Chemistry 100 Report - Spring 2008

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1 Introduction

With UC Merced completing its third year of teaching undergraduates, our native students have begun to reach upper division chemistry courses. Concern has been expressed in regards to student performance at mid-semester of the spring 2008 Chemistry 100 course. Although this text focuses on Chemistry 100: Organic Synthesis and Mechanism, we hope to start a discussion on the lower division chemistry sequence and any issues surrounding the courses.

2 Results

For the purpose of this document, a student receiving a "C-" or better is defined as passing. In addition, a native student is defined as a student taking Chemistry 1 and/or 2 at UC Merced.

Chemistry 100 is in its second term of being offered. Results are as follows.

- Spring 2007, approximately 16.6% did not pass (24 enrolled)
- Spring 2008 at mid-semester, approximately 51% are not passing (98 enrolled)

With Chemistry 100 only in its second term, we do not have ample data to draw significant comparisons. We attempt to explore reasons for this poor performance.

3 Data Analysis of Chemistry 100 Spring 2008

The number of students receiving a D or F at mid-semester in Chemistry 100 is cause for concern. Data surrounding the course was collected to help formulate a directed discussion for improvement of student learning.

3.1 Structure of Chemistry 100 and Review of Grading Policy

CHEM 100 consists of two 80-minute lectures each week. Prior to each lecture, Dr. Meyer posts lecture notes on UCM Crops which are available to all students. A quiz is given each week at the beginning of class. CHEM 100 has a corresponding 1-credit lab, CHEM 100L, which the majority of students take concurrently with CHEM 100. For this reason the CHEM 100 syllabus states that it will use the first 30 minutes of each lab as a "discussion time."

Grades in CHEM 100 are curved, with total possible points of 1000. Points are assigned as follows.

- Quizzes – A short quiz is given each Thursday at beginning of lecture. Best 13 of 15 are averaged and scaled to point total of 600 points. Students have 10 minutes to complete quiz.
- Final exam – 400 points

This grading scheme is similar to that in CHEM 8: Principles of Organic Chemistry, the pre-requisite for CHEM 100. CHEM 8 has an included lab component worth approximately 15% of course grade.

3.2 Analyzing the academic history of students enrolled in CHEM 100 during spring 2008

Comparing the academic history of students enrolled in CHEM 100 from spring 2007 to spring 2008 yields the following results.

Spring 2007 (24 students enrolled)

- 7 native students, 1 (14.3%) did not pass
- 17 transfer students, 3 (17.6%) did not pass
- 17 students took CHEM 8 with Dr. Matt Meyer during spring 2006, only 2 of which (11.8%) did not pass

Spring 2008 (98 students enrolled)

- 73 native students, 36 (49.3%) are not passing
- 25 transfer students, 14 (56%) are not passing

The enrollment for CHEM 100 has more than quadrupled in size and, although not surprising, the largest increase comes from the number of native students.

As stated in the 2007 – 2008 academic catalog, CHEM 8: Principles of Organic Chemistry and CHEM 10: General Chemistry II are both pre-requisites to CHEM 100. With the largest increase being students who attend the lower division courses at UC Merced, it seems fitting to look at these two courses and how they may correlate to CHEM 100. Specifically we will look at how students who took CHEM 8 are performing in CHEM 100 and the sequence they took CHEM 8 and 10.

Table 1. Summary of student enrollments for CHEM 8, success in CHEM 8, number of students enrolled in CHEM 100 during spring 2008 that completed CHEM 8 in particular semester, and success of those students in CHEM 100.

Semester	Enrollment	Number passing CHEM 8 with "C-" or better	Number of students in CHEM 100 Spring 2008	Number of students receiving A, B, or C
Spring 2006	25	19 (76.0%)	3	3 (100%)
Summer 2006	17	15 (88.2%)	5	3 (60.0%)
Fall 2006	93	67 (72.0%)	29	17 (58.6%)
Spring 2007	80	57 (71.3%)	22	10 (54.5%)
Summer 2007	36	29 (80.6%)	14	7 (50.0%)
Fall 2007	88	64 (72.7%)	17	7 (41.2%)

In Table 1, we see that the enrollment numbers for CHEM 8 have started to level off near 85 students during fall and spring semesters, with approximately 72% of students passing. During summer semesters, passing rates increase significantly, which may be due to smaller class sizes. In addition, students who took CHEM 8 with Dr. Meyer are doing very well despite the lapsed time, as they were during the spring 2007 offering of CHEM 100. To some degree, we should expect this to be the case – students are familiar with Dr. Meyer as well as his teaching approach. In addition, Dr. Meyer knows his expectations of students in CHEM 100 and can align his teaching in CHEM 8 for student success in subsequent courses.

Examining the correlation between CHEM 8 and CHEM 100 further, we look at grades in CHEM 8 and their current grade in CHEM 100. The results are as follows.

- 77.3% (17 of 22) of students who received an A+, A, or A- in CHEM 8 are passing CHEM 100 at mid-semester
- 51.4% (19 of 37) of students who received a B+, B, or B- in CHEM 8 are passing CHEM 100 at mid-semester
- 30.0% (9 of 30) of students who received C+, C, or C- in CHEM 8 are passing CHEM 100 at mid-semester

The chemistry faculty can comment more on their expectations of preparedness for students who receive an A, a B, or a C in CHEM 8. Generally, a passing grade in a pre-requisite course should indicate that they have obtained the necessary skills to continue on. However, we are seeing approximately 1 in 2 students who received a B+, B, or B- are passing CHEM 100. Furthermore, approximately 1 in 3 students who received a C+, C, or C- are passing CHEM 100.

3.3 Sequence of Pre-requisites

Next we look at the sequence of courses to see if the order students are taking pre-requisites may have an effect on their performance in CHEM 100. Of students enrolled in CHEM 100 spring 2008,

- 51 (52%) took CHEM 8 before CHEM 10, 49% (25) are receiving a D or F.
- 27 (27.6%) took CHEM 10 before CHEM 8, 51.9% (14) are receiving a D or F.
- 20.4% (20) did not take CHEM 8 and 10 at UC Merced, 55% (11) are receiving a D or F.

It is clear that most students took CHEM 8 before CHEM 10, although CHEM 8 is more aligned to prepare students for CHEM 100. One would assume taking CHEM 8 before CHEM 10 would be disadvantageous due to the time passed between CHEM 8 and CHEM 100. At this point, however, this does not appear to be the case. Both sequences are exhibiting approximately 50% of students failing at mid-semester.

In addition, it has been brought to my attention that an adjustment has been made in regards to this chemistry course sequence. Approximately one year ago, the chemistry faculty felt more chemistry background is needed prior to taking CHEM 8. Thus, the

adjustment has been made that a student must either pass CHEM 2 with an "A-" or better or pass CHEM 10 with a "C-" or better in order to enroll in CHEM 8. The effects of this change are still unknown. Will the additional chemistry experience prior to CHEM 8 allow for topics to be covered in more depth and breadth, ultimately increasing students' preparedness for CHEM 100?

3.4 Results of Lab Sections

Table 2. Summary of lab sections, time offered, and student performance in CHEM 100.

Section	Time Offered	Enrollment	Number Passing CHEM 100
1	R 1:00 - 3:50pm	18	10 (55.6%)
2	R 5:00 - 7:50pm	16	10 (62.5%)
3	F 10:00 - 12:50pm	18	9 (50.0%)
4	F 3:00 - 5:50pm	15	7 (46.7%)
5	W 4:00 - 6:50pm	15	7 (46.7%)
No Lab	N/A	16	7 (43.8%)

From Table 2 we see that most students (82 out of 98) take the lab concurrently with CHEM 100. Of the 16 students who are not currently enrolled in lab, 4 are students who previously took CHEM 100 and failed and 2 of those 4 are failing at mid-semester.

3.5 Discussion with Instructor

On 11 March 2008, I spoke with Dr. Matt Meyer to discuss his spring 2008 Chemistry 100 course. During this discussion, Dr. Meyer explained his teaching of the course as "exactly" as he had during the spring 2007 semester. During that term, he had given 7 students an "A" and felt confident about those grades. Dr. Meyer describes the effort of students during the spring 2008 term to be very low. To test this hypothesis, he devised a small "test." After one of the weekly quizzes, of which the majority of students "bombed," he held a "remedial week." The following week, he administered a quiz almost exactly identical to the quiz given a week prior. Again, most students scored very low, thus, confirming his claim of students' lack of effort outside of class.

In contrast, he is seeing 20 – 30 students attend office hours, a good turnout by most instructor's expectations. Per Dr. Meyer, these students attending are not necessarily the top performing students but they have, indeed, seen improvement in their grades.

In addition, he has advised students currently receiving less than 50% of the possible points on quizzes to drop. As of the latest numbers, approximately 8 students have dropped since mid-semester. Dr. Meyer has also pointed out that "if he knew he would have this type of population every year, he would cover less material and go slower."

3.6 Discussion with Students

On 4 April 2008, I held a focus group which contained 5 students[*], one student from each grade category. On average, students said they spend 25 hours a week outside of class

[*] 16 students were invited.

studying for CHEM 100. While it is inappropriate to take much from a single student's comments, some common themes were exhibited. In no particular order, they were:

1. Instructor knows material very well.
2. Students feel their chemistry background is not adequate. Depending on which professor they had for CHEM 8 depends on what subjects they have been introduced to prior to CHEM 100, each group felt they were disadvantaged in some way.
3. Instructor uses humor to connect with students. Some students find humor funny while others find it condescending and inappropriate.
4. More time should be allowed for completion of quizzes.
5. Office hours go over quiz questions leaving little time for other questions. Outside of office hours, it is difficult to reach instructor.
6. Students agree that regardless of how instructor chooses to run course, it is their responsibility to learn material on their own.
7. Students do not like grading policy.

Students had suggestions for change. Of those they noted that while they enjoy lecture notes posted online, lectures follow notes word-for-word with little deviation. Students admitted there are many students who do not attend lectures or attend only to take the weekly quiz and then leave. Students recommend either not including all information in online version of notes. This will provide incentive for students to attend lecture.

Another change they recommended be made is the addition of a discussion section. Even though the syllabus states first 30 minutes of CHEM 100L should be used as a discussion section, it is rarely used as such. Furthermore, the lab is not required for CHEM 100 and labs are not connected with lecture. For these reasons, labs do not supplement learning of CHEM 100 topics and should not be used for discussion. For these reasons, students suggested making CHEM 100L a component of CHEM 100 with labs corresponding to topics in CHEM 100 and treating first 30 minutes as a discussion section. Alternately, students suggested keeping the lab separate and adding a discussion component to CHEM 100.

3.7 Summary and Next Steps

At mid-semester, UC Merced native students are exhibiting the same pass/fail rate as transfer students. However, we are seeing a gap between CHEM 8 and CHEM 100. For this reason, I recommend reviewing and aligning learning objectives. This consistency will help instructors know what needs to be done in order to reach common goals and student will have a clear knowledge of what is expected of them and what they will have obtained.