Millikin University
Student Learning in the Chemistry Major

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July 1, 2007

Executive Summary

The Department of Chemistry supports the mission of the university in preparing students for professional success, democratic citizenship in a global community, and a personal life of meaning and value by producing graduates who achieve the following three chemistry-specific learning outcome goals:

1. Demonstrate the skills to solve problems and communicate through writing and speaking.
2. Discover how to integrate and apply knowledge and skills both within the chemistry community and between chemistry and other disciplinary communities.
3. Develop the capacity to address real-world scenarios in which chemistry plays a role.

Our curriculum introduces each student to the five sub-fields of chemistry recommended by the Committee on Professional Training of the American Chemical

Report

Goals

The Department of Chemistry supports the mission of the university in preparing students for professional success, democratic citizenship in a global community, and a personal life of meaning and value. The mission of the department is to produce graduates who achieve the following three learning outcome goals:

1. Demonstrate the skills to solve problems and communicate through writing and speaking.
2. Discover how to integrate and apply knowledge and skills both within the chemistry community and between chemistry and other disciplinary communities.
3. Develop the capacity to address real-world scenarios in which chemistry plays a role.

The successful graduate of the Department of Chemistry is not necessarily a professional chemist. For example, recent graduates are working in the chemical and pharmaceutical industry, practicing medicine or pharmacy, selling technical goods and services, running their own businesses, teaching, and working in the areas of government and law, among other things.

Snapshot

The Department of Chemistry is approved by the Committee on Professional Training (CPT) of the American Chemical Society (ACS). The department consists of five full-time faculty members representing the five major sub-fields of chemistry: analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. All chemistry majors choose one of four emphases: biochemistry, business, research, or secondary education. Students complete 23 credits of common core courses plus additional courses specific to the emphasis. Our CH121-General Chemistry course serves approximately 250 students per year, including students majoring in chemistry, biology, nursing, elementary education, athletic training, physical education, psychology, and exploratory studies, *inter alia*

with the fall 2005 semester, we instituted a math proficiency requirement for CH121 enrollment. In terms of staff, the department was reduced from 5.5 FTE to 5 FTE beginning in the fall 2004 semester.

The Learning Story

Three hallmarks characterize the typical learning experience provided through the chemistry major:

1. **Do Chemistry as Chemists Do It**
   Students use modern instruments from the first lab class in the first year; repeating experiments should be normal, not remedial. The desired outcome of an experiment is an accurate, reproducible, unambiguous result, not a predestined "right one."

2. **Modern Chemistry is Integrated**
   Chemists address problems with concepts and techniques that span the various sub-fields of chemistry. Moreover, biologists, nurses, psychologists, and physicians also regularly use these same concepts and techniques.

3. **The Main Goal of Laboratory is Tackling a New Problem Capably**
   We design experiments to develop maximum independence, not maximum coverage.

The curriculum map is included as Appendix 1. Our core curriculum introduces each student to four of the sub-fields of chemistry while providing a foundation in essential laboratory techniques. The additional courses in each emphasis then offer students more specialized technical training. Regardless of emphasis, undergraduate research is the capstone of the chemistry major at Millikin. It has four components, including the proposal, the research, a final written report, and a final 1 Tfwrddhie thesntaginae.

appropriate adjustments taken to reach an acceptable level or desired rate of improvement): 60% to 80% of the students ranked “adequate” or “excellent”; and “Red light” (our current status or direction of change is unacceptable. Immediate, high priority actions should be taken to address this area): fewer than 60% of the students ranked “adequate” or “excellent”.

For reporting purposes, a rubric numeric score of 13-14 will be considered “excellent”; a score of 8-12 will be considered “adequate”; and a score less than 8 will be considered “nominal”.

Assessment data are listed in the tables below.

Table 1.

Department Goal 1: Demonstrate the skills to solve problems and communicate through writing and speaking.

Rubric Category	Percentage of students in category
Excellent	0
Adequate	83

Table 3.

Department Goal 3. Develop the capacity to address real-world scenarios in which chemistry plays a role.

Rubric Category	Percentage of students in category
Excellent	14
Adequate	86
Total of above (used for rating)	100
Nominal	0
Number of students evaluated	7
Average numeric score	10.6

Rating for goal 3: “Green light”.

Table 4.

Year-by-Year Comparisons.

		2006	**2007**
1	Rating percentage	75	83

Final Presentation: written and oral report of results

	Excellent	Adequate	Nominal
Report	[5 points] A report having quality that might be submitted to a research journal. Includes background, data and methods, results, and discussion. Includes suggestion for further work.	[3 points] A good report but missing some aspect of an excellent report	[1 point] A report having minimal value
Oral Presentation	[5 points] Clear, confident presentation. Audience questions are answered in a way to illustrate a complete knowledge of the topic.	[3 points] A good presentation but lacking clarity or confidence.	[1 point] An awkward, weak presentation but a presentation made nevertheless.
Reflection	[2 points] A valuable reflection on the complete undergraduate chemistry experience.	[1 point] Some attempt at reflection but incomplete	[0 points] No reflection
External presentation	[2 points] Presented results at an off-campus conference or meeting	[1 point] Presented a good poster at the Millikin undergraduate research symposium	[0 points] No presentation

Appendix 3: Student Learning Evaluation Forms

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Department of Chemistry
Student Learning Evaluation

Evaluation of: Department Goal 1.
"Demonstrate the skills to solve problems and communicate through writing and speaking."

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Student Learning Evaluation

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Evaluation of: Department Goal 3.