha</th>
<th>5 Well-being</th>
<th>6 Hawaiʻi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Hawaiian</td>
<td>4.1</td>
<td>4.2</td>
<td>4.0</td>
<td>4.2</td>
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Findings

Teacher agency and capacity building:
• Find community partners
• Form school teams
• Gain expertise in science, culture, place
• Value social & ecological justice
• Complete or enter programs: 8 MEd, 8 PhD/EdD

Barriers
• Cost and time restrictions of buses for field trips
• Weak school support

Matt and Kekaha on board Hōkūle‘a
Matt: Polynesian Voyaging Crewmember, peer teacher leader.
CONCLUSION:

**Teachers:** Transformed content and pedagogy, indigenized, collaborated, partnered, involved students & community

**Students:** Higher interest in STEM, language, culture, Nā Hopena Aʻo and academic outcomes,

**School:** Attendance rose 62% to 70% from 2015 to 2017

**Community:** Engaged, supportive
MAHALO NUI LOA, THANK YOU VERY MUCH

QUESTIONS?

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Dwarf 'ōhi'a lehua, Wai'aleale Bog, Kaua‘i, P. Chinn
Selected References


