



CHEMISTRY
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To: John P. Ferraris
Interim Dean, NS&M

From: Inga H. Musselman
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Re: General Chemistry I, Fall 2005 Grades

This memo serves three purposes. First, it provides an explanation for the large number of D's and F's earned by students in the Fall 2005 offering of CHEM 1311 General Chemistry I. Second, it explores possible reasons why students perform poorly in General Chemistry. Third, it proposes changes that are expected to have a positive impact on student performance in this course.

1. Increase in total D's + F's owing to nature of different grading curves.

In Fall 2004, the General Chemistry "teaching team" consisted of Gregg Dieckmann (2 sections), John Sibert (1 section), and Dick Caldwell (1 section). The team administered common hour exams as well as a common final exam and graded the students in the different sections using the same scale. At Dick's suggestion, a unique curve, $= [100^{(1-0.8)}] * [(exam\ \%)^{(0.8)}]$, was applied to each exam grade, which preferentially raised the lowest grades. The resulting grade distribution at the end of the semester was: A's 13%, B's 31.8%, C's 23.4%, D's 16.5%, F's 15.3% (or 31.8% D's and F's).

In Fall 2005, the General Chemistry "teaching team" included Gregg Dieckmann (2 sections), John Sibert (1 section), and Warren Goux (1 section). Again, the team administered common hour exams as well as a common final exam and graded the students in the different sections using the same scale. In this semester, however, a straight or linear curve was applied to exam and final course grades, which raised each student's grade proportionally [The instructors believed this curve to be more fair.]. The resulting grade distribution at the end of the semester was: A's 12.3%, B's 20.7%, C's 26.4%, D's 13.6%, F's 27.0% (or 40.6% D's and F's). It was determined that if the unique 2004 curve had been applied to the 2005 scores, the total number of D's and F's (32.2%) would have been very similar to the 2004 number. Also, if the linear curve had been applied to the Fall 2004 scores, the total percentage of D's and F's (45.8%) would have been higher than that of Fall 2005.

It is also notable that course drop/withdrawal deadlines changed in Fall 2004. In Fall 2003, a course could be dropped (W) as late as Nov. 20th with the signature of the Associate Dean. As a result, students who were failing General Chemistry late in the semester typically withdrew from the course saving themselves an "F" on their transcript. Therefore, prior to 2004, F's were generally awarded in General Chemistry courses only to those students who didn't bother to withdraw. In Fall 2004 and Fall 2005, the last day that a student could drop a course (WP/WF) was October 21st and October 20th, respectively, one full month earlier than in 2003. In Fall 2004 and Fall 2005, the majority of students with low grades continued in the course beyond the drop/withdrawal deadline knowing that many more quizzes, two more hour exams, and a final exam were still to come.

In summary, the new drop/withdrawal deadlines have made it difficult for students who are performing poorly to drop a course. In addition, the application of the unique curve to Fall 2004 scores preferentially increased the grades of the poorer performing students, resulting in the granting of fewer D's and F's compared to Fall 2005.

2. Why are students doing poorly in General Chemistry?

(also see email sent by Warren Goux to General Chemistry instructors)

As discussed above, the low performance rate (D's and F's) in chemistry courses at UTD has not actually changed in recent years. Instead, a combination of the new early semester drop/withdrawal deadlines and the anomalous grading curve in Fall 2004 makes it appear as though performance has decreased. In Fall 2005, there was some variation in the total percentage of D's and F's among the 4 sections of General Chemistry I. It is unclear whether differences between instructors is significant, especially when there exists an 11% variation for one instructor (Dieckmann) who presumably taught the course in the same way to two sets of students.

1311 001 (Dieckmann): 34% D's and F's

1311 002 (Dieckmann): 45% D's and F's

1311 003 (Sibert): 33% D's and F's

1311 004 (Goux): 41% D's and F's

That said, it is still important to understand why so many of the enrolled students are struggling with chemistry. This spring during office hours, Warren Goux made an effort to engage poorly performing General Chemistry I students in a discussion of the course (see attached email). Warren then identified 3 categories of students.

Category I: Overburdened student

(course load too heavy; works too many hours per week; long commute)

Category II: Student ill-prepared for college chemistry

(several year gap between high school and college courses; poor quality of some high school chemistry programs)

Category III: Unengaged student

(does not attend class, does not complete homework, does not access course website)

3. What changes can be made in the instruction of General Chemistry to improve student performance?

- The overburdened student (i.e. category I student) and his/her family may benefit from additional advising/counseling prior to the beginning of the freshman year. They need to understand the demands of college, in general, and the gateway courses, specifically, (e.g. General Chemistry, Algebra, Calculus), and adjust their schedules to include sufficient time for study.
- The ill-prepared student (i.e. category II student). All students, and especially the ill-prepared student, would benefit from *small* mandatory lecture recitation sections. Recitation sections could be used to administer quizzes, to review key lecture concepts, and to work homework problems. These recitation sections could be staffed by the TAs and scheduled during the hour preceding the laboratory.
- The unengaged student (i.e. category III student). We have an *enormous* problem with student attendance. On a typical lecture day, somewhere between 25 and 50% of students are absent from class. During the fall of freshman year, when most students take General Chemistry, students are experiencing college life and its freedoms/choices for the first time. Whereas the high school student and/or parent is contacted when the student does not show up for school/class, a college student can be absent for many lectures before suffering any negative consequences, e.g. failing a quiz or exam. Once this cycle begins, it is often hard for a student to get back on track. Therefore, during this transitional freshman year instructors should consider using teaching methods (both mechanics and pedagogy) that encourage class attendance, e.g. taking attendance, assigned seats, unannounced quizzes, not posting *everything* related to class on the web, working of problems in class, interesting chemical examples, etc.

Other ideas to improve General Chemistry at UTD:

- Change how General Chemistry is taught. A) Assign one faculty member to a very large lecture section and assign other faculty (as opposed to TAs, see above) to small recitation sections. B) Schedule more sections of General Chemistry so that the number of students in each section is smaller.
- Separate students into introductory and honors general chemistry courses.
- Assign graded homework.

Changes that will be implemented in Fall 2006:

- Exams of a length to be given in a 50-minute class will be administered in the evening in a 1-½ hour time block. We believe that this will reduce the anxiety of students taking exams and provide them with additional time to check their answers.
- The faculty who currently teach General Chemistry at UTD have agreed to a set of grading standards.