Chapter 8: Undergraduate Discipline Spotlight

Each year the Assessment Almanac chooses to highlight the assessment methods of one Truman discipline. This year features the Chemistry Department which is currently in the first year of the two year process for a full program review. Unlike several of the disciplines reviewed previously, Chemistry is able to draw on a number of standardized tools for their assessment. This report will discuss the methods currently being utilized for program evaluation within the Chemistry Department.

Quantitative and qualitative assessment occurs throughout the chemistry curriculum. In the introductory courses, Basic Chemical Principles (CHEM 129) and Chemical Principles I and II (CHEM 130 and CHEM 131), a common final exam is given across all sections of each course. These exams have been prepared in-house to align with the department-developed learning outcomes for each course using a combination of multiple-choice questions prepared by the Division of Chemical Education Examinations Institute of the American Chemical Society (ACS) and problems written by Truman faculty. The exams are all internally normed, and in addition the multiple-choice portion of the CHEM 131 exam is an ACS nationally-normed assessment instrument. Individually, these exams serve as a measure of how well we are achieving our departmental course outcomes for each class. Together, and when used in conjunction in the ACS Toledo placement exam administered at the start of CHEM 129 and CHEM 130 and ACT test scores, they give a sense of how the entire sequence is meeting our outcomes and help identify at-risk students.

Most other lecture-based courses utilize nationally-normed ACS subject examinations as the final exam for the course. These exams provide a measure of student performance in the context of our ACS-approved curriculum. The ACS updates these exams frequently and the

results are useful for providing a measure of content-based proficiency for students in our courses.

In 2012, the chemistry department switched our Senior Exam from the Major Field Achievement Test (MFAT) to the ACS' Diagnostic of Undergraduate Chemical Knowledge (DUCK) exam. Both exams are content-based diagnostic instruments, but the DUCK exam consists of scenarios that require students to solve problems that incorporate knowledge from more than one traditional area of chemistry. The year before the switch was made, a cohort of students took both exams and student scores were comparable. However, the department felt the scenario-based format of the DUCK provided a better diagnostic of our students' abilities to utilize information across the discipline. Since fully implementing the DUCK, Truman chemistry majors have scored, on average, at least twenty percentile points above the national average.

Broader perspectives of the student experience in the major are obtained during our sophomore and senior seminar courses offered each fall semester. Near the end of each course, students are first given an online survey that asks for their anonymous feedback on items ranging from course availability, research opportunities, advising, and many other items. Then, for one class session, the students participate in a faculty-facilitated discussion centered on several other questions (that were provided in advance). To encourage openness, the faculty leading or recording these discussions are not currently teaching courses at the grade level of the students in that seminar course.

Examples of the classroom discussion questions include:

- What experience(s) in chemistry have had a major impact on your development as a chemist?

- To what extent has creative problem solving been taught and encouraged in your chemistry classes? What are your suggestions for integrating creativity into the chemistry curriculum?
- How would you improve the Chemistry Department and the learning environment that it is trying to provide for its majors?

We have found that students, particularly seniors, are very forthcoming with their comments and suggestions. The results of the surveys and discussions are shared during a department meeting during the following term, providing useful information to guide curricular and co-curricular developments.

In the Fall of 2013 the department placed increased emphasis on the Truman Portfolio in our Senior Seminar course (CHEM 445). In contrast to past practice, the philosophy of the portfolio as a whole is now discussed in one of the first class sessions. Each individual prompt is then briefly discussed in subsequent weeks with student responses to the discussed prompt being due the following week. In this way, the students can begin to think about their best response to each prompt while in class, and the actual submission process is broken down into a series of smaller, more manageable tasks. This approach has resulted in a greater appreciation for the portfolio itself (as judged by the responses to the Senior Survey and in the Letter to Truman portfolio prompt), and to more appropriate artifacts being selected for inclusion in the portfolio (as demonstrated by improved performance by chemistry students on several of the portfolio prompts, namely the Critical Thinking and Writing scores, where they are now fairly consistently above the university average). We believe that, now with our students taking the time to submit their best work, the portfolio data are more meaningful overall, and with better data, we can find

the parts of our curriculum that need improvement while maintaining the parts of our curriculum that are working well.