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COMMITTEE ON ACADEMIC PLANNING AND REVIEW

14-15 CAPR 23  
Thursday, May 21, 2015

**TO:** The Academic Senate

**FROM:** The Committee on Academic Planning Review (CAPR)

**SUBJECT:** 14-15 CAPR 23: CAPR Report of the Five year report for Earth and Environmental Sciences (2006-2013)

**PURPOSE:** For Action by the Academic Senate

**ACTION REQUESTED:** Acceptance of the Five-Year Program Review of the Department of Earth and Environmental Sciences; it is recommended that the program continues without modification.

**BACKGROUND:**

At its meeting on December 4, 2014, CAPR invited Dr. Mitchell Craig from the Department of Earth and Environmental Sciences to attend the meeting and provide CAPR with an overview of the department and the five year review process.

The Department of Earth and Environmental Sciences offers degrees in Geology (B.A., B.S., M.S.) and Environmental Science (B.S.) in addition to courses that fulfill requirements for General Education and other degree programs. The department teaches courses under two discipline listings, Geology (GEOL) and Environmental Science (ENSC). The department offers upper-division and graduate coursework in geology and environmental science, including hydrology, geophysics, structural geology, petrology, and geochemistry. Many classes include laboratory- and field-based activities. In addition to teaching, faculty conduct research, publish, and participate in scientific meetings. The department is involved in STEM Education activities for K-12 teachers.

Enrollments for the department (measured in FTES) quadrupled between 2005 and 2009, largely due to increased participation in the General Education program. The Geology graduate program and the Environmental Science B.S. program have experienced overall increases in the total number of majors during the past five years.

The Department has implemented most of the changes recommended in the last review, conducted in 2005. These include increasing the Department's participation in General Education and Environmental Science programs, increasing the number of students in the Geology graduate Program, and hiring a new tenure-track faculty member with expertise in hydrogeology. A tenure-track search was successful in hiring a new faculty member in Environmental Science.

## **OVERVIEW OF DOCUMENTS SUBMITTED TO CAPR:**

The EES five-year review was conducted on three different degrees, BS and BA in Geology, BS in Environmental Science, and MS in Geology.

Documents submitted for this review include the department's self-study that examines existing curriculum, modifications and updates from its previous five year review, student learning and success, student advising and retention, assessment, faculty and resources. In addition, a plan forward is presented through 2018 as well as an outside reviewer's assessment and an extensive appendix of the department's processes, road maps and planning for distinction materials.

## **CAPR ANALYSIS OF THE PROGRAM'S FIVE-YEAR REVIEW:**

### **Program:**

All programs included in the self-study report have seen sustainable growth in the last five years as a result of the merger. Program learning outcomes are mapped to ILO's, tied to an extensive curriculum map along with signature assignments. It is particularly impressive to see the level of detail employed in how the department has set itself up for success both since the merger and the plan ahead in the process of switching to semesters.

Program Learning Outcomes are:

### **Geology B.S., B.A.**

Students graduating with a B.S. or B.A. in Geology from Cal State East Bay will be able to:

1. Identify and classify geologic materials, including minerals, rocks, and fossils, and know their material and/or biological properties or characteristics. (Geologic Materials)
2. Collect, organize, and analyze qualitative and quantitative data from both field and laboratory investigations such as lithostratigraphic and biostratigraphic correlations, geologic maps, geophysical surveys, cross-sections, soil tests, and geochemical and groundwater quality analyses. (Data Analysis)
3. Synthesize, interpret and critically analyze geologic datasets (2D and 3D) and reports using discipline-specific methods, techniques, and equipment. (Interpretation)
4. Critically analyze geological and environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form. (Communication)
5. Understand geologic time, evolution, Earth's place in the Universe, and global-scale processes such as plate tectonics, earth systems interactions, and climate change. (Geologic Time)

### **Geology M.S.**

Students graduating with an M.S. in Geology from Cal State East Bay will be able to:

1. Attain an advanced understanding of the relationship between geologic materials and their physical and chemical properties. (Geologic Materials)

2. Collect, analyze, and interpret data using advanced discipline-specific methods, techniques, and equipment. (Data Analysis)
3. Critically analyze geological and environmental issues through the evaluation of current scientific literature, and present an argument clearly and persuasively in written and oral form. (Communication)
4. Conduct geologic research, including preparation of a project or thesis; the result should be of high enough quality to be presented at a professional meeting. (Research)
5. Understand geologic time, evolution, Earth's place in the Universe, and global-scale processes such as plate tectonics, earth systems interactions, and climate change. (Geologic Time)

### Environmental Science B.S.

Students graduating with a B.S. in Environmental Science from Cal State East Bay will be able to:

1. Demonstrate knowledge of the principles of form, function and organization of organisms at the levels of molecules, cells, tissues, organs, organisms, populations, and communities. (Biology)
2. Demonstrate knowledge of the fundamental principles of chemistry, chemical structure, bonding, equilibrium, dynamics, and reactions, as well as classes of organic compounds and reactions. (Chemistry)
3. Characterize the nature and distribution of earth materials, the processes by which the materials are formed and altered, and the nature and development of the landscape. (Earth Science)
4. Synthesize knowledge of the major components of the physical environment, including landforms, climate, vegetation, and soils. (Synthesis)
5. Critically analyze environmental issues through the evaluation of scientific literature, and present their positions clearly and persuasively in written and oral form. (Communication)

### **Findings of last program review and Department Responses:**

Prior to the 2006 merger of the Department of Geological Sciences and the Department of Environmental Science, the 2005 program reviews were conducted separately. Geology Programs were reviewed by Prof. C. John Suen of CSU Fresno, and the Environmental Science Program was reviewed by Prof. Stephen Welter of UC Berkeley. The main recommendations from each of the reviews are summarized below, along with a brief statement of the new EES department's progress towards their implementation.

Compliance with Dr. Suen's recommendations:

- The current number of tenure-track faculty (four) is less than needed for a comprehensive department. Grow to 6 or 7 tenure-track faculty within 4 or 5 years.

*There has been no net change in the number of tenure-track Geology faculty (four) since the last review.*

- Increase participation in the G.E. program, Liberal Studies, and Environmental Sciences program. *Completed. There are five courses offered that are part of GE clusters, two of which are in Environmental Science. The Environmental Science program is now administered by the Department.*
- The department's productivity as measured in student credit hours per FTEF, or FTES per FTEF (SFR) should be increased by maximizing the class sizes of non-lab general courses. *Completed. Overall SFR for the department has more than doubled since the last review, increasing from 13 in 2005 to 29 in 2012.*
- The department's budget needs to be augmented to counter the effect of the loss of the vehicle pool. *Faculty have written proposals and received A2E2 funds to help pay for transportation for class field trips.*
- Review and update all catalog listings. *Many new classes and several revised current courses now appear in the catalog.*
- Establish linkages with UC Berkeley faculty to develop opportunities for collaborations in teaching and research. *One of the department faculty has established a collaboration with a UCB faculty member.*
- The number of students in the graduate program is too small. *The number of graduate students has grown from 6 in 2005 to a historic high of 19 in 2012.*
- The department should work with the graduate admission office to expedite the application-admission process. *The department has worked more closely with applicants and the graduate admissions office to ensure that qualified students are admitted to the program. Faculty monitor the progress of applications and follow up on any applications that are incomplete due to lack of transcripts or other required information.*
- Create a roadmap for undergraduate student advisement based on a consistent two-year cycle of course offerings. Avoid canceling classes because of low enrollments. *Completed. Roadmaps for undergraduate programs are provided in the appendix of this current review. Low-enrollment classes have been switched to a two-year cycle, to avoid cancelling majors classes.*
- Hire a TT faculty to cover the area of hydrogeology ASAP. Identify and recruit outstanding minority or female candidates for the TT faculty position. *Completed. The Department hired a female hydrogeologist as TT faculty member in Fall 2008. In addition to teaching two existing hydrogeology courses, new courses have been developed in environmental hydrology and isotope geochemistry.*
- Faculty should encourage students to take calculus-based Physics. Math 2304 (third quarter of calculus) should be listed as a required course rather than implicitly in the footnote. *Some of our students take the calculus-based physics sequence (PHYS 1001, 1002, 1003). This is particularly useful for those who are interested in*

*computing or modeling applications, or who wish to enter a graduate program. The non-calculus based Physics (PHYS 2701, 2702, 2703) sequence is more appropriate for other students who plan to focus on less-quantitative areas of Geology. Math 2304 may be used as an elective, but making it a requirement would increase the total number of units required above 180.*

- A data analysis and/or statistical application course is needed and should be considered for the BS curriculum. *Not yet implemented for the Geology curriculum but will be considered this in the future. Stat 3010 or Stat 3031 is required for the ENSC B.S.*
- A lower-division introductory Environmental Science course should be introduced for the Environmental Science Program. Ideally, this course may also be included as part of the university's G.E. program. *Completed. Global Environmental Problems (ENSC 2801), and Global Environmental Issues (ENSC 2802) are new courses that first appeared in the 2008-2009 catalog and are now part of G.E. clusters.*
- Develop web-based and distance-learning non-lab courses. Convert existing appropriate non-lab courses to web-based or distance learning format. *An online class was implemented, GEOL 3401, The Oceans, which currently has an enrollment of ~120 students per quarter (three sections with ~40 students in each). It is planned to develop an additional course of this type.*
- Conduct an alumni survey to obtain long-term assessment data. Possibly, use the state registration examination results. *This was not completed during this period, but it is hoped to do this in the near future.*
- Increase student recruitment effort by working with the university's recruitment and out-reach office. Increase publicity through local public media. *Faculty members regularly participate in University recruiting and outreach efforts, both on- and off-campus. Faculty have given public lectures to community organizations and schools, and been interviewed by local TV stations.*
- Ask the college to implement a more reliable and better organized information technology support service. *Campus information technology support has significantly improved during this period. Faculty have worked with campus IT staff to maintain and upgrade hardware and software in student computer labs.*
- Make a contingency plan for Mr. Garbutt's anticipated retirement. *A new Instructional Support Technician was hired in 2007 upon Mr. Garbutt's retirement. Mr. Garbutt helped to train the new technician.*

#### Compliance with Dr. Welter's Recommendations:

In his 2005 review of the Environmental Science program, Dr. Welter provided recommendations pertaining to administration and curriculum development. Many of the administrative recommendations were addressed by the 2006 merger of the program with the Department of Geological Sciences. Prior to the merger, the Environmental Science program was not associated with a department. It is now administered by the Department of Earth and Environmental Sciences.

### Administrative

- Inclusion of Environmental Science program director in communication channels or meetings targeting department chairs. *The Environmental Science program is now part of the Department of Earth and Environmental Sciences, and is represented by the department chair.*
- Consider a more formal recognition of the program director's role with additional release time to compensate for the increased time burden. *See #1 above. The administrative duties associated with the program are now shared between the department chair and program coordinator. The program coordinator receives release time.*
- Increase the number of faculty directly involved with the administration of the program as well as with the teaching elements. *A tenure-track search is underway for a new faculty member whose primary responsibility would be Environmental Science.*
- Enhanced presence of the program on CSUEB web sites. *A search of the University home page directs users to the Environmental Science program text in the University Catalog. The catalog text for the program has undergone major revision since the last review, including the addition of many new courses.*
- Determine the desired target size of the program relative to student numbers because a larger student body will require additional resources from the administration and commitment from the faculty. *The number of majors has grown from 25 to 35 since the last review. We anticipate that with the new faculty member, the program will be able to grow further.*

### Curriculum Development

- A review of the entire major relative to its core and elective courses with an eye towards development of a comprehensive, but more streamlined, set of courses independent of the four departmental affiliations. *Completed. An extensive revision of the program was completed, as explained in the following section.*
- Consider reducing the number of required courses in the core to increase the number of students declaring the ES major. *Completed. An extensive revision of the program was completed, as explained in the following section.*
- Review the overlap between the ES and Environmental Studies program to determine if a single major with multiple tracks can be developed. *This was taken into account during the modification of the Environmental Science program that was completed in 2009. Several new Environmental Science (ENSC) courses were created that more clearly differentiate Environmental Science from Environmental Studies. One of the associated faculty (Prof. Michael Lee), whose home department is Geography and Environmental Studies, has provided guidance in this area.*

- The students made a strong plea for continued, if not increased, "hands-on" lab courses that include field components as needed. Many of these courses were viewed as seminal to their own training as well as a source of inspiration. Perhaps additional opportunities for involvement with the private sector may provide other pathways for more direct training as opposed to lecture formatted courses. *Two new classes were added that address this need; ENSC 2401 (Environmental Biology Laboratory) and ENSC 2900 (Field Activity in Environmental Science). Their course descriptions may be found in the appendix.*
- Consider developing closer ties to outside constituencies relative to internship, employment, educational or funding opportunities. *The department has begun to do this. It is hoped to be able to work with numerous ES graduates who are now employed in county, state, and federal agencies, as well as in private environmental consulting firms, to develop a broad-based Advisory Committee to help implement these suggestions.*

### **Assessment Activities and Actions Taken**

The department's assessment plan consists of four parts, one for each of our three main degree programs and one for General Education courses. The goal of assessment is to evaluate student learning and determine whether or not our students are meeting course and program objectives.

#### *Assessment of Geology Undergraduate Program*

Assessment of students who attain the bachelor degree in Geology is an ongoing process with the goal of maintaining the highest possible quality in our undergraduate program. The plan takes into account that EES is a small department that produces fewer than ten graduates annually, and thus cannot rely on the statistical reliability of any sort of objective testing on an annual basis. The plan consists of three parts: 1. Completion of specific learning activities by students; 2. Faculty review of results from Capstone Courses; and 3. Survey of the professional geological community approximately every five years.

Results from the implementation of this portion of the assessment plan have been encouraging. Overall, the department appears to be headed in the right direction in terms of offering a competitive, well-rounded undergraduate degree in geology. Specific results identified in faculty discussions are as follows:

The vast majority of the students are successfully achieving the desired learning outcomes based on their accomplishments in course activities. Continual monitoring of individual students by instructors and advisors on a quarterly basis has allowed faculty to identify students who require additional help in achieving specific learning goals, and to either work with them on an individual basis, or direct them to appropriate resources.

Students in the capstone course, GEOL 4800, the senior seminar, produce written and oral presentations. Most of the students have produced results that demonstrate mastery of program learning outcomes. All students have demonstrated at least adequate competency.

#### *Assessment of Geology Graduate Program*

Assessment of the Geology M.S. program is a continuous process with the goal of maintaining a high-quality program. The field of geology is interdisciplinary, and involves the application of a great variety of techniques (laboratory, computer, and field based) that must be assessed on an ongoing basis in order to prepare our students for professional work in the geological sciences.

The plan has three parts: 1) reviews of specific learning activity by students, 2) faculty evaluation of a Master's Project or Thesis (required of all graduate degree candidates) plus evaluation of a thesis defense, and 3) evaluation of a dossier compiled by graduate students, documenting their written accomplishments during their graduate study at CSU East Bay.

Department faculty will monitor these products on an ongoing basis to update and improve learning goals, and to adjust the program as necessary to reflect changes in the practice of geology. This may involve the implementation of new courses, and the modification or elimination of existing courses, and other program changes as deemed necessary.

The Graduate Seminar, Project, and University Thesis are the most important assessment tools for the M.S. Program since they require the student to utilize skills learned in several courses during the program, including data collection, analysis, interpretation, and oral and written presentation of results. If any systematic deficiencies become apparent, the graduate program will be modified accordingly.

#### *Assessment of Environmental Science Program*

Students will demonstrate interdisciplinary comprehension of environmental issues through the development of an oral and written analysis of an environmental problem in the capstone course ENSC 4800, Seminar in Environmental Science. This assignment will demonstrate accomplishment of all five learning outcomes.

#### Implementation Plan:

1. Faculty Advisory Committee members will review topics, written papers, and oral presentations from ENSC 4800 each year in relation to the learning outcomes for the program.
2. Student viewpoints regarding the structure, and depth and breadth of coursework in the Environmental Science B.S. program will be assessed annually via a questionnaire given in ENSC 4800.
3. Data will be gathered from ENSC 4800 to assess learning outcomes.

#### *Assessment of General Education Courses*

Faculty has begun to implement entrance and exit exams in selected General Education courses. The same test is given at the beginning and end of a course. The tests consist of multiple choice questions to test students' understanding of key concepts. The same test will be given to different classes over time. This type of test is relatively easy to administer and provides numerical data that can be analyzed in a straightforward manner.

#### **CONCLUSIONS:**

All three programs appear to be stable with an upward trajectory for continued growth. The Department has a well-documented and systematic assessment and evaluation process in place. It continues to make good progress on reviewer recommendations to move the program forward. The Department has also created a well thought out vision and plan for the next five year that is realistic and achievable and their efforts are applauded.



**CAPR RECOMMENDATION(S) FOR CONTINUATION OF THE PROGRAM:**

Based on the material in self-study report and the presentation of the department chair to CAPR, it is recommended to continue all programs without modifications.

**DATE OF THE PROGRAM'S NEXT FIVE-YEAR REVIEW: AY 2017-2018**