

Review Committee Report
Program Performance Review
CSU-Fullerton Department of Geological Sciences
March 2014

Summary:

A review committee composed of Kevin Furlong (Geosciences, Penn State University), Vicki Pedone (Geological Sciences, CSU-Northridge), Kay Pitts (Aera Energy) and Binod Tiwari (Civil and Environmental Engineering, CSU-Fullerton) met with faculty, students, staff and administrators on March 24, 2014 to conduct a Program Performance Review of the Department of Geological Sciences. Overall the committee was impressed with the people and the current activities the department, and we generally concur with the plans for the future. The significant growth in majors in recent years indicates both the value of the major to the University and the attractive quality of the programs. We have identified opportunities for the department to consider and areas where we think some improvements could be made. In this report we provide our perspective of the current state of the department and suggestions for how to best exploit future opportunities.

We summarize our findings and recommendations here, and provide more details and additional recommendations in the sections following.

1. *Faculty Hiring:* We encourage the department to consider geophysics and clastic sedimentology/basin analysis as priorities in future hiring.
2. *Mentoring:* We encourage enhanced mentoring programs for junior faculty, lecturers and graduate student TAs to enhance teaching effectiveness and consistency across the department.
3. *Undergraduate Thesis:* Realistically evaluate whether the current (3-semester) thesis project is sustainable with the increased enrollments and current faculty availability. Consider reserving the thesis for the top-performing students.
4. *B.A. Degree Program:* As this program develops work to ensure it is seen as of equal standing to B.S. program and provides an appropriate suite of courses for its stated goals.
5. *Program Assessment:* Develop additional (non-capstone course focused) metrics for assessing the effectiveness of the undergraduate degree programs.
6. *Graduate Program:* For competitiveness with comparable programs, work to reduce tuition and other costs to graduate students with university stipends
7. *Stakeholder Engagement:* Develop an industry-based Advisory Committee to enhance links to potential employers

The Faculty

The members of the faculty (including adjuncts and lecturers) in the department of Geological Sciences represent a group of dedicated individuals who are committed to providing high quality educational opportunities to the students in the department. The combination of substantial growth in the number of undergraduate majors, the movement

of key faculty members into administrative roles, and retirements and other departures has put a significant stress on the faculty to maintain the breadth and intensity of the educational program.

Faculty Expertise and Future Hiring

The current faculty (including recent hires) covers much of the breadth of a traditional geology program. As the scope of geological sciences has broadened, and the skill-sets expected in many current career opportunities have changed, there remain some significant gaps in the faculty expertise. We see several areas that we think the department should consider in future hiring.

1. With David Bowman's move to the Dean's office and Phil Armstrong's appointment as Department Chair, there is a substantial hole in geophysics capabilities in the teaching staff. This is being temporarily dealt with through a part-time lecturer appointment, but the committee feels that with the department's location in the LA Basin and its earthquake activity, and the career opportunities for students in the energy industry that a geophysics position should be a very high priority in future hiring.
2. Similarly, expertise in clastic-sedimentology and basin studies would be beneficial to preparing students for various career opportunities.

The rapid increase in enrollments has put substantial strain on various aspects of the department, not the least of which is the faculty. Coming at a time of reduced FTE faculty numbers, the load on individual faculty is large. This is being mitigated somewhat by the hiring of temporary lecturers – which helps on the course-load side of the equation, but the load on faculty in terms of advising senior theses, and increased numbers in the labs and classrooms remains. The department has made several new hires that, as they come on-board will help distribute the load, but the current reliance on lecturers and new hires brings with it a need to make sure that these staff members are well-mentored to be effective and efficient teachers and colleagues. We heard from students disappointment in their experiences in some courses that were not up to the expectations they had, based on previous offerings of the course by a more experienced teacher. We recommend a specific action to help with this.

1. Provide explicit mentoring of new hires (and new lecturers) to help them effectively develop and offer courses. Perhaps a few 'master teachers' within the department could be identified to help mentor these new colleagues

At present there are a range of career opportunities for geological science students. Students felt they would benefit from more exposure to potential industry career opportunities. As noted above, there are gaps in faculty expertise or availability in some areas critical to such career preparation. We considered whether the department might consider hiring a 'professor of practice' or similar individual to meet some of these needs. There may be a more effective solution, and that is to utilize the available industry expertise in the region (retirees, and other professionals) to help teach courses or course modules specific to industry preparation. This will allow a broad range of expertise to be

brought to the department, enhance links with potential employers, and retain flexibility in the future if the current boom in geo-focused jobs declines.

We did not observe any specific issues facing the mid-career faculty (other than the current high student numbers). We do note that among the tenure-track and tenured faculty the number of female or other under-represented-group faculty members is small, although the lecturer group is largely female. This should be of some concern to the department and innovative ways to provide a more representative faculty-face to the students should be considered.

Finally, some faculty raised concerns that university policies restricted their abilities to supplement salaries through research grants. As explained to our committee there seemed to be confusion about what the policies are, and how they conform to standard norms and federal funding agency regulations. We recommend that, in conjunction with the university's research administration, a workshop be held for all interested faculty to clarify policies and opportunities for salary supplements via external research grants.

Undergraduate Program

Summary

CSU Fullerton Geological Sciences has a strong tradition of excellent preparation of B.S. Geology degree undergraduate students for professional careers in geology and entry to graduate school. A major change since the 2006 program review is the addition of a B.A. Earth Science program in Fall 2012, which provides pathways to K-12 teaching careers and non-traditional Earth Science-related careers. There were 27 B.A. majors at the end of Spring 2013, of which only 7 seem to have switched from the B.S. program. We think this indicates potential for significant future growth in the B.A. program. The required core courses for the B.S. Program and elective courses (59 units) are typical of many geology programs nationwide. The curriculum is well aligned with the Vision and Goals of the University and the Department. The new B.A. Program has not yet solidified its curriculum or its "identity" within the department. The 10 undergraduate students interviewed by the Review Team were very satisfied with their classes, field trips, research opportunities, and advising, and particularly noted the approachability and mentorship of the faculty.

Entry points into the major, retention, and time-to-graduation are similar to those of the geology programs at other Los Angeles area CSU campuses. Recruitment efforts have significantly increased the number of undergraduate geology majors during this review period. The number of majors has grown 318% from 39 in Fall 2005 to 163 at the end of Fall 2013. This growth, combined with faculty retirements, has increased faculty workload and dependence on PT faculty and strained resources and physical facilities.

Recommendations on Curriculum

Undergraduate Thesis. The requirement of an undergraduate thesis of original research in the B.S. Program is becoming difficult to maintain as the number of majors increases and the number of available faculty members to supervise these theses has decreased. Some faculty members mentor a much larger number of students than others. Finding enough

and appropriate projects is difficult. The quality of the research and writing of the theses is highly variable, owing to differences in student ability and the lack of time for faculty to provide sufficient mentorship to those students who need more help. Students work on projects over three semesters, for which faculty are given teaching credit. This is costly for the program, as it necessitates the hiring of part-time faculty to cover classes that tenure-track faculty are relieved from.

Specific recommendations are:

1. Examine how the undergraduate thesis requirement can be better managed with growing enrollment or develop another model that meets the same student learning outcomes as the thesis in a different context, such as team-based research within laboratory courses.
2. Require the proposed GEOL 280 Research Methods in Earth Science course (currently proposed only for B.A. students) for both B.A. and B.S. students, rather than add another supervisory course (GEOL 299, freshman and sophomore individually mentored research).
3. Consider adding an Honors Program for high-performing students with strong promise in research abilities, with expectations of significant research effort and written thesis.

B.A. Program. The program is too new to determine if it will meet the intent of training students for K-12 teaching careers and non-traditional Earth Science-related careers. The Review Committee commends the department for identifying areas where curricular modifications are needed to address weaknesses and assessment gaps in the B.A. Earth Science Program. In the present structure there is little overlap in the core curriculum between the B.A. and B.S. programs--only 4 courses (one of which is being proposed to be removed from B.A. program). This limited overlap could be a contributing factor to the attitude that appears to exist (based on some off-the-record comments) that the B.A. degree is worth less than the B.S. degree or is a consolation prize.

Our specific recommendations are:

1. Consider adding concentrations (or recommend course sequences) to better define different career pathways of the B.A.
2. As new GEOL electives are developed in coming years, ensure that B.A. students have the prerequisites to take many of them. Currently many B.A. students have limited choices because they lack the prerequisites for many upper-level electives.
3. Consider making the proposed GEOL 280 a department-wide requirement.
4. Make the capstone experience for the B.A. students rigorous and challenging, meeting the same SLOs as the B.S. capstone. This should help raise the stature of the B.A. Program.

Recommendations on Assessment

Data collection of the assessment plans of both the B.A. and B.S. programs are at present solely focused on the capstone experiences. The ASBOG and alumni survey data are valuable and should be continued, but do not provide direct measurement of student performance in the programs. Our specific recommendations are:

1. Develop a plan that measures performance in each SLO at a minimum of two points in the program to assess longitudinal gain (value added).
2. Conduct simple norming exercises for faculty using rubrics so that scores are relatively consistent between evaluators.
3. Continue to analyze the data and use it to make improvements in curriculum to help students better meet the SLOs and possibly shorten the time-to-graduation.

Recommendations on Recruitment

The exceptional growth in the number of majors has caused the department to reach the limits of its lecture and lab space and its faculty workload capability. The department has as a top priority the recruitment of new majors. This goal should be balanced with the reality that too much or too rapid growth could cause the department to surpass its space, faculty, and teaching resources before it can develop the needed infrastructure for a substantially larger number of students. According to the self-study, the number of majors increased by 63 from 100 the end of Spring 2013 to 163 the end of Fall 2013. The infrastructure cannot handle continued growth at this rate, and the current curriculum is not designed to accommodate more majors. The high impact practices (student-faculty research, field/lab experiences) are costly and difficult to maintain with a high student-to-faculty ratio. Our specific recommendations are:

1. Assess the direct impact of increased enrollments on highly valued educational experiences such as field and laboratory work. Prioritize those activities considered most important to the overall success of the students and distribute resources accordingly.
2. Develop targeted recruitment efforts for underrepresented minorities (URMs). URMs make up 26% of geology majors, slightly under the University 37% URM demographics, which is not unusual for STEM fields. However, neither in the self-study nor in our discussions did we see any specific considerations of how best to attract URMs to the major. Additionally partnerships with regional Geo-based employers may provide targets for additional resources to help in recruiting and retaining URMs.

Graduate Program

Although the graduate program is small, we met with an enthusiastic cadre of students who are excited about the geological sciences and are motivated to succeed. In our assessment of the program, and discussions with various faculty members and the graduate students, we did discern some issues that the department should consider in its future evolution. In particular there are issues related to the programs small size and associated limited course offerings. Additionally the lack of funding to cover tuition or similar fees for the graduate assistants (TAs or RAs) puts CSUF at a significant disadvantage relative to other graduate programs in recruiting. Fundamentally the department faces a tough situation – it needs a moderate graduate program to provide TAs to support the undergraduate teaching program, and since many members of the faculty have active research programs there are opportunities for M.S. students to participate in these projects. It is not clear that graduate students who are willing to come to CSUF (considering the relatively small stipends) are

the best students for these research projects. Considering these and other issues, we have the following recommendations:

1. Develop a focused graduate curriculum with key core courses, relevant to most of the graduate students programs, and an explicit sequence through the curriculum so students can plan an efficient path through the program.
2. Identify the desired career paths for the graduate students and make sure there is sufficient training in those areas. For example increasing the available courses in hydrogeology (maybe in partnership with Civil Engineering or other departments), or participation in the International Barrel award (IBA) program discussed below could help better prepare the graduate students for jobs.
3. Explore ways to remove or reduce the additional costs (tuition and other fees) graduate students have, even when being supported on university funds. These costs place the department at a large disadvantage in recruiting students into the graduate program.

We also note some logistical or program-wide issues regarding the graduate program. We realize that the department is serving two distinct populations of students in its graduate courses – full-time students (who often are serving as TAs in the department) and part-time students (who are often working full-time outside the university). The result is that most if not all of the graduate courses are offered in the evening. This creates very long days for students who are TAs during the day, and then need to remain on campus until the evening courses. There is no simple solution to this, but continued assessment of who is taking the courses and their situation may allow for some more effective scheduling. Second, at present the graduate program appears to be only accessible for students with an undergraduate degree in geology. They may consider whether this is really serving their goals, and might consider whether the program could be adapted to be welcoming to students from other disciplines. For example in the graduate program in geosciences at Penn State, approximately 30% of the incoming graduate students have undergraduate degrees in other sciences than geosciences. Finally, similarly to what we noted above for junior faculty and lecturers, the graduate students involved in teaching need additional mentoring and training in teaching. In our discussions with them, they felt that there was only minimal interaction with the faculty members teaching the course for which they were a lab instructor, and they were uncomfortable at times with the training they had to teach. Perhaps a more senior (and also an effective teacher) graduate student could serve as a mentor to the TAs and help them in their teaching.

Other

In addition to issues specifically under the headings of faculty and the educational programs there are several other areas of department activities for which we have comments and recommendations. Specifically we highlight several issues in departmental funding, links to industry groups, the role of the Cooper Center, and some ancillary issues related to facilities and logistics.

Departmental Funding

The department seems to be searching for a route to more effectively engage external groups in funding. Some similar programs have found that an *Advisory Council* with a charter that focuses on two things: (1) helping the department maintain relevancy to industry and (2) funding strategies can be that conduit. Representatives from target industries and key alumni can be recruited for this council to serve as a sounding board, as advocates and as volunteers to create and improve industry and alumni connections.

As a specific example of where the department may be able to quickly engage with some of the stakeholders, we see an opportunity that builds on CSUF's historically strong hydrogeology program. A major concern for the petroleum industry is the SB-4 Oil and Gas: Well Stimulation bill. This bill has caused stoppage in permits for injection wells and hydraulic fracturing since January 1, 2014. CSUF is well positioned to create a consortium funded by industry to do research, and address concerns from the State Water Resources Control Board. Topics that may be requested by the consortium include feasibility and implementation of closed loop water systems in oilfields, effect of water injection and water production from geologic beds, groundwater monitoring model criteria, and other topics as suggested by the consortium. The topic of handling produced water from oil fields is going to continue to increase in significance for years to come. A similar consortium has been formed at Penn State focused on the gas-shale and hydro-fracturing developments in the state. It provides funding for research, student support and facilities and provides a research-based assessment of issues as they arise.

Additionally some of the following may be worth considering as a means to develop stronger connections with department alumni, as a foundation upon which to build future financial support.

- Alumni and friend field trips that generate a profit and tie alumni to the department.
- Sponsor field trips and short courses at geologic conventions.
- Invite alumni and the local geologic community to present or attend the departmental monthly technical talks.
- Offer specifics for sponsorship such as "buy a student a field camp experience"; gas for vehicles, field trips, etc.
- Provide an annual report to donors on how the funds are used to increase transparency and awareness.
- Engage alumni and friends by keeping the current and historical newsletters on the department website. For example, the newsletter on the website at of 5/16/2014 is from 2010/2011.

As we noted above, many of the students we spoke didn't feel that the faculty is encouraging them to go into an industry career. We realize this is not necessarily the case, but the perception is there. We think the faculty should be conscious of this and perhaps there needs to be a shift to not only encourage students to be researchers and academics, but also to work in industry. We recommend that there be an increase in participation by

students and faculty with the relevant professional industry organizations. For example activities such as (some of which do occur):

- Volunteer for conventions, technical sessions, speaking at professional meetings, or offering to host symposia. The participation of CSUF at the joint GSA/AAPG meeting was a good example of possible synergies.
- The energy industry is overtly attempting to become more diverse. As a Hispanic-serving institution CSUF can provide a highly qualified, diverse source of employees. Faculty meeting and chatting with recruiters at conventions and job fairs about this niche would be welcomed and likely very effective.

We think there are some other activities that might strengthen the ties with industry and also provide students with some hands-on exposure to more applied earth science.

1. The department should support the AAPG Imperial Barrel Award competition. A strong advocate is needed in the faculty. Some schools bring in a retired industry geologist to serve as the team advisor (e.g. SDSU). Students learn skills and gain knowledge that is directly applicable to their work in the energy industry. The IBA program has gained a reputation among recruiters such that students who have participated in the competition – either at the local or finals competition have an advantage over other applicants. Support by CSUF can include a basin analysis course or independent study units for faculty and students who participate in the competition. Some schools offer a course and bring in guest lecturers and mentors to supplement the faculty’s knowledge. Teams form within the class, each team interprets the data, they compete against each other and the winning team and advisor goes to AAPG Section competition. The department benefits because it receives advanced geologic modeling software at no cost and a new dataset for the competition each year. The datasets can be used for internal teaching outside of the IBA class, although most of the datasets cannot be used in published work.
2. The department could partner with CSUN or other regional universities to participate (or at least actively encourage students to participate) in such activities as the AAPG/SEG EXPO, poster session and field trip.

Cooper Center

The Cooper Center is an outstanding facility for teaching and research. Understandably there are some logistical complications because of its location and it would be very difficult to locate the center closer to CSUF. Although it is still a very young facility, it does have an enthusiastic and dedicated director who seems excited to make things happen cooperatively with the department. Kudos on the progress made to date, and we encourage continued thinking on how to enhance that interaction.

Department Logistics

Overall the technical and administrative support staff are very proud of the department and their contributions to its success. There were a few issues that were noticed and that we feel could be mitigated with direct management intervention.

- Room scheduling, particularly of rooms that the department or the college 'controls' needs more flexibility; e.g. if a M/W/F class isn't scheduled into a room, allow a M/W class to use the room.
- The required university review of any IT expenditure over \$100 is ludicrous. It creates bottlenecks, waste and rework.
- Having a technician handle travel for students and staff seems to be a waste of talent; having a part time administrative assistant or external travel agency handling travel would allow the technician to focus on higher value-added work.