

**To: Sharon Calhoon**  
**From: NIMS Chemistry Faculty**  
**Subject: Chemistry Degree Assessment Report**  
**Period Covered: Spring 2006-Fall 2007**  
**Date: October 31, 2007**

## **I. Brief Summary of Assessment Plan**

We have decided to select Goal I: Students earning a Bachelor of Arts degree in Chemistry will demonstrate knowledge and understanding of the theoretical basis for descriptive chemistry. We tested the CHEM-C 106 students using a multiple choice examination prepared by Dr. Gillette and reviewed by the other chemistry faculty. We tested the CHEM-C 211 students using an examination prepared by Dr. Gillette. Dr. Xie used the organic chemistry examination prepared by the American Chemical Society to assess CHEM-C 343 students.

The benchmarks we have selected are:

- CHEM-C 106: Because this examination had not been tested previously, the only valid benchmark we can anticipate is a strong correlation between the success of students on this examination and their final grades in the course.
- CHEM-C 211: Based on our previous experiences with this examination, slight changes have been made to better test the desired outcome. Because enrollment is so low in this course (three students in Fall 2006) it has been difficult to set a benchmark. We would expect to see a strong correlation between the score and student's final course grade.
- CHEM-C 343: Dr. Xie has set performance at the national average as a benchmark for this examination.

## **II. Assessment Methods**

- CHEM-C 106: Dr. Gillette prepared a 42-item multiple choice exam that was reviewed by department members and was given in May, 2007. This examination was worth 100 of the 460 available points upon which the grades were based. Because the exam had never before been used, we have nothing concrete with which to compare student results, except for a measure of overall student performance, and a correlation between individual student performance on this examination and final course grades.
- CHEM-C 211: Student(s) demonstrated their understanding of the course material by completing a two-problem, open book, written examination. Each problem involved a scenario in which the student, working in a commercial analysis laboratory, is contracted to analyze a hypothetical sample for a specific substance. Students must design an analytical method based on the equipment and reagents present in their "analytical business" and prepare a complete procedure for each analysis, including standardization of reagents. They present this information to the instructor, who then generates data appropriate for the analysis. Using these data, students determine the outcome of the analysis and write a formal report to the person requesting the analysis. This examination, which counts for 200 points of a possible 800 points in the course, was last given by Dr. Gillette in December, 2006.
- CHEM-C 343: Dr. Xie gave the American Chemical Society organic chemistry examination in May, 2006. Students are accountable for their performance on this examination because it is worth 200 points of the total of 600 available points upon which their final grade is based.

### III. Description of Assessment Results

Only very limited data have been collected since the assessment document was prepared because the number of chemistry majors is small.

- CHEM-C 106: Results of the department exam, completed by eighteen students, are shown below.

Department exam, %	Final course average, %	Final course grade
65	61	C-
86	96	A
67	90	A-
41	56	D
48	59	D+
26	28	F
79	89	A-
98	100	A+
81	88	A-
55	74	C+
65	61	C-
67	72	C+
60	65	C
62	75	B-
69	76	B-
72	85	B+
67	78	B-
76	80	B
Average: 66%	Average: 74%	

- CHEM-C 211: Three students completed CHEM-C211 in Fall 2006.

Final exam score	Overall course average	Final course grade
170/200 (85%)	95%	A
190/200 (95%)	95%	A
190/200 (95%)	92%	A-

- CHEM-C 343: Dr. Xie's students took the nationally-normed American Chemical Society organic chemistry examination in Spring 2006. Dr. Xie's students averaged a score of 42.125, while the national average for the same exam was 39.22. This certainly speaks well to the manner in which Dr. Xie presents what is, admittedly, a very difficult subject, to her class. The data also indicate a direct correlation between the students' earned course grades and their performance on the exam (see below).

ACS Exam Score of a possible 70	Final Course Grade
35 (50%)	D
49 (70%)	B
51 (73%)	A-
34 (49%)	C+
33 (47%)	C
40 (57%)	C+
35 (50%)	C+
60 (86%)	A+

The average score on the ACS exam for Dr. Xie's students was 42.13 (60%), while the national average for the same exam was 39.22 (56%). Note that Dr. Xie's students exceeded the national average in their scores on this examination, and, thus, they have more than met the benchmark identified for this examination by Dr. Xie. This certainly speaks well to the manner in which Dr. Xie presents what is, admittedly, a very difficult subject, in her class.

#### IV. Using Assessment for Program Improvement

The most significant response to changes we've made resulting from assessment work relate to the relative successes of students completing CHEM-C 106 and moving to CHEM-341 the next fall. For more than ten years, students in the freshman chemistry class (C105/C106) had not been required to do a particularly large amount of problem solving as part of the curriculum. In our 2006 assessment report we noted that this lack of experience on the students' part appeared to make their transition to organic chemistry difficult. To help correct this situation, the C105/C106 course requirements were revised to include a problem solving component. While it is unreasonable to judge the success of a curriculum change on the basis of a single set of results, a comparison of student achievement on the first exam in C341 in 2006 (students having little problem solving experience) and 2007 (students who just completed C105/106 having considerable problem solving experience) is interesting. According to Dr. Xie, the two exams were very similar in content, and both included the opportunity for students to earn 10 extra points. Scores marked with a double asterisk (\*\*) are for students who took C105/106 in Fall 2006/Spring 2007; the unmarked scores are for students who either took their freshman chemistry more than one year ago, or have transferred to IU Kokomo from another institution where they took their freshman chemistry. While the comparative test score averages clearly support the practice of requiring C105/106 students to have extensive problem solving experiences, conclusions drawn from such a small sample have no real validity. It will be critical for us to follow this trend over several years before we can establish the merits of the curriculum change.

C341 Exam 1 Scores, 2006, %	C341 Exam 1 Scores, 2007, %
73	95**
61	94.5**
76	73.5
43.5	45
57.5	98.5
85	60
92.5	60**
63	99**
81.5	98.5**
49.5	76
67.5	76.5**
78	90.5**
96	75**
31	58
64	62
72.5	105
41	
Average: 66.6%	Average: 79.2%
	Average of ** scores: 86.1%

A second reflection of our use of assessment data to promote program improvement relates to curriculum. After a thorough comparison of the requirements for our BA degree in Chemistry with

the requirements for similar degrees on our peer campuses, and a discussion of the math background necessary for students to understand physical chemistry and inorganic chemistry, we decided to change the mathematics requirement for our degree from MATH-M215 and M216 to MATH-M119 and MATH-120. We hope this change will make the Chemistry major more accessible to a greater number of students.

## **V. Dissemination of Results**

Students learn of the assessment results because, in each case, the grades they earn on the exams count heavily into their final course grades. Faculty/staff learn of the results when the department members meet to consider program changes and/or modifications.