

Geoffrey M. Goellner
CETL Capstone
Spring 2007

For: Cell Biology course (320)

My CETL capstone project was an active learning exercise, involving reading and presenting current primary scientific research articles, for students taking Cell Biology with me this Spring semester (2007). Peer reviewed publication of novel data is the culmination of any research project in science. Thus, this capstone project not only allowed my students to learn the basic “facts described” in the papers, but also displayed to them how current research is performed (as well as reinforced the scientific method) and communicated within the scientific community.

Small groups of students were assigned one article to not only review/critique in written form (25pts- each student turned in own critique), but also to orally present (25pts/student) to the rest of the class (PowerPoint). As there were approximately 20 students in my class, I broke them into groups of 5 students/paper and had 4 student presentations throughout the semester. Prior to the student presentations, I presented a journal article- and essentially modeled how the students were to dissect their papers. Students who wished to earn extra credit were allowed to provide written reviews of articles not specifically assigned to them for up to 10 extra credit points per paper. Format for written reviews: Times New Roman 12 point font, 1” margins, single-spaced, 1-2 pages. Written reviews were to concisely examine the major points of the paper (hypothesis, results, data support hypothesis?), as well any critique of how experiments could have been performed more effectively (controls, better method?). Written reviews were due at the beginning of the classroom oral presentations. Format for oral reviews: Each student in the group was required to speak. As a general guideline, individual students were suggested to cover either the introduction/discussion section of the paper or 1-2 figures within the results section.

The beauty of this capstone proposal was that it integrated a number of the concepts discussed in our CETL meetings:

- 1) Active learning: Students not only actively prepared these presentations as a group outside of class, but actually “led the class” for the day during their oral presentations. Thus, I played only an ancillary/supportive role (asking questions, clarifying concepts) while the students themselves led the seminar.
- 2) Group work: This project was designed to have students work collaboratively, which allowed them to not only learn from each other, but helped them to feel less isolated during the learning process.
- 3) Critical thinking: Analyzing and interpreting a primary research article is a challenging endeavor- for one has to critically evaluate the data/results of the study. For example, one always has to ask the question: did the authors do an appropriate experiment to test their hypothesis? Furthermore, were appropriate controls performed? This type of interpretation relies heavily on critical thinking skills, and this proposal was designed to help the students practice these skills.
- 4) Integration: I specifically chose articles for the students to review/present that were not only up to date (published within the last couple of years), but that were also relevant to the current “lecture” topic of that week. In this way, the students were hopefully integrating what they had recently learned in lecture with what was being explored in the paper. For example, during the week we covered cancer cells in lecture, we also had a paper presented exploring the relationship between the proto-oncogene Bcl3 and the

tumor suppressor gene p53. In this way, students were exposed to some of the basic concepts of cancer covered in lecture and in their primary text- and then were allowed to assimilate the current experiments described in the research article presentation.

5) Learning how to learn: This proposal was also designed to teach students to “learn” on their own- i.e. learn how to learn. By being able to critically read and evaluate current scientific literature, the students will be one step further in their quest to become independent life-long learners in and out of the classroom.

6) Confidence: Although, as I expected, there was some trepidation and anxiety on the part of the students during this process- particularly in regard to the oral presentation- I believe in the end it actually helped their self-confidence. When they were finished, they recognized that they could tackle a complex idea, intellectually dissect it, and make it understandable to themselves and others. Nothing builds confidence better than successfully completing an originally daunting task.

7) General Education: At many of our CETL meetings, we professors have lamented about how poorly our students’ communicate- particularly in a written format. In addition, I think it is generally accepted that one of the best ways to get better at something is to practice- practice- practice. Thus, by having students read an example of good scientific writing in the manuscript itself, and then write a summary/critique of the article- students received significant practice in this regard.

In short, this capstone project not only taught my Cell biology students “scientific facts” relevant to general concepts we covered in class, but also was an active learning strategy that had far-reaching implications as outlined above. Based on test scores, it was clear that this was a powerful technique for student learning (the students really had the main scientific ideas of the papers understood). Also, it appeared that the students actually enjoyed themselves (both the presenters and the rest of the class). This impression was corroborated when I directly surveyed the students (on the course as a whole- but also specifically on this capstone project). Student comments from the survey about the paper presentations included:

- 1) “Very good part of the course- do not take this out.”
- 2) “Very helpful- shows what is going on in the Cell research field today.”
- 3) “I liked them because they were very challenging and forced me out of my comfort zone. Plus it gave me an opportunity to learn when and how techniques are used.”
- 4) “I thought they were hard and intimidating at first, but at the end I was confident with scientific papers and reading and understanding them.”

Thus, this CETL capstone project has been a successful addition to my Cell Biology course, and I expect to employ this or similar techniques in future courses.