#### Report

#### Performance Learning

Millikin students thrive through our unique approach to performance learning. In addition to a solid foundation in the theory of a given field, Millikin students gain practical, hands-on experience in their fields of study. Students in the Department of Chemistry demonstrate performance learning in the three stages of an undergraduate research project. Our students learn how to plan and communicate their plan for research by writing a proposal. They learn to conduct research by performing research. They learn how to communicate their results through written and oral presentations. We want our students to learn how to do chemistry the way chemists do it, and we accomplish that by having our students chemistry the way chemists do it.

The culmination of performance learning for students in the Department of Chemistry is presentation of their research to an external audience. Seven chemistry majors graduated this May. One of the seven students presented his research at the 2016 national convention of Sigma Zeta National Science and Mathematics Honor Society. Another student presented her research at the 251<sup>st</sup> national meeting of the American Chemical Society. Seven students presented their research at the 2016 Millikin University Undergraduate Research Poster Symposium, and four of them received awards for their posters, including two first place awards, a second place award, and a third place award

#### <u>Snapshot</u>

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 200 students per year, including students majoring in chemistry, biology, nursing, elementary education, athletic training, physical education, psychology, and exploratory studies, inter alia. Our CH224-Inorganic Chemistry and CH301/302-Organic Chemistry courses each serve approximately 50-65 students per year, primarily chemistry and biology majors. In the decade from 1994 to 2004, approximately nine majors per year graduated with chemistry degrees. Since 2004, the number of majors has typically been above that numberas high as 18 in 2008-in part due to the 83,000-square-foot Leighty-Tabor Science Center, which opened in the spring 2002 semester. Approximately half of our graduates pursue advanced degrees.

Faculty: <u>Students can only thrive when an active and engaged faculty mentors</u> them. Fortunately, that is the case in the Department of Chemistry. In the past

Curriculum: In terms of curriculum, <u>external forces have driven the most recent</u> <u>initiatives for</u> our department. For example, a unilateral decision by the faculty of another science department as to how to advise their students to select courses resulted in the decimation of the enrollment in CH131 Accelerated General Chemistry. Consequently, we will not offer the course in fall 2016. Also, in response to the recent budget crisis, the department decided to begin offering CH420 Instrumental Analysis and CH406 Advanced Inorganic Chemistry on an alternating-year basis instead of offering each on an annual basis. In addition, the retireme

### The Learning Story

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

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.

Just as the curriculum helps the department achieve goals for student learning outcomes and helps students actualize their plans of study, so too does the advising process. Advising in the Department of Chemistry facilitates and of 8 on each rubric) if the department goals are being achieved. Realistically, however, there may be students, for a variety of reasons, who are ranked less than

the following assessment criteria will therefore be used to evaluate student progress in achieving department learning goals:

and not requiring any immediate change in course of action): 80% or more

as desired or declining slightly. Strategies and approaches should be reviewed and appropriate adjustments taken to reach an acceptable level or desired rate of improvement): 60% to 79.9% of the students ranked

Immediate, high priority actions should be taken to address this area):

For reporting purposes, a rubric numeric score of 13-14 will be considered

# <u>Table 2.</u>

Department Goal 2:.

leave Millikin and go on to successful and distinguished professional careers. Furthermore, the last university self-study ranked the Department of Chemistry

designated. We therefore know our students gain a quality education that prepares them for professional success and that our program is a high quality program.

We conduct exit interviews with each of our graduating seniors. We ask students to be prepared to discuss the following seven questions (students are given the questions in advance):

- 1. What will you be doing one year from now?
- 2. What will you most remember about your experience as a chemistry major five years from now?
- <u>3.</u> What, if anything, would you do differently if you had to complete your degree all over again?
- 4.4. How would you advise a new chemistry student?
- 2.5. What are the strengths of the chemistry program?
- 3.6. What aspects of the chemistry program need improvement?
- 4.<u>7.</u> why not?

Students are open and honest in their responses to these questions. The doing what you have been Even so, students often offer specific suggestions for improvements in the department that we take to heart. Recently, students have expressed concerns about the age of the instrumentation in the department. <u>Coupled with the comments received from the response to the ACS-CPT report dated January 23, 2014, our aging instrumentation has become a critical issue. The ACS-CPT report states:</u>

<u>The Committee strongly encourages you to work with your</u> administration to identify a long-range plan for the systematic replacement of laboratory instruments to ensure that your students have access to modern equipment for instructional and research purposes

ons Institute and the Educational Testing Service Major Field Test in Chemistry. We find that our students typically score below the 50<sup>th</sup> percentile on such standardized exams.

## Appendix 1: Curriculum Map for Chemistry

## University Goals

- 1. Professional success
- 2. Democratic citizenship in a global environment
- 3. A personal life of meaning and value

#### Department 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.

<u>Curriculum Map</u> (Lecture/Lab) (Bold = Chemistry core courses)

Appendix 2: Evaluation Rubrics for Undergraduate Research The proposal: grading done by faculty member teaching Introduction to Research

Excellent

	Excellent	Adequate	Nominal
Quantity	[5 points] You work consistently over the entire research period with clear evidence of significant weekly work. You consistently report to faculty mentor.	[3 points] You work consistently most of the time but miss from time to time	[1 point] You try to cram the work into a short period
Quality	[3 points] You work efficiently with some measure of success. Your work is worthy of submission to an off-campus conference	[2 points] You have some success but not at the level worthy of an off-campus conference	[1 point] Work is not worth crowing about.
Notebook	[4 points] Notebook is clearly written and contemporaneous.	[2 points] Notebook is contemporaneous but hard to follow.	[1 point] Your notebook is incomplete and a mess.
Safety	[2 points] You consistently use safe practice and clean up your work area.	[1 point] You consistently use safe practice but leave a mess behind.	[0 points] You work in an unsafe manner.

# Research: evaluation by faculty mentor using notebook

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Final Presentation: written and oral report of results

Millikin University Department of Chemistry Student Learning Evaluation

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## Millikin University Department of Chemistry Student Learning Evaluation

Evaluation of: Department Goal 3.

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-world scenarios in which chemistry plays a

Item evaluated: Research (evaluation by faculty mentor using notebook) Student name: Date of evaluation: Evaluation by: Faculty mentor Faculty name:

ltem	Criteria			Student Score
	Excellent	Adequate	Nominal	