

Assessing Student Performance Using Standardized Exams



Abstract

One main focus in our assessment strategy is to continually monitor the student performance in our chemistry courses using standardized exams provided by the American Chemical Society (ACS). In addition we are keeping track of the student performance on the professional exams such as the MCAT. The results are reviewed by the department and adjustments made in the curriculum and teaching to maintain high performance levels with the main outcome of our students being successful in achieving their career goals in chemistry.

Goals for our Chemistry Graduates

General Goal I: Our students will be prepared for professional careers in chemistry

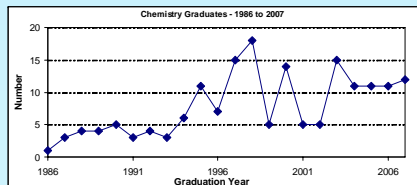
- as skilled entry level employees in industry
 - as enthusiastic educators in elementary and secondary schools
 - as competent graduate students in chemistry, biochemistry, and chemical engineering
 - as motivated medical and dental students
- Success in Achieving Career Goal:** 75% of our students will enter the career path of their choice in the chemistry area as defined by the four listed above.
 - A professional curriculum:** Our students will experience a curriculum as close as possible to that recommended by the American Chemical Society Committee on Professional Training (ACS CPT).
 - Technology:** Our students will be exposed to, and have competence in, the operation and analysis of state-of-the-art scientific equipment, software and the data produced.
 - Chemical Knowledge:** Students will demonstrate a breadth and depth of knowledge in chemistry. This will be evidenced by average performance on ACS National Exams of least the 60th percentile, and 30% of the students will score above the 80th percentile, in each course that has an exam. The average score on the Physical Science (PS) and Biological Science (BS) areas of the MCAT will be at 60th percentile.
 - Laboratory Skills:** Students will demonstrate a sophisticated level of laboratory skills, including experiment design and problem solving, by the time of graduation. At least 50% of our graduates will be involved in a summer research project; either at Westmont or another facility, and; at least two graduates per year will complete a major honors project.
 - Scientific Curiosity:** Our students will develop a love of learning and an enthusiasm for chemistry as a science and discipline.

General Goal II: Our students will be experienced at reconciling Christian and secular scientific world views

The students will be knowledgeable in the area of the interface between Christian Faith and science and the times when they may appear to be at odds, and when they agree. They will have a perspective that integrates their scientific and theological beliefs into a seamless whole.

Number of Graduates in Chemistry

- There has been a steady increase in the number of chemistry graduates over the last 20 years, with an average of 11 graduates per year in the last 12 years.



Chemical Knowledge Assessment

Specific Goal 4

Chemical Knowledge: Students will demonstrate a breadth and depth of knowledge in chemistry. This will be assessed by monitoring performance on standardized exams.

- Average performance on ACS National Exams will be at least the 60th percentile
- 30% of the students will score above the 80th percentile, in each course that has an exam.
- The average score on the Physical Science (PS) and Biological Science (BS) areas of the MCAT will be at 60th percentile

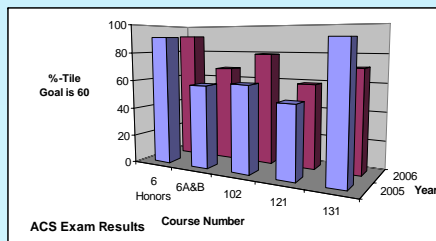
Data Collection and Analysis

Beginning in 2004, data from these standardized exams are being collected, stored and analyzed.

American Chemical Society National Exam Results

Percentiles based on National Norms							
Spring 06	Course Number	Number of Students	%Tile	Std. Dev.	Range	Above 80%tile	Percent above 80%tile
Gen. Chem.	6 Honors	21	92	8	72-99	20	95%
Gen. Chem.	6A&B	58	68	23	17-99	21	36%
Organic	102	40	79	18	26-97	27	68%
Analytical	121	10	59	22	13-87	2	20%
P.Chem.II	131	5	71	12	56-83	2	40%

Spring 05	Course Number	Number of Students	%Tile	Std. Dev.	Range	Above 80%tile	Percent above 80%tile
Gen. Chem.	6 Honors	24	91	9	65-99	21	88%
Gen. Chem.	6A&B	64	58	20	17-98	8	13%
Organic	102	48	60	28	5-100	13	27%
Inorganic	104	8	58	18	27-88	1	13%
Analytical	121	12	50	28	9-93	2	20%
P.Chem.II	131	5	91	7	83-99	5	100%



MCAT data:

Our students' MCAT scores for 4 exams in 2004-2006 placed them at the **66th and 61st percentiles** in the physical and biological sciences areas, respectively.
Goal: 60th percentile

Rationale and Analysis

One main goal for our graduates is that they be prepared for professional careers in chemistry. We track our graduates to see if they are successful in attaining their career goals in chemistry.

- 79% of our graduates during the years 1999-2002 were successful in attaining their chemistry related goals. (23 of 29)

Knowledge in and mastery of chemistry and chemical concepts are important components in the student being successful after graduation. Evidence about how the department is performing in this preparation can be obtained from the standardized exams.

The faculty are constantly in dialog about how our students are doing in a particular course that has an exam. We have been doing this informally for over 25 years, but now we are being careful to document the results in each class.

Exam data are used in two ways:

- As a check on course content to assure that we are covering the current topics in a thorough manner
- Adjustments in teaching style are made as the material and students change

Each year the department discusses the results of the standardized exams, compares them to previous years results and then brings in the perceived quality of the class. Adjustments are made for the following year as needed. Since we have small numbers of students in the upper-division classes, there can be a large variation from one year to the next. This is why the trend over several years is most important in analyzing the data, plus input from the other professors about the level of the current class is helpful.

Our students have done well on their standardized exams and have achieved their career goals. We will continue to use these exams as a check on the effectiveness of our teaching.

Summary and Conclusion

- Our goal of an average of 60 percentile or greater on the ACS exams given in our classes was attained in all but one course in 2006 and that one was at 59 %tile.

- Our goal of 30% above 80 percentile was reached in 4 of 5 exams given in 2006.

- Our goal of an average of 60 percentile or greater on the Biological and Physical Science part of the MCAT was attained in the 2004-2006 period.

- The use of standardized exams in assessing student outcomes is a valid and useful tool.

- Next Step:** Do an item analysis on each exam to see which areas are weak and need special attention.