

[CAMPUS PRACTICE]

From Service to Science in the Energy–Climate Era

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In *Hot, Flat, and Crowded*, Thomas Friedman claims that “five trends—energy and resource supply and demand, petrodollarism, biodiversity loss, climate change, and energy poverty—have all been driven past a tipping point” such that humanity must now adapt to a new “energy–climate era” (Shea 2008). This new era requires American higher education to reform its educational programs to prepare an increasingly diverse generation of graduates for engaged citizenship. Now more than ever, all college graduates need to be scientifically literate in topics affecting what Scott Thomas and others have called the “global public square” (2005). More graduates also need to be experts in the interdisciplinary realms where climate, energy, environment, economics, technology, spirituality, and human well-being coalesce and collide.

America’s community colleges, already leaders in closing minority academic achievement gaps, can be leaders in developing scientific literacy and expertise as well. Fortunately, as we have discovered at Kapi‘olani Community College, the goals of overall student success and scientific literacy and expertise can be mutually reinforcing. At Kapi‘olani, we believe that we can enhance student learning and degree completion in science and beyond by embedding three high-impact educational practices (Kuh 2008) in courses: community service, undergraduate research, and internships.

Service-Learning Pathways

Since 1995, with funding from the Corporation for National and Community Service, service learning has been a priority at Kapi‘olani; since 2002, we have

organized our service-learning initiatives into “pathways” that link courses and communities across multiple semesters. These pathways are designed to address several issues affecting urban Honolulu: education; environmental sustainability; health; long-term care; arts, history, and culture; and international perspectives. In the past fifteen years, nearly nine thousand students have provided two hundred thousand hours of community service related to these topics—equivalent to an economic contribution of nearly \$2 million. The service-learning pathways have been so successful that the college has twice received the Community College National Center for Community Engagement’s award for Partnerships with Social Agencies, in both 1995 and 2010.

As of 2008, 35 percent of part-time students and 45 percent of full-time students reported having participated in “a community-based project as part of a regular course” (Franco 2008). Students have benefited deeply from this engagement. Quantitative and qualitative assessments have consistently demonstrated that students who participate in service learning show improvement in their attitudes about making a difference in the community and working as a team, and more positive beliefs about their instructors’ propensity to be caring. Service learners have also demonstrated retention and persistence rates and grade point averages that are consistently higher than those of the overall student population (Renner 2006; Hill and Orozco 2010). Ongoing assessments of over five thousand students by community partners have shown Kapi‘olani students to be highly responsible, sensitive to diverse clients, willing to

learn, and skilled in communication. In addition, Kapi‘olani’s student leaders have presented in national venues and received high praise for being some of the most compelling student voices in the field.

Service–Science Connections

Kapi‘olani is aligning its highly successful service-learning pathways for first- and second-year students with its degree and career pathways in STEM (science, technology, engineering, and mathematics). Focused specifically on degree completion in six fields (education, health science, ecology, engineering and space science, biotechnology, and human physiology), service to science pathways provide contexts that stimulate and sustain student learning across undergraduate and graduate study and into civic life and work. They also enable female students, who are typically overrepresented in service-learning placements, to explore the STEM fields, where women remain underrepresented.

Nine first-year science courses currently offer opportunities in the service-learning program’s environmental sustainability and health pathways. Students can continue in these pathways across their undergraduate experiences. These courses and the talented professors who teach them prepare students for second-year STEM study and undergraduate research in biology, ecology, chemistry, microbiology, and biotechnology.

Undergraduate Research Experiences

Since 2005, Kapi‘olani has received several grants from the National Science Foundation (NSF) to engage more historically underrepresented Native Hawaiian and other talented students in STEM degree programs and careers. The college has developed a unique two-year STEM degree, with four transfer pathways into baccalaureate programs in engineering, ecology, biotechnology, and physiology. Since 2008, fifty

students have completed this two-year degree. Two hundred more are currently enrolled, preparing for successful transfer to major research universities and for careers in Hawai'i's STEM workforce.

Research opportunities have been central to these degree programs. Kapi'olani is now the leading community college participant in NSF's new Hawai'i-based Experimental Program to Stimulate Competitive Research (EPSCoR). The college is leading the Diversity, Education, and Workforce (DEW) component of this project, which aims to engage more students underrepresented in STEM (Native Hawaiians, Pacific Islanders, Filipinos, and others) in undergraduate research, prepare them for degree completion, and direct them toward careers as technicians, researchers, and professors.

Internship Opportunities

Internships with university researchers and private-sector partners are a third high-impact practice positively affecting STEM participation at Kapi'olani. Native Hawaiian and other students underrepresented in STEM can now engage in funded pretransfer internships in two Hawai'i EPSCoR research areas: Environmental Dynamics and Ecosystem Responses, and Ecological Genomics and Metabolomics. Students successful in these internships can qualify for both undergraduate- and graduate-level EPSCoR internships in the years ahead. Internships provide students with supervision and coaching from STEM professionals in both research and career settings. They also provide the college with a basis for collaboration and fund development with emerging STEM businesses and industries.

Of course, effective mentoring cannot begin with college internships. As we align engagement pathways on campus with the goals of our university and industry partners, we recognize that building a more diverse STEM workforce will require sustained, high-quality support systems for students as early as middle school.

To address this need, the service-learning program, in conjunction with the EPSCoR DEW initiative, is forming a student-led program called College and Career Cadres, which will provide mentoring services in STEM and promote financial aid awareness for middle school students and their parents and guardians.



Students work to restore taro fields, protecting this nutritious and spiritually important natural resource

Final Thoughts

In the energy-climate era, Kapi'olani and America's other leading community colleges need to prepare students for the civic and scientific challenges, economic opportunities and constraints that will affect the nation and the planet. We need to reform our programs and refocus our efforts on degree completion and student learning for a complex and capacious future. For community college students, local and national economies, and earth itself, STEM degrees matter. ☐

REFERENCES

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High-Impact Practices with STEM Connections

Kapi'olani students have participated in a variety of high-impact practices related to their STEM disciplines:

Community Service

- Restoring fields of taro, a spiritually significant and nutritious Native Hawaiian food
- Monitoring the quality of water entering Maunalua Bay, O'ahu
- Delivering workshops on diabetes prevention to the Native Hawaiian community

Undergraduate Research

- Engineering Remotely Operated Vehicles (ROVs), used to assess coral reef restoration efforts
- Determining virulence in strains of Hawaiian *Campylobacter* (a food-borne bacteria)
- Exploring the impact of historical reforestation efforts on contemporary forest composition

Research Internships

- Participating in one of two ongoing projects: Environmental Dynamics and Ecosystem Responses, and Ecological Genomics and Metabolomics

—Robert Franco