Application for UCSC DCG Funds

Bioengineering

2014 Dec. 14

Submit to the Academic Senate Office, c/o Susanna Wrangell (swrangel@ucsc.edu) by December 19, 2014 or March 20, 2015

Proposals must be approved by the department or program chair and Dean. They are due in the Academic Senate Office by Friday, December 19, 2014 or March 20, 2015 at 5 p.m. submitted by email to swrangel@ucsc.edu.

1. Proposed title for Disciplinary Communication Grant (DCG)?

   New technical writing course for biomolecular engineers

2. Department/Program:

   Bioengineering Program (course to be offered through Biomolecular Engineering Department)

3. Amount requested:

   $14,000 ($7,000/year for 2 years)

4. Number of students affected:

   40 directly, 20-60/year after the first two years

5. Overview of the program's DC requirement:

   Bioengineering majors currently take CMPE 185, Technical Writing for Computer Engineers and Scientists, to satisfy the DC requirement for the major.

   In addition, CMPE 185 is a prerequisite to the senior thesis or senior capstone project requirement, which further develop communication skills including writing, scientific graphics, and oral and poster presentations. Writing and scientific graphics skills are also developed in BME 101/L, Applied Circuits for Bioengineers, which is now required of all four concentrations in the bioengineering major.

   Many of the upper-division BME courses require oral presentation, either individually or in groups. At the senior exit interviews, students express high confidence in their ability to handle technical oral presentations in grad school or on the job.

6. What is proposed?

   A new course, BME 185, Technical Writing for Biomolecular Engineers, will be created and refined with a focus on topics, issues, and communication methods relevant to biomolecular engineering.

   Because the BME department has insufficient tenure-track faculty to teach all our current course offerings, the BME 185 course design will focus on developing a curriculum that can be delivered effectively by Writing Program faculty or lecturers who may not be highly trained in the field.

From prior experience with CMPE 185 we are aware of the challenge in finding people highly trained in technical fields to teach writing courses. For this reason, we propose a course structure and assignments that will enable Writing Program faculty who have modest familiarity with the field to teach the course effectively through the use of guest lectures by technical experts and developing effective writing prompts, examples, and rubrics.

We do not expect that the first iteration of the design will be successful in both covering all the skills we wish to have taught and being a "turn-key" design that can be taught by other Writing Program faculty. So we propose a series of prototype runs of the course over two years, with extensive analysis and redesign of the assignments during and immediately following each run of the course.

Some of the assignments being considered that are expected to require significant revision on the first few iterations include

library puzzle The library puzzle will be a set of questions to help students find information from sources that are not immediately obvious. This includes finding lab protocols; vendors for various biotechnology reagents, including custom DNA synthesis; material safety data sheets; on-line data repositories; data sheets and technical descriptions of equipment; bioinformatics software (both downloadable and web-based servers); and so forth. It will be preceded by an information session from the science librarians.

scientific graphics We expect to need at least two assignments on producing useful scientific graphics, but which graphics are most useful for the students is not clear yet. Scatter plots, heat maps, box-and-whisker plots, and histograms are all likely candidates. Ideally, the assignments would involve extracting data from public data sets (perhaps found during the library assignment), plotting them, and interpreting the plots.

lab protocols Writing a lab protocol is a very important, but very discipline-specific skill, which will be particularly difficult for Writing Program faculty to evaluate. Students will probably be expected synthesize a new lab protocol from component protocols found in the library puzzle, with some guidance from a guest lecturer. The assignment will call for two components: an explanation of what the protocol is for (and how it works) and the detailed steps of the protocol itself. For this assignment to work with writing instructors who are not trained in molecular biology, there will need to be a correct solution that the student work can be compared to, and there may be a need to call in experts to evaluate protocols that differ significantly from the proposed correct solution.

research proposal or survey article Students will propose their own final projects, which must involve a substantial library-research component (writing a survey article or the prior-work section of a thesis proposal). The appropriate target audience for such a document is other bioengineering students, which may assume more knowledge of molecular biology than the Writing Program faculty can be expected to have. Since a lack of biology knowledge by the instructors and teaching assistants of CMPE 185 has already been a problem, finding ways to evaluate student writing on topics that the instructors don't understand will be a challenge.

We also plan to experiment with different pedagogical techniques. For example, peer critiques have been successful in some courses, but were not particularly successful in CMPE 185 when tried there a decade ago—student feedback was not sufficiently informative to be worth the time spent. Perhaps weekly writing groups of 4–5 students, as used in some Writing 2 courses could be tried, under the guidance of Writing Program faculty who have implemented them successfully in other courses.

We would like to experiment with online technology for sharing papers, collecting initial peer remarks, recording summaries of peer feedback resulting from facilitated group sessions, etc. It is not clear whether there is an existing tool that would serve this purpose directly, or if we would need to repurpose a Google application or some of the tools that the campus learning management system provides. Even the comment feature on Google Docs might be useful, though it provides rather limited access to earlier drafts and comments.

Training undergraduate tutors to facilitate group sessions would be valuable—if we can find biomolecular engineering students who have completed the tech writing course and have sufficient time to be group tutors (the senior year for bioengineering majors is very heavily loaded).

7. What problem will this proposal solve?

   Currently BME students take CMPE 185 to satisfy the DC requirement and this current format is a problem for two reasons:

   - Currently, CMPE 185 is required for Computer Engineering, Electrical Engineering, and Bioengineering majors. The class is already at capacity with 180 students a year and all three majors are experiencing growth in enrollments.
   - CMPE 185 is primarily aimed at students working on software and digital hardware, making it a reasonably good fit for some, but not all, of the bioengineering concentrations. CMPE 185 is a good option for students in bioelectronics and the two assistive technology concentrations, but it is a poor match for students in the biomolecular concentration, which is currently the most popular of the concentrations. Teaching Assistants for CMPE 185 are selected from Computer Engineering and therefore lack the background in biology to provide effective feedback on assignments related to biomolecular concepts.

   The proposed BME 185 will facilitate the development of students' effective communication on topics and in formats specifically tailored for the discipline, thereby improving their preparation for both graduate study and entry into the field upon graduation.

8. How does the DC fit within your programs learning outcome goals?

   There are two relevant learning outcomes:

   - A bioengineering student completing the program should be able to find and use information from a variety of sources, including books, journal articles, on-line encyclopedias, and manufacturer data sheets.
   - A bioengineering student completing the program should be able to communicate problems, experiments, and design solutions in writing, orally, and as posters.

   The first of these outcomes will be addressed by a library information session and "library puzzle" homework assignment. The details of this assignment will have to be refined to find the right level of challenge to maximize what students learn—part of the goal of the grant is to develop re-usable assignments for which the answers are not copyable from year to year, and which can be easily adjusted as the information sources change.

   The second of these outcomes will also be addressed directly with required oral presentations, poster presentations, and a lot of written assignments. One proposed writing assignment is for the students to write a new lab protocol, combining elements of lab protocols found as part of the library puzzle.

9. Detailed budget: (you may attach additional spreadsheet)

   We are requesting $7,000 a year as partial course relief for Prof. Kevin Karplus, who designed the CMPE 185 course with Dan Scripture and who taught it sixteen times from 1987 through 2003.

   Prof. Karplus will work with the instructors of the course, Writing Program faculty, and other interested parties to design and refine the challenging technical assignments of the course.

10. Assessment plan. How will the effectiveness of this change be measured?

    For the problem of CMPE 185 being too full, the effectiveness is trivially measured: every student that registers for BME 185 is one less for CMPE 185.

    For the more interesting pedagogic problem of teaching biomolecular engineering students to communicate effectively, we will have frequent discussions with instructor(s) teaching BME 185, to evaluate and redesign assignments that are specific to biomolecular engineering but that can be taught and evaluated by the Writing Program faculty.

    These discussions will occur both while the course is being taught and immediately after each offering of the course, to figure out which assignments worked, which need revision, and where more assistance is needed for the writing instructors.

    These discussions will include not only the instructors for BME 185, but also the faculty who teach BME 123T (the senior thesis writing course), other Writing Program faculty, the undergraduate director for bioengineering, science librarians, and the guest lecturers who will aid in presenting technical material (such as lab protocols).

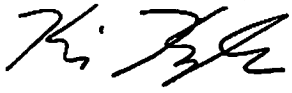
    To avoid serious schedule conflicts, many of the discussions will occur on-line as e-mail or blog discussions, with face-to-face meetings of subgroups for more intensive brainstorming.

11. Sustainability. How will this innovation be continued without DCG funding?

    The Biomolecular Engineering Department expects to teach BME 185 in future years using Temporary Academic Staffing (TAS) funds from faculty course buyouts and through the summer school.

    Current plans call for one instructor for each 20-student class and no teaching assistants--the BME department needs the few teaching assistants that are allocated to cover our labs, the discussion sections of bioethics, and the large-enrollment courses. If the demand for BME 185 is higher than can be met with one 20-student course in the academic year and one in summer school, the course will be offered in multiple quarters. It is currently cheaper to offer the course repeatedly than to add a teaching assistant to increase the size of the course.

Recommended by (or attach dated email approval):



Program Chair (Bioengineering)
Vice Chair (Biomolecular Engineering Department)

December 14, 2014
Date

Dean

12/18/2014
Date

Approved by CEP October 15, 2014