STEM Activities

Office of Student Academic Support (OSAS)

UHM STEM Teacher Recruitment Sessions
OSAS initiated partnerships with the UHM College of Natural Sciences and the Hawai‘i Department of Education (HIDOE) to conduct STEM teacher recruitment sessions on a bi-annual basis. Guest speakers include HIDOE administrators, HIDOE Science Specialists, HIDOE Teachers, COE Faculty, COE Academic Advisors, and COE students.

Achievement Scholarships
To support COE students majoring in Secondary Math or Secondary Science, OSAS has awarded $80,842 in scholarships to 62 BEd Secondary Education and Post Baccalaureate Certificate students.

Department of Curriculum Studies

Ethnomathematics
Now in its sixth year, the UH Ethnomathematics and STEM Institute brings together P-20 teachers and administrators from across the State of Hawai‘i to design and implement STEM curricula grounded in the ethnic, cultural, and historical diversities of our island home. Thus far, ~200 participants impacting ~20,000 students from six major Hawaiian islands have been involved. Through a yearlong professional development program, teachers explore connections to the Common Core State Standards for mathematics (CCSS-M) and Next Generation Science Standards (NGSS) that are contextualized, relevant, and sustainable.

In conjunction with classroom learning, experiential and service learning occurs at locations such as the Waikalua Loko Fishpond in Kāne‘ohe Bay, Ma‘o Organic Farms in Wai‘anae, Hawai‘i Institute of Marine Biology’s Coconut Island, sailing with the Hōkūle‘a canoe around the Hawaiian Islands, and Kalaupapa National Historical Park on Moloka‘i.

The Ethnomathematics and STEM Institute partners with the following research institutions and community-based organizations to ensure capacity building and quality education: the University of Hawai‘i System, State of Hawai‘i Department of Education, Pacific American Foundation, Pacific Resources for Education and Learning, Hawaii P-20 Partnerships for Education, and Polynesian Voyaging Society.

Funding provided by the U.S. Department of Education Elementary and Secondary Act (ESEA) Title IIA and Hawai‘i P-20 Partnerships for Education.

POC: Linda Furuto
Mālama Honua, Caring for the Earth: STEM PD and the World Wide Voyage

Mālama Honua: STEM Professional Development (PD) is a partnership involving HIDOE, COE, CTAHR, SOEST, and School of Hawaiian Knowledge. The project enables 25 full and part-time teachers on Oahu and Molokai in programs and schools with high proportions of Native Hawaiians and Pacific Islanders to receive 3 credits of EDCS 433 Interdisciplinary Science Curriculum, Mālama Honua and 3 credits of PEPS 310 Environment and Agriculture.

Adoption of Common Core State Standards (CCSS) and anticipated adoption of Next Generation Science Standards (NGSS) underscore the need for teacher PD enabling teachers to write, teach, and assess inquiry-oriented integrated earth and biological science lessons. Meanwhile, Hōkūleʻa and Hikianalia's 3-year, 47,000 mile World Wide Voyage and “Promise to Our Children” signed by HIDOE and UH-Mānoa in 2013 present a unique and meaningful opportunity to address STEM PD through 21st Century skills that include collaborative problem solving, teamwork, risk-taking, and way-finding. The Sept. 1, 2014 to Aug. 31, 2015 award provides tuition and focuses on STEM content, effective pedagogy, and moral purpose/connectedness: sustaining an interconnected world.

Funding provided by the U.S. Department of Education Elementary and Secondary Act (ESEA) Title IIA Improving Teacher Quality State Grant.

POC: Pauline W. U. Chinn

Kahua Aʻo—A Learning Foundation: Using Hawaiian Language Newspaper Articles for Place and Culture-based Geoscience Teacher Education and Curriculum Development

Kahua Aʻo, an NSF OEDG project utilizes Hawaiian newspaper articles about earth science (ES) events written between 1843 and 1948 as a foundation for earth science education. In Hawaiʻi, a lack of ES teachers limits student awareness of ES as a part of daily life, a potential career path, and a link to past events. This is particularly relevant to Native Hawaiians who are 28% of students in Hawaiʻi’s public schools but underrepresented in STEM courses and careers. Kahua Aʻo is a collaboration among College of Education, School of Hawaiian Knowledge, School of Ocean and Earth Science and Technology, and Windward Community College.

Articles provide insights about living on islands with limited resources exposed to natural hazards. As over 95% of 1.5 million pages of text are still in Hawaiian, the project increases historical, place-based resources for science teachers, scientists, and informal science educators and conveys the science underlying Hawaiian cultural practices. Earth science lessons, including ArcGIS wind maps, are disseminated through teacher education classes, workshops, symposia and Kahua A'o website: manoa.hawaii.edu/kahuaao.

The Kahua Aʻo project: 1) develops place, culture, and standards-based weather and geology curricula employing Hawaiian language newspaper articles related to geosciences; 2) provides hands-on, inquiry-oriented professional development via classes, field trips, workshops, and
symposia; 3) disseminates project research and teacher-tested curricula through project website, conference presentations, and publications; and 4) advances public and scientific knowledge of Hawaiian language geoscience events by expanding Hawaiian language and translated resources for diverse audiences. Funding provided by National Science Foundation OEDG award No. 1108569.

POC: Pauline W. U. Chinn

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NEON Project BudBurst Hawai'i
"He keiki aloha na mea kanu.  Beloved children are the plants."  M. Kawena Pukui.

Ninety percent of plants in Hawai‘i’s tropical ecosystem are endemic, unique to Hawai‘i and thus at great risk from climate change, habitat disruption, and invasive plants and animals. BudBurst Hawai‘i (http://budburst.org/hawaii) helps teachers, students, and citizen scientists learn about, cherish, and potentially restore native plants in their schools, communities, and local ecosystems. Hawaiian plants host the endemic Kamehameha Butterfly, birds, bees and other unique arthropods, and protect the watershed and coral reefs.

The project is a collaboration among Curriculum Studies, NEON BudBurst, UHM Landscaping Dept., Bishop Museum, Center for Conservation Biology, and The Nature Conservancy. Partners identified 10 culturally important native plants able to be grown or found in the wild (budburst.org/community/pdfs/hawaii_flyer.pdf). Eight of 10 BudBurst plants were installed at the College of Education by UHM Landscaping. COE plants have been uploaded onto the interactive Campus Plant Map at manoa.hawaii.edu/landscaping/ (click Options for dropdown menu, select categories, e.g., native, canoe, poisonous, medicinal, download the app).

A power point of the "College of Education Curricular Landscape" will be posted on the College of Education website as a guide to the Curricular Landscape. Funding provided by NHEP awards Mālama I Ka ʻĀina, Kūlia I Ka Nuʻu, and Pīkoi Ke Kaula Kualena.

POC:  Pauline W. U. Chinn

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The Curriculum Research & Development Group (CRDG) is an organized research unit in the College of Education whose mission is to create innovative, effective curricula and associated professional development for PreK-12 students and schools.

**STEM on TV**
CRDG, in partnership with the UH Sea Grant Center for Marine Science Education, created a STEM, ocean science focused TV outreach show called Voice of the Sea (VOS)

- VOS is a six-time Telly Award wining, public outreach television show that airs at 6 pm on Sundays on channels 5 and 1005 and is archived online at voiceofthesea.org.
- Hosted by CRDG associate professor Kanesa Seraphin, VOS exposes viewers to STEM and ocean science issues and research pertaining to Hawai‘i and the Pacific region.
- Episodes align with and are supplemented by the Exploring Our Fluid Earth (EOFE) online curricular materials and online VOS supplemental materials.
- VOS has profiled some of the Pacific’s most advanced researchers in aquatic science. These experts provide content expertise and science research expertise that is locally relevant to our island population.

POC: Kanesa Duncan Seraphin

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**Online Marine Science Curriculum and Professional Development**
The Teaching Science as Inquiry: Aquatic (TSI Aquatic) project is funded by the US Department of Education (USDOE) Institute of Education Sciences and the National Oceanic and Atmospheric Administration (NOAA) Pacific Services Center in partnership with the UH Sea Grant Center for Marine Science Education.

- TSI Aquatic consists of a series of professional development modules for teachers focused on the pedagogy of inquiry and the subject area of marine science and includes a combination of in-person and online formats.
- Over the past three years, cohorts of teachers on all neighbor islands have participated in a series of workshops and evaluation studies that advances research on this type of professional development effectiveness.
- Accompanying curriculum materials, Exploring Our Fluid Earth, delivered entirely online (exploringourfluidearth.org) include activities, student content, teacher materials, and an online teacher community. The curriculum is comprised of six modules, allowing it to be used as a whole for a marine science class or to be broken up to supplement other science courses. Four of the modules—chemical, biological, ecological, and physical—are content based, and two—practices of science and standards—are process based. The practices of science module is made up of activities that explicitly teach the process of inquiry, whereas the standards module links activities in the other five to the Ocean Literacy Principles (OLP) and to the NGSS.

POC: Kanesa Duncan Seraphin

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COSEE Island Earth
(collaboration between CRDG, SOEST (HIMB and UH Sea Grant), and Maui College)
The Center for Ocean Science Education Excellence (COSEE) Island Earth (IE) began at the end of 2011 and is working with the national network of COSEE centers, funded by the National Science Foundation, to address the challenges of increasing our citizens’ ocean literacy. COSEE IE expands upon the work begun under the Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists (POLYPPS) collaboration with COSEE California. Both projects are joint partnerships with COE’s CRDG and the UH School of Ocean and Earth Science and Technology (SOEST), the Hawai‘i Institute of Marine Biology (HIMB), UH Sea Grant, and UH Maui College.

COSEE IE works to advance understanding and encourage stewardship of ocean environments by drawing not only on the newest research in modern science and technology but also on the cultural contexts of the learners. As its over-arching goal, the Hawai‘i COSEE partnership strives to build a collaborative network that connects ocean research and teaching with traditional knowledge in order to facilitate active engagement in stewardship by all ocean users.

COSEE IE programs include: 1) seaHarmony, an online collaborative network connecting ocean scientists, formal or informal educators, and organizations, 2) Communicating Ocean Sciences Courses, 3) Journalist at Sea, 4) Ocean Awareness Training, 5) Traditional & Indigenous Knowledge, 6) All Things Marine Radio Show, and 7) HI Sci. Learn more about these projects at [http://www.cosee-ie.net/programs](http://www.cosee-ie.net/programs).

POC: Kanesa Duncan Seraphin

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MaTCH—Integrating Mathematics, Teaching, Research, and Technology
The Math Teachers’ Circle of Hawai‘i is a community of teachers, mathematicians, and educators who meet regularly to do mathematics. MaTCH invites mathematicians from academia and the greater community to lead the group in problem solving activities. Over the years the group has studied population growth models of bees, the mathematics of game shows, mathematical modeling of traditional Hawaiian sports, investigations inspired by an art exhibit on display at the Spalding House, and the mathematics of locating whales in the ocean.

POC: Linda Venenciano

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A Modeling Approach to Algebra
A Modeling Approach to Algebra is research-based curriculum material developed by CRDG for HIDOE’s Modeling Our World I course to support the understanding of algebra concepts through investigations involving mathematical modeling. The materials comprise rich tasks with an emphasis on technology that span a range of contexts. Studying mathematics using a modeling approach emphasizes the bridge between phenomena around us, such as carbon dioxide content in the air, bungee jumping, population and food production, and water conservation, with the mathematics they contain, which provide students entree into STEM.
In response to a groundswell of interest, CRDG has adapted *A Modeling Approach to Algebra*, originally developed specifically for a HIDOE course, to use in a broader range of settings outside of Hawai‘i. The research-based curriculum uses a modeling approach to explore tough-to-teach and tough-to-learn algebra topics in more depth through problems that investigate everyday phenomena around us.

POC: Fay Zenigami
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**Adaptation of Algebra Materials for Post-Secondary Use**
CRDG’s Marketing and Publications Services worked with Rasmussen College to deliver a modified version of CRDG’s *Algebra I: A Process Approach* textbook and support materials to over 2,000 college students on their twenty-plus campuses in the Midwest. The materials are tailored to Rasmussen’s developmental mathematics course needs on multiple campuses. The arrangement started with distribution of print materials, but moved in 2014 to electronic delivery of materials to students.

POC: Helen Au
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**Continued PD for HIDOE Access Learning Schools**
Extended professional development on pedagogical techniques and learning strategies as well as relation to Common Core State Standards is conducted by the project staff that includes personnel from CRDG and University Laboratory School.

**School Internet Safety Initiative**
This is a foundational piece of all professional development provided by CRDG involving STEM initiatives, including public and private school 1:1 device programs. Digital citizenship, Internet safety, and safe school online communities are discussed with teachers, parents, administrators, and students.

POC: Truc Nguyen
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**Archimedes Hawai‘i Project's Technology for Untapped Talent Program (TUT)**
This unprecedented vocational training program provides the opportunity for individuals with physical and sensory disabilities, such as visual impairment, deafness, tetraplegia, quadriplegia, amputation, autism, and Asperger’s syndrome, to acquire gainful employment, with serious growth potential in the high tech design and manufacturing marketplace. TUT participants learn how to use computer-aided design (CAD) software, computer-aided manufacturing (CAM) software, and computer numerically controlled (CNC) machines, such as laser cutters and engravers, and 3D (three-dimensional) printers.

POC: Neil Scott
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CRDG Summer Programs
The CRDG Summer Programs for grades 3 through 9 continues its commitment of over forty years of summer enrichment learning and exploration. Students explore concepts in STEM (science, technology, engineering, mathematics) and the arts through over 20 courses that include core science programs that explore the land, sky, and water; Robotics; Drama: Stage Production and Improvisation; Creative Programming; Digital Media; and Tastes of Technology for the 21st Century. Inquiry-based instruction and hands-on learning in the classroom, laboratory, field, and theater are the cornerstones for all of our courses. CRDG Summer Programs provides an opportunity for students to engage in educational and engaging programs and for teachers-in-training to gain experience in real-world classrooms as teaching assistants. Summer Programs also allows CRDG the opportunity to conduct research, evaluate programs, and disseminate knowledge.

POC: Helen Au

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Center on Disability Studies (CDS)
The Center on Disability Studies is an organized research unit in the College of Education whose mission is to promote diverse abilities across the lifespan through interdisciplinary training, research, and service.

Pacific Alliance for Supporting Individuals with Disabilities in STEM Fields Partnership
The National Science Foundation funded Pacific Alliance project seeks to increase the number of individuals with disabilities who enter, persist, and graduate with a degree in STEM postsecondary education programs in the University of Hawai‘i (UH) system and ultimately who are employed in the STEM workforce in Hawai‘i by providing mentoring, academic support, and career support. Four Communities of Practice (COP) were developed to connect STEM employers; disability and student support personnel, STEM faculty, and administrators at the UH system; and feeder high school teachers. COP have developed and provided common and COP-specific support for students with disabilities. In addition to the four COP, the project has Hawaii US Department of Agriculture, Isis Hawaii, Maui Economic Development Board, Inc.-Women in Technology Project, 3D Innovation, Assistive Technology Resource Centers of Hawaii, Hawaii Young Adults in Transition: A Working Group of the Autism Society of Hawaii, and SEE-IT Hawaii as collaborators.

POC: Robert Stodden/Kelly Roberts

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A Cluster Randomized Study of The Impact of Heuristics Math Teaching vs. Intelligent Tutoring with Community College Students with Disabilities in Algebra I Classes and Continued Participation in More Advanced STEM Course Work: Pathways to STEM
This National Science Foundation funded project intends to ensure early academic success and persistence in STEM disciplines for postsecondary students with disabilities. Approaches include two theory and research based math interventions focused on problem solving skills: (1) heuristic math teaching method (HMTM); and (2) intellectual tutoring system (ITS). HMTM is a strategy for instructors to use with their students. ITS is a computer aided individualized student
intervention based on the Zone of Proximal Development. Both strategies foster students’ mathematics and metacognitive awareness skills. The goal of the research is to determine the impacts of using HMTM by instructors and using ITS by students on the successful completion of elementary Algebra I class and persistence in STEM related coursework of community college students with disabilities. From two community colleges, elementary algebra course instructors are recruited and assigned into one of the four groups: ITS group, HMTM group, both intervention group, and control group. Through the instructors, students are recruited. Student participants assigned into the ITS and both intervention groups receive a training on the use of ITS and independently use the program. Instructors assigned in the HMTM and both intervention group receive a training on HMTM. Instructors and students in the control group do not receive any training and practice their business-as-usual.

POC: Robert Stodden/Kelly Roberts
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