

**Improving student learning and student retention at the undergraduate level  
Application Cover Sheet**

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Collaborators Department of Biology; other departments with Pre-Med majors

Title: Improving Retention and Success for Chemistry, Biology and Pre-Med majors  
Entering Freshman Chemistry (Chem 1211K and 1212K) Sequence

Theme Use of placement exams, non-lab basic chemistry course, tutorials and  
enhancing advisement to improve retention and success of students unable to register in  
the Fall term

College rating APPROVED

## **Improving Retention and Success for Chemistry, Biology and Pre-Med Majors Entering Freshman Chemistry (Chem 1211K and 1212K) Sequence**

**Summary of Project:** Students will be required to pass a chemistry high school equivalency placement exam before taking General Chemistry I (Chem 1211K, Science/Pre-med majors). The major goal is to improve the success rate in Chem 1211K to keep a large cohort of the best prepared students on track to graduate in a timely manner. Student background and preparation will be screened by use of a nationally accepted placement exam. During our initial pilot study students who scored below random on the placement exam were given advisement before being placed in a preparation course, with peer-led tutorial support, that must be passed before advancing to Chem 1211K the next term. We see that the combination of a placement exam, advisement and a preparation course to have an immediate positive effect by opening up at least 20% of the Fall seats to prepared students (see below) and lead to an overall higher success rate for Pre-Meds.

Over the last several years, the increased quality of admitted Freshmen has resulted in large increases in science and pre-med majors in several departments including Chemistry and especially Biology. Many of these students want to take Chem 1211K in the Fall. Several years ago, the Provost generously provided funds to build desks for two additional sections of Chem 1211K for the Fall using all the available remaining space.. The capacity of the Fall 1211K course was increased from 384 to a maximum of 480 students. This improved the situation for a while, but continued growth has taken place such that the maximum capacity is still short of the current Fall demand. For example, the Biology major entering Freshman class alone has increased to approximately 500. Since an estimated 800 science and pre-med majors all need to start Chem 1211K (Freshman Chemistry) in the Fall, course capacity and success rate have become major issues leading to bottlenecks, student frustration, and lowered retention rates. Students who cannot register for Fall end up taking the course either in the Spring or Summer, essentially falling up to one year behind on the graduation date.

We have carried out an analysis of what is needed to improve the student outcome for this sequence. We have found that at least an above random score on the placement exam (California Diagnostic Exam used to measure H.S. level knowledge with nationally accepted norms) or an AP Advanced Chemistry score of 2 are necessary to pass. Thus, the student who enters 1211K would have at least the *minimum* background for success and retention. Students also lack knowledge of the difficulties and approaches required to be successful as Pre-Med focused majors. Specific early advisement and interactions with faculty Pre-Med advisors and successful peers are needed. With better prepared students, one would expect a substantial reduction in the current Fall DFW rate from ~33% to around 20% and in fact we see a 15% projected DWF rate for Spring 07, the semester that the pilot program was put into place. Since Freshman chemistry is a prerequisite for Biology courses, a reduction of the DFW rate would directly aid the Biology success rate since more of the best students would be ready to take the Biology sequences in the next semester. Ultimately this would increase the four-year through six-

year graduation rates. In addition use of this exam would allow most of the prepared students to take 1211K in the Fall, removing much of the backlog and frustration. It would also lead to greater efficiency in these courses, increasing the available seats because students would not need to repeat as often.

**The Department had added a peer-led tutorial course (Chem 1201) to support Chem 1211K in an effort to reduce the DFW rate. This effort did greatly improve the DFW rate but with increasing class size seems to have hit a limit of reducing the overall rate to around 33%. Individual sections have had rates as high as 42%. The Department gave the diagnostic placement exam (H.S. equivalency) the first day of Fall term several years ago and was shocked to find that at least 20% of that term's total 1211K enrolled students scored random (0%) or below. Interestingly, any student who scored on scale had a reasonable chance of passing 1211K. Some of the random score (0%) students that term were convinced to drop back to Chem 1050 (no lab) to make up the background problems. Of the remaining ill-prepared students who chose to remain in 1211K, almost all were part of the DFW outcome. Of the ~30 students who dropped back to Chem 1050, approximately 20 (67%) were able to pass that course and then take 1211K. This last Fall, we again gave the placement exam the first day. The random (0%) and below rate was still at least 20% of the class with some sections as high as ~25%! This time we could not convince any of these ill-prepared students to drop back. Advisement is needed at this point. Sadly, the course DFW rate remained ~33%.**

The students who score random or less on the placement exam must be given a path toward success. Normally, they could register for Chem 1151K, which does not require a high school chemistry background, but space is also a problem in that course. After advisement by a faculty Pre-Med advisor, these students will be placed in Chem 1050 (no lab and therefore no space limitations) with small added peer-led tutorial classes (Chem 1202) for additional support. A faculty Pre-Med advisor and successful peers (recruited from the GSU American Medical Students Association) will meet regularly with this group of students as well as those in Chem 1211K to help the students understand the approaches needed to be successful in a Pre-Med focused major. In Chem 1050, we can and will instill the skills necessary to be successful in Chem 1211K. For each term, we propose adding special sections of Chem 1050 with added peer-led tutorials to prepare (salvage) these students. Students who successfully complete Chem 1050 will then be able to register for 1211K the next (following) term. Thus, we should be able to get many of these students back on track after only one semester. Based on our limited trial, up to two-thirds of these students may be saved but we suspect that we may only be able to salvage half of this group. This is still a substantial improvement over the current situation in which essentially none of these students continue!

**Evaluation of Process:** Please see the yearly report on grant CHRPG submitted 03/01/07.

## Department of Chemistry

### Preliminary Report on Grant CHRP

A total of \$38,960.00 was received for this grant to improve student retention and progression through the general chemistry sequence. At this time \$14,150.00 has been spent on graduate assistants and an additional \$16,483.91 on student assistants. The remaining funds will be spent by the end of April with an additional \$10,000.00 needed to cover necessary remaining costs.

#### I. Administration of the placement exam

Our pilot program for increasing the number of students who successfully complete chemistry 1211K was begun with the implementation of voluntary placement testing. During fall '06 the California Placement Exam was administered to 210 students by the department of chemistry. A total of 15% of the students taking the test did not make above random test and were asked to consider taking Chemistry 1050, a course which was developed to strengthen the basic skills needed to successfully complete chem. 1211K.

The admissions and standards committee overwhelmingly approved the implementation of mandatory testing for chemistry 1211K starting in SU '07. The department feels that this will give more students the opportunity to successfully complete the general chemistry sequence with a lower DWF rate.

#### II. Chemistry for Citizens (Chemistry 1050)

The number of students who registered for chem. 1050 more than doubled from spring 06 to spring 07, which was expected because of the placement exam. In addition to the faculty member who taught chem. 1050 a peer leader was assigned to assist students outside of class. We anticipate that the demand for chemistry 1050 will increase, especially in the fall semester which will double or triple the number of GLA's needed to staff this course properly.

#### III. Staffing of peer led tutorials for 1211K students and GLA's for the pre-med advisor

Three tutorials (Chem 1201) were offered in which students could receive help with problem solving techniques. These tutorials are popular with the students as they are allowed to ask questions to a peer leader (SA or GLA) and get help in small groups (30 as opposed to 120-200 in the lectures).

**Evaluation of the Process** The major indicator of the success of this program would be a decrease in the DWF rate for chemistry 1211K. A preliminary look at 1211K scores up to this point indicates 23 students in the D or F range and another 4 who have withdrawn

from the course. If this trend holds true this would be a 15 % DWF rate, which is far below the rate that is usually associated with this course.

Another indicator of success would be the success rate of students in 1050. Currently 6 out of the 34 students would receive a D, W or F with the rest of the students receiving A's and B's. This would be a 82 % success rate for students in the introductory course which should indicate that these students would be able to complete 1211.

The success of the proposal depends also upon the number of students who succeed in chemistry 1211K after taking 1050. Currently we have 9 students in 1211 who enrolled in 1050 during the pilot program, of these only 2 have a D, W or F at midterm. This number is above the 67% anticipated to successfully advance through the general chemistry sequence after taking chem. 1050.

In summary we consider the pilot program to be a success. Students who are enrolled in 1050 are making the appropriate progress in order to successfully complete chemistry 1211 and past students who have completed chemistry 1050 in the fall are successfully completing 1211 this semester. Funding for the additional SA's and GLA's needed for full implementation of this project is not available at this time and therefore the chemistry staff will be called upon to bridge the gap until fall semester.

## Budget Tied to Goals

### A. Costs Associated with Giving the Placement Exam

Estimated Number of Students Who Need to Take Placement Exam	Proctors Needed
Summer 07 150- 250	4 x 2 sessions 8 = \$ 160
Fall 08 600-800	5 x 5 sessions 20 = \$ 1,000
Spring 08 150 – 250	4 x 2 sessions 8 = \$160
Grading/ student notification	S.A. costs \$500
	Subtotal \$1,820

Exams will be given in 576 Kell (max 48) or 218 NSC (max 75 students): at least 5 times for Fall semester and 2 for Spring and Summer semesters

### B. Costs Associated with Preparation Courses and Supporting Tutorials

Estimated Number who Fail Placement test	GTA support (Chem 1050)	SA support (tutorials)
Summer 07 45 – 65	2 @ \$2,900 = \$5,800	3 @ \$500 = \$1,500
Fall 08 100 – 120	3 @ \$2,900 = \$8,700	4 @ \$500 = \$2,000
Spring 08 45 – 65	2 @ \$2,900 = \$5,800	3 @ \$500 = \$1,500
	GTA \$20,300	SA \$ 5,000
Total		Subtotal \$25,300

### C. Costs Associated with Advisement for Chem 1211K and Chem 1050

GTA support for a Pre-Med faculty advisor	3 @ \$2,900 = \$8,700
SA support for Pre-Med upper level peer mentors (various majors recruited for GSU American Medical Students Association)	Summer 07 6@ \$500 = \$3,000 Fall 08 12 @ \$500 = \$6,000 Spring 08 6 @ \$500 = \$3,000
	Subtotal \$20,700

Total Estimated Costs

\$47,820