

Undergraduate Assessment by the Department of Chemistry Spring 2007

Our Values

Our department values the education we provide our undergraduate students, most notably our majors. We are committed to maintaining excellence in teaching and mentoring, achieving maximal learning benefit for each student, and capitalizing on our status as a Research I institution to enrich our students' experiences. In order to do so, we as a department must determine those things that make an undergraduate education successful, and then determine the things we do well all the time, some of the time, and rarely. In the process, we will highlight those things that make a chemistry major at Iowa stand out.

Credo

As a department, we believe an undergraduate education in chemistry confers the following skills and knowledge on the graduate:

- 1) Knowledge and understanding:** a working knowledge of
 - The nomenclature, syntax, symbology, and rules of inorganic and organic chemistry
 - The use of mathematical models and quantitative theories in chemistry
 - The relationship between the microscopic, macroscopic, and symbolic descriptions of matter
 - Content knowledge in the four traditional disciplines (organic, inorganic, analytical, physical chemistry) and biochemistry.
 - Content knowledge in sub-disciplines of choice (*ie.*, environmental, chemical education, or other emphases)
 - Basic laboratory skills, including the importance of understanding the measurement in question, record keeping, data collection and presentation, and safety.

- 2) Skills to acquire, analyze and process data:** the ability to
 - Acquire advanced content knowledge through database, library, and journal searches
 - Read the literature critically
 - Solve problems using the scientific method
 - Clearly express thoughts and results in writing and presentations

- 3) Independent and creative thought:** the ability to
 - Assess facts
 - Postulate hypotheses
 - Plan experiments
 - Interpret results

- 4) Knowledge of the profession in society:** an understanding of
 - The mechanics of conferences, presentations, and journal publication
 - The jobs and roles chemists occupy (what chemists do)
 - Current topics in chemistry, and their societal context
 - Ethics in science

Current Teaching Methods

In order to confer this knowledge and skill set upon our students we rely on a broad curriculum. Many of our majors do independent research, the culmination of their experience in the department. Whether this curriculum is serving **the majority** of our students to confer the goals of our credo is a testable question.

Assessment tools

To determine whether our curriculum is in fact conferring the knowledge and skill outline in our credo (as we believe it is), we will measure our success with the following mechanisms.

A) Collecting information with specialized exams (majors)

What: Standardized ACS exams given to Juniors and Seniors

Who: graded and analyzed by one or a few faculty (rotating committee)

Tests: knowledge; some problem solving

In order to assess the knowledge base of our graduating seniors, standardized exams could be used to compare their performance to national norms.

B) Collecting information from existing curricula (majors and non-majors)

What: Final poster presentation or final report/paper, as a separate class or part of existing classes

Who: A rotating committee of faculty will grade papers/presentations and prepare a report to the department and college on the year's graduates

Tests: writing skills; analysis and presentation skills; some knowledge

As part of classes taken by seniors (to be determined, such that all students are covered), a final report on independent research, a literature topic, or other class project will be presented to the undergraduate assessment committee. The committee will "grade" the entire class of majors for the department (students will not see this "grade", but will receive the class grade from their professor only).

For those doing independent research, the existing poster session could be expanded to have a presentation component, and the committee would again grade and report on the skills and knowledge of the year's seniors.

What: Language added to each syllabus to indicate which parts of the credo are addressed.

Who: A curriculum committee of faculty

Tests: Indicates knowledge and skills developed throughout the curriculum; when and where items are covered

A rotating curriculum committee would prepare a topical checklist (see Figure 1 below for an example), to include with the syllabi of each class. This could be elaborated to give quantitative weight to each aspect (i.e., large, med, small, or no contribution). This committee would be able to report annually on whether all aspects of the credo are being delivered, and to what fraction of the population of students. Recommendations could be made from there.

C) *Collecting information from a single class common to all majors*

What: A “capstone course” in chemistry; Symposium on the Frontiers of Chemistry (or like course, TBD)

Who: A rotating committee of faculty would teach “units” within this course, of about 2-3 weeks in length; assumes about 5 units (speakers). The 5 professors would meet and “grade” the students for the department assessment (though the students would in fact receive S/U credit on their record).

Tests: writing skills; analysis and presentation skills; knowledge; ability to read and interpret literature; problem solving; critical thinking and formulation of hypotheses

A course would be developed or the independent research course (4:162) modified to include a format based on undergraduate students interacting with visiting speakers in each of 5 topics in chemistry (traditional areas or interdisciplinary areas). Students would read and discuss the literature from the speaker’s lab and relevant related topics, preparing a literature paper or proposal, lists of questions for the speaker (hypothesis still to be tested, questions about why experimental choices were made, etc), and/or class presentations on the topic. When the speaker visits campus, an afternoon with the students would be included in the schedule.

An alternate or additional format for this course could include Iowa faculty presenting research seminars, with particular emphasis on the thought processes or development that went into the research. This would be a somewhat different focus than strictly a ‘results oriented’ presentation such as one would give at a conference.

Based on the annual assessment of our “success,” as described by the percentage of undergraduate students meeting minimal achievement goals outlined in our credo, further changes to our courses or curriculum as a whole would be made if necessary.

Figure 1. Syllabus Checklist example

<p>This course contributes to the department’s mission to prepare undergraduate chemistry students in (give value of 0 (none) to 3 (lots)):</p> <p>___ scientific writing</p> <p>___ reading and interpreting literature</p> <p>___ chemical knowledge base</p> <p>___ laboratory skills and safety</p> <p>___ developing testable theories/experimental planning</p> <p>___ utilizing mathematical models</p>
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