Innovative Course Redesign Grant Reports   Teaching Resource Center

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Title of Grant Award: **Pilot using *Poll Everywhere* Student Response System in Chemistry Courses**
Course Development Grant (Summer, 2010)

Project Goal: To evaluate the PollEverywhere student response system for use in two different levels of chemistry/biochemistry lecture courses.

When Implemented (Quarter the course was taught):

Chem 208: Survey of Human Biochemistry; F 2010

Chem 221a/222a/223a: Organic Chemistry I, II, III; F/W/S 2010-2011

Brief Description of the Project (as described in the proposal)

  Clicker technology, like eInstruction currently used on campus, has been shown to promote student engagement. The current system requires students to purchase both a clicker and access, and the campus to configure receivers. An alternative student response system is *Poll Anywhere,* a web-based product that uses a students' own device (i.e. cell phone, laptop, Ipod touch) to respond. We propose to run a pilot test of Poll Everywhere in two chemistry courses—Survey of Human Biochemistry and Organic chemistry I, II, and III. The two classes, with different instructors who use different teaching styles will enable us to explore a variety of different ways to best use the technology.

How the Project was Implemented (including how it differed from original plan)

The two faculty did not sign up for individual accounts, but rather shared one "two professor/up to 250 responses" account for $65/mo. This allowed us to have access to all of the advanced features of the PollEverywhere system, including rostering students, and was more cost-effective than two individual unlimited faculty accounts.

Students were asked to sign up (free of charge) at the PollEverywhere web site and register for our courses (Chem 208 and Chem 221a, Fall 2010) prior to the first day of class. Some students registered successfully, many others did so after classes started. Some students elected not to register (and used an alternative system of index cards for responses). A small percentage of the grade for each course was based on participation via PollEverywhere or notecards.

Chem 221a/222a/223a

In the organic chemistry courses (Chem 221a/222a/223a), a daily warm up quiz, as well as periodic responses to questions on lecture slides were used in all except three of the 84 class periods in which the class format was either interactive lecture (just under 2/3

of the sessions) or Guided Inquiry (through the POGIL project, pogil.org). Warm-up quizzes of a single question with up to 9 responses, were given promptly at 8:00 AM MWF, and were based on either the reading that should have been completed before class, or on topics from the prior class session. These questions were intended to serve as a starting point for the day's class. Lasting only 3-4 minutes, the warm up questions were originally intended to be graded for accuracy, but due to technical and practical issues were soon modified to count for participation only.

At least one other question (per 50 min. lecture day) or two to four concept quiz questions (per 50 min. Guided Inquiry day) were asked on slides, with PollEverywhere responses. The lecture question(s) served to provide immediate feedback to students and instructor regarding understanding of the prior 15 minutes or so. The concept quiz questions helped student groups pace themselves during the Guided Inquiry sessions, and provided the instructor an opportunity to give a mini-lecture on difficult concepts, when a low percentage of correct responses was received.

Chemistry 208

Poll Everywhere was used in two separate sections of Chemistry 208. One section was taught during the Fall quarter to 68 students and the other section was taught in the Spring quarter to 85 students. In both quarters, questions were asked one or two times per 50 minute lecture period and the students were given up to 2 minutes to respond. The questions were presented on PowerPoint slides and were similar to previous Chem 208 exam questions. Since the first half of the course presented the structure of organic and biochemical molecules, several polls were made asking students to predict the physical and chemical properties of molecules based on their structural features. The second half of the course presented how carbohydrates, proteins, and lipids are used in the body to generate energy. After introducing students to the major pathways of carbohydrate and lipid metabolism, several concept questions about control and regulatory mechanisms of metabolism were asked. When most of the students (~85%) arrived with the correct answers to these questions, lecture would move on to the next topic. In some cases when 20% or more of the class voted incorrectly, then an explanation as to why each of the answer choices was either right or wrong was provided to help clear up misconceptions.

In the fall quarter, students were able to earn a total of 50 points for PollEverywhere participation, which counted towards 7% of their total course grade. Each question was worth 6 points and students were awarded full points irrespective of whether their response was correct or incorrect. Even though students were expected to attend all lectures, the point value for each question was reduced to 2 points in the Spring quarter to keep students from losing a lot of points during an absence.   A total of 20 points was assigned for participation, which represented a smaller part (3.8%) of the total course grade compared to the Fall quarter.

Results of the Project:

Chemistry 221a/222a/223a:

Approximately 85% of the responses received in the fall quarter were through PollEverywhere, the balance through note cards. The percent of registered students using PollEverywhere increased for the second and third quarters of the course, but the percent of electronic responses peaked at well under 95%. Students who responded electronically did so by either texting (approx 80%) or entering their answers in a web form on their internet device (laptop, ipod or smart phone).

Students were overall comfortable with the technology, and most had access to unlimited texting. Of the 70 electronic responders on the first day of classes, 66 students considered themselves avid or casual texters, and only 5 reported limited text plans or per-text charges. Of course, these responses didn't consider (a) the students who did not text responses, and (b) the students who might use alternate web voting.

Daily warm up quizzes encouraged class attendance, and when they worked properly, in-class questions during lecture kept students awake. Many students "celebrated" when they got the right answer, and paid extra attention when they didn't. The room was frequently noisy during response time as students discussed the answers.

There were some serious issues with PollEverywhere, which is not yet ready to replace commercial clickers. For example, the original registration was so difficult that some students gave up and chose to use index cards even though they owned cell phones, or internet devices. Reception for some carriers was inadequate in PS-10, preventing other students from replying reliably. Having two instructors using the same account was somewhat confusing for the instructors retrieving results.

Accounting for student participation was very cumbersome for the professors, and difficulties in texting caused some students anxiety. In particular, the PollEverywhere system is just not set up for academics; while it appears to work well when summary responses are required, it is very cumbersome to download, sort, assign to user the responses for instructors. Adding in the index card option provided both students and instructors with additional work, accounting for "who answered what", and figuring a day's participation points took hours. There were times when students claimed to have texted, but no response was recorded by PollEverywhere, and some of the features available (including the text number for academic accounts) changed throughout the year. One of us also "caught" students texting responses remotely, without attending class. At times slow network/server speed used up valuable class time.

Chemistry 208:

Similar to Chemistry 221a/222a/223a, approximately 85% of the responses were received electronically through PollEverywhere in both the Fall and Winter sections of Chemistry 208. The remaining 15% were responses received on note cards from students who either did not have a cell phone or a text-messaging plan.

During the 5th week of the Fall quarter, a survey was provided to students through Blackboard to evaluate their perception of PollEverywhere. The survey included 13 questions inquiring whether PollEverywhere helped them improve their learning. A look

at some of the survey results showed that a majority of students agreed that PollEverywhere reinforced important concepts presented in lecture (79%). However, when asked if PollEverywhere helped them to prepare for their exams, less than half the students agreed (38.6%). Those students that did not find it to be helpful on exams, however, still recommended the use of PollEverywhere in future Chemistry 208 classes (76.9%). The results of this survey were unclear and somewhat contradictory. Although students were told in lecture that the questionnaire would be anonymous, it seemed that many were concerned about their anonymity while taking the survey online.   Some students might have been under the impression that their responses could be traced by the instructor and the students therefore might not have been fully forthcoming. Perhaps administering an in-class scantron survey would have yielded more accurate feedback from students.

Additional Comments (Lessons Learned, Insights, Future Plans, etc.)

Poll Everywhere technology has promise for classes. It is an excellent choice for occasionally getting a gauge on class (or audience) understanding, but is serious limitations for participation or other in-class evaluation without further refinement. For a small class (the product is free for small groups in education) it is ideal. For larger classes, the professor must purchase access (note: the site recently added a "Student Purchase" option, for which students can pay $14/year to enroll in a class, and these accounts appear to have all of the features of a full account, other than "custom keywords"). The Poll Everywhere site is probably not ADA compliant unless linked through a compliant slide set. There is some faculty effort required to use all of the features, of PollEverywhere, as well as limited documentation. Email support was available with some delay.

One of us is exploring ways to continue using cell phones for classroom response. A competing product designed specifically for higher education, "Tophatmonicle" is being field tested by two CSUSB faculty during the 2011-2012 AY, but costs somewhat more than the new "student pays" option of PollEverywhere, or when using for multiple quarters, costs more than clickers. PollEverywhere continues to develop, and in addition to the new "student purchase" option, now has a limited grading features for questions that has not been explored. Finally, using cell phone response as an optional portion of the grade, or as "extra credit" may be an option to avoid student dissatisfaction with expense and/or technical issues.