Teaching and Learning Biology at CU: Course Evaluation and Revision Project

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Project Description
The proposed research will support the coordination and extension of an existing collaboration, in its early stages, between Prof. Erin Marie Furtak in the School of Education and Prof. Michael Klymkowsky in MCDB. The collaboration was initiated with the development and enactment of the Teaching and Learning Biology (TALB) course, MCDB 4811/5811, initially offered in the fall of 2008, and currently involves evaluation of the TALB course and dissemination of the course model at the national level. The research fulfills two goals of the i3 funding stream in that it will further develop STEM faculty members at CU in terms of their own understanding of the effectiveness of their instruction, and, through revisions of the course based on its evaluation, it will increase the quality of STEM education for MCDB students in future semesters. The proposed research will support:

1. An evaluation of the TALB course, including an examination of its effectiveness as a teacher education and educational research recruitment tool;
2. Suggested revision of the course when it is offered again in the fall of 2010.

The proposed research meets the stated goals of the i3 funding in that its results will further develop the instructional practices of Profs. Furtak and Klymkowsky, and revision of the course will increase the quality of STEM education at CU.

The TALB Course. Current science education research indicates that, in order to effectively teach a subject, instructors need not only in-depth knowledge of the subject, but also an understanding of how that subject is learned (Gess-Newsome, 1999; Shulman, 1986). To that end, the TALB course was designed for upperclass MCDB majors to explore and build upon their own understanding of the fundamental concepts of molecular biology, as well as to come to a more sophisticated understanding about how students learn in this subject area.

The course was designed around a framework whereby students examined molecular biology curriculum from multiple perspectives, including the intended curriculum, or that planned by instructors; the implemented curriculum, or what is actually taught; the assessed curriculum, or what is tested; the perceived curriculum, or what students believe they have learned; and finally, the learned curriculum, or what has actually been learned (Bolin & Zumwalt, 1992; Furtak et al., 2008). These perspectives are illustrated in Figure 1.

Course impact. Since the conclusion of the original offering of TALB in fall of 2008, several students from the course have taken steps to further engage in STEM education as alternatives to their original intended career paths in medicine or molecular biology research. Students have sought information about science teacher education.
programs, observed local biology teachers, secured UROP funding to work on educational research projects, have written honors theses in DBER, and have explored graduate programs in education research. These impacts go far beyond the original intent of the course, and underscore the importance of the TALB course being revised and disseminated nationwide to potentially increase the talent pool available to DBER and STEM education careers.

**Proposed evaluation.** Diverse data have already been collected on the efficacy of TALB, including surveys and in-depth interviews with course participants, classroom artifacts, student responses to the Biological Concept Inventory (Garvin-Doxas & Klymkowsky, 2008), and final course projects. The proposed funding will support rigorous qualitative inquiry into these datasources to better understand what students learned in the course, and the ways in which their participation in the course may have impacted their career choices (Bogdan & Biklen, 1998; Erickson, 1986; Taylor & Bogdan, 1998). All data will be carefully coded and triangulated to bring evidence to bear on the quality and nature of student learning in this new critical thinking course. The proposed research has not yet been performed due to faculty member time constraints; however, one month of summer funding from the i3 grant will allow faculty member release time to donate the time necessary to complete the necessary research to evaluate this course model.

**Dissemination of the Course Model.** Based on the results of the qualitative analysis described above, multiple manuscripts for the STEM and educational research communities will be written. Three versions of the manuscript will be prepared: a shorter, focused version intended for the STEM audience will be sent to *Science*, and a second, longer article will be sent to a science education journal such as *Science Education* or *Cell Biology Education*. A proposal to the National Association of Research in Science Teaching (NARST) conference to will be submitted in July to present the course model to science teacher educators.

**Course Revisions.** TALB will again be offered in the fall semester of the 2010-2011 academic year, and larger numbers are expected in the course due its initial success and its anticipated cross-listing as a course in the School of Education. A revised syllabus for the next offering of TALB will be prepared based on the evaluation described above to increase the impact and effectiveness of this course. Subsequent offerings of the TALB course could increase significantly in number if the course is adopted as a capstone for the MCDB major, as currently proposed by Prof. Klymkowsky, further underscoring the importance of proceeding thoughtfully in the future development of the TALB course.

**Timeframe**

Since the data for the project have already been collected, data analysis and initial manuscript drafting will take place during the summer of 2009. Manuscripts will be submitted by the end of the summer and during the fall semester of 2009, and conference travel and course revision will take place during the spring semester of 2010.
References


Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.), *Handbook of Research on Teaching* (pp. 119-161). New York: Macmillan.


