

MEMORANDUM

Dec. 5, 2016

TO: Michael Bruno, Interim Vice Chancellor for Academic Affairs

FROM: Brian Taylor, Chip Fletcher, and Chris Ostrander, SOEST

SUBJECT: SOEST External Review 3-year-post-review progress report

The 2013 external review of SOEST yielded constructive recommendations for school, department, and unit-level actions to improve the outcomes of the teaching, research, and service activities. As was reported to the VCAA in our 8/2/13 response to the external review and our 10/13/14 one-year progress report, the School has worked diligently to implement the recommendations of the review committee and is pleased with the positive impacts those changes have generated. Progress made towards the adoption of recommendations, detailed in prior submissions from the School, are not repeated here.

The 12/1/14 memo from VCAA Dasenbrock, in response to our 1-year post-review progress report, affirmed the substantial progress the School has made towards implementing the recommendations of the review committee and identified three areas for the School to focus and report back on in this 3-year post-review progress report.

A. Undergraduate recruitment and retention

Encouraging more undergraduates to take SOEST courses has entailed seven primary efforts:

1. To attract a diversity of students, and create an environment in which they can thrive, SOEST instructors are currently transforming their classes by introducing peer collaboration and other active learning techniques. Thirty instructional faculty signed on to participate, and this strong show of support led to NSF funding through the Improving Undergraduate STEM Education GEOPATHS initiative in 2016 (B. Bruno, PI; C. Fletcher, L. Pagotto & J. Engels Co-PI). Experts from the Carl Wieman Science Education Initiative at the University of British Columbia are serving as external consultants. They will be holding workshops and faculty consultations at SOEST in February 2016 during a weeklong visit.

A key focus of this project is to coach and support faculty as they introduce active learning instructional techniques into their classrooms, as opposed to using the full class period for lecture. Active learning techniques have been shown to decrease failure rates by one-third, increase mean exam performance by half a standard deviation, and to help all students, but especially women and minorities. Of these techniques, peer collaboration has been shown to be particularly effective in improving undergraduate learning and persistence. Progress is being evaluated through exam performance and through a standardized protocol called the Classroom Observation Protocol for Undergraduate STEM (COPUS).

2. Development of additional courses that fulfill General Education Core Requirements, so that undergraduates can fulfill must-have graduation requirements in SOEST.

- a. This has included a very successful new course that fulfills Global and Multicultural Perspectives: OCN 105 (FGA) Sustainability in a Changing World (3) examines how environmentally sustainable and non-sustainable practices have affected the development and spread of human culture and societies from pre-history to the 1500s in Asia, Africa, Europe, the Americas, and Hawai'i/Oceania. One of only eight approved FGA courses on campus, and taught using active-learning techniques, this course is oversubscribed each semester, and has an enrollment capped at 120 students (given a lecture room capacity of 122).
 - b. We have also developed a second course (in addition to GG104 Volcanoes in the Sea) that fulfills the Hawaiian, Asian, and Pacific Issues requirement (ATMO102, Pacific Climates & Cultures, HAP).
 - c. Additional course development is currently under way in our three undergraduate departments. For instance, GG170 was redesigned to fulfill the Symbolic Reasoning Requirement (FS) and it, and GG102 (Intro. to Global Change) will be transitioned to meet the new Quantitative Reasoning requirements. Likewise, an existing course GG 130 (Geologic Hazards) is being redesigned to fulfill FGC requirements and an ATMO 106 class is being developed to have FGB designation. Also, a curriculum has been developed and a proposal has been submitted for a new course OCN101 – Environmental Sciences (see more below in section B).
 - d. The Department of Geology and Geophysics (GG) has hired part-time a faculty member from the University of Alaska who has experience in teaching Introductory Geology (DP) as an on-line course. He is offering an on-line section of GG101 in Spring 2017 and will be training GG faculty in the use of course software and will be further developing the curriculum to be handed off to our faculty in future semesters.
3. We have seen attrition rates of up to 50% in our first year students during past semesters. One reason for this is the high failure-to-advance rate of certain math and chemistry courses in the College of Natural Sciences. We have undertaken a number of steps to address this situation.
- a. We have held a series of meetings with the Math department and received interest from them in collaborating on building new courses, MATH215 Applied Calculus I in the Earth and Environmental Sciences and MATH216 Applied Calculus II in the Earth and Environmental Sciences. This course development is currently underway.
 - b. Meanwhile, we have also initiated weekly tutoring sessions, taught by SOEST faculty, for SOEST students who are taking the math (calculus) courses currently required for our degree programs. There is also discussion of offering chemistry recitation sessions on a weekly basis, though these have yet to be organized.
 - c. Through the efforts of Dr. Michael Guidry (Chair, GES Program) all SOEST undergraduates are part of Dr. Ron Cambra's three-year effort to test GradesFirst (GF) on Upper Campus (SOEST majors and Manoa Advising Center undeclared students). GF is a web-based student performance monitoring system that provides automated student services and communication between faculty, academic advisors, Student Support Services staff, and students. Beginning in the Fall of 2016, SOEST undergraduates, Leona Anthony (SOEST Director of Student Services), and Michael Guidry all started receiving simultaneous progress reports and at-risk alerts from UHM course instructors. Both Anthony and Guidry are following up with

interventions for those SOEST students receiving at-risk alerts and also tracking the resultant outcomes. They are also part of a small working group created by Dr. Cambra to monitor, refine, and improve the Upper Campus rollout of GF. Moving forward these interventions, experiences, and resulting outcomes will help guide and refine SOEST efforts to improve student outcomes, retention, etc. and will also ultimately inform and create best practices for other Upper Campus programs that are added to the GF effort (e.g., Nursing will soon be added). In this way, SOEST is helping lead the way on cutting edge approaches to improving undergraduate student outcomes and retention.

4. In their first two years at UH Manoa, students who major in SOEST undergraduate degrees typically take only one 3-credit course per semester from SOEST faculty – the remainder of their courses being required GenEd or other Science (Math/Physics/Chemistry) pre-requisites. Therefore we have implemented a required one-credit course (OEST 100) each semester for newly entering SOEST undergraduate students to equip them with a toolbox of skills to succeed in college and life, and to build an annual cohort among fellow students. Skill building themes guide the course and each semester's syllabus is shaped by upcoming events, to enhance correlation between principles and application. Students are provided with engaging exercises weekly; participatory activities are assessed at the end of the semester for continual improvements. Themes include topics such as resume building, study habits and time management, how to communicate with your instructors, the academic pathway toward your degree, and how Manoa and SOEST are structured. These and other subjects are designed to build a sense of belonging and to better equip entering students for successful navigation toward their degree.

5. In January 2017, SOEST will begin a monthly high school recruitment effort that will bring groups of 40-50 junior and senior high school students onto the SOEST campus, split them into smaller groups of 10-15, and rotate them through 5 prepared engaged-learning activities in Atmospheric Science, Marine Robotics, Biological Oceanography, Space Exploration and Planetology, and Earth Science. Over the course of 3 hours the students will be exposed to a hands-on instructional-research exercise, run largely by graduate and undergraduate students in SOEST, in order to get a taste of the learning environment in the school. Many SOEST undergraduates work in faculty labs doing student-centered research. This is a real component of the undergraduate experience that we offer. This recruitment effort will showcase this experience for potential future students. Our goal is for these high school students, brought from various institutions across the island, to see SOEST as among the viable choices for their u/grad education.

6. The Department of Geology and Geophysics has taken several steps toward increasing undergraduate recruitment and retention.

a. Faculty member Paul Wessel has been funded by the NSF to establish a new REU (Research Experience for Undergraduates) program that will begin in the summer of 2017. The department will offer 10 motivated undergraduates the opportunity to engage in independent research alongside scientist mentors at the UHM. Participants in this 9-week program will receive a stipend of \$4,500 plus travel and room/board. Students will also

participate in field trips to sites of active volcanism and a short marine expedition on a research vessel.

b. The GG department revamped its Bachelors of Arts degree to create two tracks designed to address state and national needs in the Earth and Environmental Sciences employment sectors. A BA in Earth Science Education has been established in response to the deficit of trained science teachers at the Hawaii Department of Education. A BA in Environmental Earth Science has been created to assist in workforce training for the local consulting industry. Students in this degree path specialize in skills building course work in remote sensing, environmental management, geospatial analysis, hydrogeology, environmental geochemistry and computer programming.

c. The GG department has established a 1-year Plan B Masters named the MGEO that students may access as a stand-alone degree or as part of a 5-year curriculum in combination with the BS. Designed along the lines of the MENG, the MGEO offers students rapid progress toward a master's degree with training in workforce skill sets, including workplace internships.

7. Begun in 2014 by HIGP faculty member Barb Bruno to enhance retention and the learning experience for SOEST undergraduates from local families, the SOEST Maile Mentoring Bridge Program fulfills a broad desire to inspire Native Hawaiians, kama 'āina, and individuals of other underrepresented ethnicities into ocean, earth and environmental science professions. Like the many varieties of Maile, this program creates unique mentoring relationships that offer support, encouragement, and the sharing of knowledge. The program weaves individual student goals with their personal and cultural experiences by pairing undergraduate students with SOEST graduate students and faculty in mentoring relationships. NSF's GEO directorate and Kamehameha Schools provide program funding.

Dr. Bruno also conceived and implemented the KapiolaniCC-SOEST Summer Bridge Program. Begun in 2014 it has been designed to increase enrollment of native Hawaiian and other underserved minority students in SOEST following graduation with the ASNS degree from KCC. Sixty-four students have participated in the program over a three-year period. Approximately two-thirds of the students are from groups that are underrepresented in STEM and approximately one-third are Native Hawaiian. Only a small number of these students expressed interest in geoscience majors prior to program participation, and many were not even aware that geoscience majors existed. By the end of each weeklong program, students show statistically significant gains on a set of questions designed to test geoscience learning. Results have been published in Bruno et al., 2016¹. To date, five summer bridge alumni (four Native Hawaiian) have declared geoscience majors, representing 31% of the University of Hawai'i at Mānoa's Native Hawaiian geoscience enrollment.

¹ Bruno, B.C., J.L.K. Wren, K. Noa, E.M. Wood-Charlson, J. Ayau, S. Leon Soon, H. Needham, and C.A. Choy (2016). Summer Bridge program establishes nascent pipeline to expand and diversify Hawai'i's undergraduate geoscience enrollment. *Oceanography*, 29(2):286–292, <http://dx.doi.org/10.5670/oceanog.2016.33>. **Download the PDF.**

B. Enhancement/expansion of the Global Environmental Sciences degree program

With the recruitment of Dr. Michael Guidry to replace the retired Dept. Oceanography undergraduate chair, Dr. Jane Schoonmaker, the expansion of the Global Environmental Science (GES) program has continued unabated, indeed it has accelerated. This fall, the GES program enjoyed a >15% increase in enrolled majors over the average of its prior fall enrollments.

Effective Spring 2017, the GES Program will offer four new tracks for our students, which focus on the dynamic intersections between environmental sciences and human dimensions: Environmental Planning (cross-disciplinary with the Department of Urban & Regional Planning); Environmental Health Sciences (cross-disciplinary with the Office of Public Health Studies); Sustainable Tourism (cross-disciplinary with the School of Travel Industry Management); and Sustainability Science (in collaboration with the Hawaii Natural Energy Institute).

As mentioned in A.2, above, another initiative begun by Schoonmaker has been fulfilled and successfully implemented by Guidry and Sansone, in the new OCN105 course, which is FGA.

Dr. Guidry, with collaborating faculty at UHM, Windward CC, Honolulu CC, and Kauai CC, successfully spearheaded a newly awarded \$850,000 multi-institutional NSF Tribal Colleges and University Program (TCUP) and Partnerships in Geosciences (PAGES) effort in undergraduate education. There are two primary aspects of the 5-year award:

1. Development of a 101-level Environmental Science and Sustainability "gateway course" for all students (STEM and non-STEM) providing exposure to environmental sciences, geosciences, and sustainability. This course will be taught at UHM, HCC, and KCC (with the expectation it will spread to all other UHCCs) and will articulate from the UHCCs to UHM.

This course will also serve to provide AP college credit for those high school students that do well enough on their AP Environmental Science Placement Exam. AP Environmental Science is now one of the most popular AP courses per enrollment nationwide and so this is a great way to attract interest in UHCC ASNS degrees and four-year environmental and geoscience SOEST u/grad degrees.

2. The second aspect is that UHM, via the GES Program, Dept. of Oceanography, SOEST Marine Operations, and other SOEST units will provide a six-week, summer residential oceanographic, environmental, and geoscience experience for 10-14 underrepresented minorities, especially Native Hawaiians.

A new development relevant to this summer experience is that the GES Program recently established an agreement with Ka Papa Lo'i 'o Kānewai of the Hawai'i inuiākea School of Hawaiian Knowledge (HSHK) to collaborate by providing data for lo'i management and support for cross-disciplinary undergraduate research projects that combine u/grad students with interest in indigenous knowledge and cultural practices (from HSHK) with those from environmental and geosciences (e.g., Global Environmental Sciences, Geology and Geophysics, and Atmospheric Science SOEST undergraduate majors). From this collaboration it is expected that aspects of indigenous science, knowledge, and cultural practices will be integrated into the six-week summer experience.

Both of these efforts should increase enrollment, aid retention, and increase numbers of underrepresented minorities in environmental and geo-sciences, along with creating some dynamic cross-disciplinary opportunities for students and faculty alike within UHM and also between UHCCs and UHM.

C. Teaching and classroom communication in Atmospheric Sciences

The Department of Atmospheric Sciences takes the recommendation to improve teaching and classroom communication very seriously.

Planned and completed actions reported in our 1-year report, including the enhancement of student research opportunities, increase in undergraduate and graduate course options, upgrades to classroom projection and seating, reduction in team-taught courses for undergraduates, and the assignment of one-to-one faculty-undergraduate mentoring relationships have yielded clear progress.

Additionally, though the retirement of three senior faculty (including the Chair), the Department has had the opportunity to refresh its leadership (new Chair appointed January 2016), diversify its faculty (three new female faculty hired as of January 2017), and reinvigorate the importance of student learning and research experience. Our new faculty are passionate about teaching and engaging students in experiential learning. They are bringing new courses to the Atmospheric Sciences curriculum, implementing new teaching techniques that go beyond PowerPoint lectures, and engaging their students in the field. (One is also contributing to the OCN105 course).

Beyond the classroom, the Department has continued to evolve its advising services for u/grad students. To complement the u/grad student advising provided at the School level, the Department has assigned three new faculty advisors to engage with each u/grad major. Every student who enters the department has a dedicated faculty mentor/advisor as well as the direct connection to the School-level Director of Student Services.

D. Going beyond

This year, building on a faculty-generated proposal, a planning committee chaired by the Associate Dean has designed several innovative elements for our undergraduate program that we hope to implement in the coming semesters. This plan aims to develop a common core curriculum and cohort and thereby build a sense of community and cohort unity among our students, streamline progress toward degrees, and unify similar courses taught in sister departments by combining and re-visioning them. Below are the main elements:

1. Develop SOEST pre-requisite introductory courses in chemistry, physics, and math that we teach as applied to the Atmosphere, Ocean, Earth and Environmental Sciences: i.e., with a focus on practical examples in SOEST fields of study; similar to the progress we have made in Math described in A.2 above.
2. Schedule these courses so that SOEST undergraduate students in a single cohort travel through their curriculum together, despite being enrolled in separate degrees (all SOEST

undergraduate degrees have similar requirements in math, chemistry, and physics).

3. We have developed and submitted a course proposal for a 100-level microbiology course to be offered by research faculty in PBRC. As this course achieves success in the next 2 years we hope to adopt it (or the new OCN101) to fulfill our undergraduate biology requirement.

4. Across SOEST, instructors are implementing innovative classroom practices that are strongly focused on student engagement, experiential learning, and moving away from traditional lecture style instruction.

Beyond that, we have challenged the faculty to consider a single unifying SOEST undergraduate degree with tracks that represent both the existing degree curricula and areas of SOEST strength (i.e. climate, Earth science, ocean science, energy, atmospheric science, planetary science, exploration technology). This could improve the integration of new (Department and ORU) faculty expertise into our curriculum, provide students with expanded undergraduate research opportunities, and allow for easier movement of students between degrees and specialties within the School (and in partnerships across campus). Indeed, several of the enhancements to the SOEST undergraduate programs mentioned in this report are originating and being executed by faculty in our research Institutes (notably HIGP, HNEI and PBRC).

To date we have had dynamic discussions among the various units and the faculty as a whole. The primary barrier to adoption is legitimate concerns among faculty and Chairs/Directors over an effective model for degree governance and UG teaching assignments across multiple units (Departments and ORUs) that have other (graduate, research, service and extension) components. Exploration of a way forward continues.