

**Methodology:** Both principal investigator and participating educators are action researchers studying their practices, assessing their knowledge, evaluating and sharing outcomes.

The strategy of *community mapping* increases teacher knowledge of the structures and resources in students *ahupua'a*. The strategy of *curricular mapping* supports writing of innovative curricula that intersect the schema and resources of science, Hawaiian culture, and place. These new, place-based, hybrid culture-science learning activities can be assessed both for STEA<sup>2</sup>M learning outcomes and *Nā Hopena A'o* (HIDOE, 2015) Hawai'i-focused General Learner Outcomes that embody core Hawaiian cultural values of sustainability and environmental stewardship. Research findings suggest that PD supporting teacher expertise in intersecting place-based STEA<sup>2</sup>M content, cultural values and practices enables teachers of underrepresented NH students to develop curricula that address STEA<sup>2</sup>M as well as *Nā Hopena A'o* socioemotional senses of belonging, responsibility, excellence, aloha, total-well-being, and Hawai'i.

Teacher agency arises through the deliberate intersection of structures and reassembling of schema and resources in new ways that transform knowledge structures, roles, relationships, and identities. Thus, modeling by team and peers is an essential aspect of PD. Four NSF teachers, half the science department in a rural, majority Native Hawaiian intermediate school, collaborated with peers to restructure their NGSS curriculum grounded in STEA<sup>2</sup>M resources of their Wai'anae *ahupua'a*. This led to developing new curricular resources (e.g., a student-designed curricular mural based on *mo'olelo* (stories) of plants, animals, and geology of their place). As a STEA<sup>2</sup>M learning center, they host peers and share work at conferences. Projects on campus and in the community include 1) adopting part of a state park heavily used by students to restore with native plants, 2) building a native plant nursery of bamboo, selecting five large coral blocks to create a refuge for endangered yellow-faced Hawaiian bees, and 3) teaching iNaturalist and GIS mapping to monitor and share progress. Personal and professional collaborations span agencies, higher education, and local community. Teachers in American Samoa created a coral reef mural with Coral Reef Advisory Group partner after seeing Wai'anae's curricular mural.



Wai'anae Intermediate School's curricular mural, June 2019.



American Samoa teachers and coral reef mural inspired by Wai'anae mural, July 2019.

Project teachers assess curricular outcomes with student work, field notes, and surveys developed by the project. Likert surveys assess interest in STEM/stewardship/Hawaiian language and *Nā Hopena A'ō* (senses of belonging, responsibility, excellence, aloha, total well-being, and Hawai'i). Surveys administered over the past few years indicate across grades and schools that place-based lessons increased students' interest in STEM and shifted *Nā Hopena A'ō* senses of belonging, responsibility, excellence, aloha, total well-being, and Hawai'i in positive directions. When analyzed by ethnicity (an optional response) students self-identifying as Hawaiian reported higher ratings on both surveys than non-Hawaiian students. Teachers' course evaluations reveal that they valued learning STEA<sup>2</sup>M content and greatly valued the professional and peer networks established through pedagogy involving active learning with peers and community partners at their sites. Most reported multiples of 2-3 times more human and physical resources from the beginning to end of the course. Most significant was recognition of their peers as resources, suggesting the value of having participants host class sessions at their sites and schools. An indicator of teacher agency is acceptance of six teachers into PhD programs and one into an EdD program. Six of the seven are Native Hawaiian. These findings support Sewell's (1992) theory of structure and agency and Yosso's (2005) theory of community-based resources that support strength-based educational approaches (Kana'iaupuni, 2004).

## References

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