Central Washington University
Assessment of Student Learning
Department and Program Report

Please enter the appropriate information concerning your student learning assessment activities for this year.

Academic Year of Report: 2009-10  College: COTS
Department: Chemistry
Programs: B.A. Chemistry Teaching

1. What student learning outcomes were assessed this year, and why?

In answering this question, please identify the specific student learning outcomes you assessed this year, reasons for assessing these outcomes, with the outcomes written in clear, measurable terms, and note how the outcomes are linked to department, college and university mission and goals.

Our program annually assesses all Student Learning Outcomes (SLO) to provide a suitably detailed evaluation of student knowledge, skills, and disposition. Note that SLO #8 was added this year and assessment will begin in the 2009-10 academic year.

Also note: No Chemistry teaching majors or post-baccalaureate students completed their program in 2009-10 so no new data have been added in the last year. Please refer to the “2008-9 B.A. Chemistry Teaching Program Report” Appendix A for the compilation of 2006-9 data. Answers to Questions 2-4 were still given to detail the way assessment is typically conducted.

Student Learning Outcomes (SLO):

1. Demonstrate an ability to individually and collaboratively engage in inquiry and integrate the nature of science. (SCED goal 1, 3, 4; COTS Goal 1, 4, 6; CWU Goal 1, 6)
2. Explain and apply fundamental science content concepts, principles, and methods.
3. Demonstrate an ability to effectively facilitate learning for all students. (SCED Goal 1, 3, 5; COTS Goal 1, 4, 6; CWU Goal 1, 6)
4. Create safe, effective learning environments that support inquiry, collaboration, intellectual risk-taking, ethical decision-making, and student construction of knowledge. (SCED Goal 2, 3, 4; COTS Goal 1, 6; CWU Goal 1, 6)
5. Demonstrate an ability to assess teaching and learning outcomes using multiple methods, effectively evaluate teaching and learning effectiveness, and improve practice based on reflection and data. (SCED Goal 1, 2, 3, 4; COTS Goal 1, 6, 7; CWU Goal 1, 6)
6. Demonstrate an ability to make science personally and socially relevant to individual and community by incorporating current events within collaborative and social networks. (SCED Goal 2, 3, 4, 7, 8; COTS Goal 1, 6; CWU Goal 1, 6)
7. Participate in a variety of activities that enhance professional development and improve teaching effectiveness. (SCED Goal 1, 2, 4; COTS Goal 1, 5, 6; CWU Goal 4, 6)

8. Demonstrate open-mindedness and curiosity that leads to continuous improvement as a scientist and a teacher (SCED Goal 3, 4; COTS Goal 1, 2, 6; CWU Goal 1, 2, 6)

These SLO were chosen because they reflect the criteria necessary to become an effective Chemistry teacher. The SLO were originally conceived through a consensus process by examining commonalities in three sets of professional standards; National Science Education Standards for Teaching, National Science Teacher Association Standards, and the Washington Competencies for Chemistry. By using this approach, performance within the program also provides some measure of how well students are able to meet professional standards.

2. How were they assessed?

*In answering these questions, please concisely describe the specific methods used in assessing student learning. Please also specify the population assessed, when the assessment took place, and the standard of mastery (criterion) against which you will compare your assessment results. If appropriate, please list survey or questionnaire response rate from total population.*

A) What methods were used?

The Chemistry Teaching Program used a formative and summative assessment system comprised of several elements:

1) Performance-based, standards-aligned electronic portfolio
2) WEST-E and American Chemical Society content examinations
3) Entry and exit surveys

**Chemistry Teaching Portfolio**

The Chemistry Teaching portfolio was used to assess student knowledge, skills, and dispositions relative to professional standards. The Chemistry Teaching Portfolio was built from a common template collaboratively designed and constructed by members of the Department of Science Education, with additional insight provided by content colleagues and K-12 teachers. The portfolio framework was based on the latest scientific research on how people learn (National Research Council, 1999), with assessment focused on: 1) determining student preconceptions, 2) engaging students in authentic scientific inquiry and helping them develop a scientific mental framework, 3) developing and applying robust content knowledge, and 4) promoting meta-cognitive awareness of teaching and learning process and critical thinking.

Each portfolio element, or dimension, required a reflection and was closely aligned to Chemistry Teaching SLO and professional standards. In an effort to promote critical thinking, students were required to supply evidence they deemed suitable rather than those prescribed by faculty. Students had to justify their choice of evidence and progress toward meeting professional standards in each reflection. The dimensions of the Chemistry Teaching portfolio (including content strands) are indicated below:

1) Inquiry and Nature of Science
2) Content
   a. Analytical/Instrumental Chemistry
   b. Organic Chemistry
   c. Biochemistry
   d. Inorganic Chemistry
   e. Physical Chemistry
   f. Application of Mathematics and Physics to Chemistry

3) Teaching

4) Learning Environments

5) Assessment and Evaluation

6) Relevance

7) Professional Growth

WEST-E and ACS Exams

Student content knowledge was assessed in Science Education (WEST-E) and American Chemical Society content exams. Each student had to post total and component scores in the Content dimension of the Chemistry Teaching Portfolio. These scores were also tracked in a separate spreadsheet to identify areas of strength and necessary development.

Entry and Exit Surveys

An entry to program survey was used to assess student demographics, disposition toward science teaching, and program learning expectations. An exit survey was used to evaluate program effectiveness, changes in disposition, and met/unmet learning expectations. A reflection comparing entry and exit survey results was also required in the Chemistry Teaching portfolio.

Prior to being allowed to student teach, portfolios were evaluated by Chemistry teaching faculty using a standards-aligned rubric. Students had to demonstrate minimum proficiency for each portfolio dimension. An advising hold that could only be removed by a chemistry teaching or another Science Education faculty member was used to ensure compliance.

B) Who was assessed?

Typically all eligible Chemistry teaching majors, Chemistry teaching certification and endorsement students are assessed. However, it 2009-10, no teacher candidates completed a Chemistry program so no final program portfolios were assessed. A total of five have been assessed to date.

C) When was it assessed?

Portfolio was periodically evaluated during advising, additional feedback was given during SCED487, and the final portfolio was reviewed by a teacher candidate’s academic advisor in the quarter prior to student teaching.
3. What was learned?

In answering this question, please report results in specific qualitative or quantitative terms, with the results linked to the outcomes you assessed, and compared to the standard of mastery (criterion) you noted above. Please also include a concise interpretation or analysis of the results.

Due to the small number of students who finish annually, assessment results are concatenated over several years. Several points of strength and areas for improvement emerged from assessment results over the prior three years, as follows:

- Generally, the assessment methods employed provided meaningful insight into Chemistry Teaching student knowledge, skills, and dispositions.
- SLO were closely aligned to department, college, and university goals, and covered a range of basic and advanced knowledge and skills. Disposition SLO were lacking.
- Overall, Chemistry Teaching portfolio results indicated that all candidates evaluated under this method have ultimately met competency requirements of proficiency or higher for each portfolio dimension. However some candidates were required to redo certain portfolio sections to bring them to a proficiency level. The results included in this report reflect the final portfolio evaluations.
- Portfolio results were corroborated by and highly correlated with the 100% WEST-E pass rate for Chemistry Teaching students.
- Portfolio reflection scores were lower than artifact scores indicating that students need more practice in writing reflections and describing how artifacts show that learning outcomes have been met.
- Survey results and advising discussion indicated that students achieved the majority of their learning goals. Insufficient experience with assessment and evaluation and classroom management were common criticisms. The relative absence of these and field teaching experiences, particularly in College of Education courses, was a common concern.

4. What will the department or program do as a result of that information?

In answering this question, please note specific changes to your program as they affect student learning, and as they are related to results from the assessment process. If no changes are planned, please describe why no changes are needed. In addition, how will the department report the results and changes to internal and external constituents (e.g., advisory groups, newsletters, forums, etc.).

Based on collected data, the following revisions to the Chemistry Teaching program are proposed:

**Improvements for Student Learning**

- Provide more opportunities for students to experience authentic inquiry in introductory science courses. If inquiry is important in K-12 schools (and it is), then more content courses should model investigative science and focus on inquiry, not less.
• Encourage submission of higher quality evidence in some content areas, especially astronomy. The ability to choose and rationalize evidence is a key aspect of being a quality scientist; this should extend into majors coursework.
• Embed use of current events and community involvement to a greater extent in content and science education courses. We would like to add SCED 354 (Science, Society, and the Teaching Community) to the Chemistry Teaching Major, but it unclear whether than will be possible in light of program credit limits.
• Help students better connect evidence to developmental progress. Greater emphasis on metacognitive awareness will help students become better learners, which in turn should improve job performance as professional teachers. Improvement in this area will be important considering the increased emphasis on accountability in K-12 schools.

Improvements in Assessment Process

• Some aspects of the Chemistry Teaching portfolio need greater specificity and should be shared with students early in the program so they better understand what is expected.
• Since the Biology, Chemistry, Earth Science, and Physics Teaching portfolios are based on a common template, it would be useful to compare across these programs to identify overall trends in science teacher preparation.
• The LiveText software used to collect student data is disconnected from Blackboard, making it unnecessarily confusing for students and faculty. LiveText is limited in features, and exploration of new options is recommended.

5. What did the department or program do in response to last year’s assessment information?

In answering this question, please describe any changes that have been made to improve student learning based on previous assessment results. Please also discuss any changes you have made to your assessment plan or assessment methods.

Systematic implementation of assessment has been occurring in Chemistry Teaching (and Science Education generally) for several years, partly in response to NCATE accreditation requirements, which has prompted the following:

• Added a dispositional outcome for Chemistry teaching candidates. Addition based on previous years feedback, recognition of the importance of a dispositional outcome during assessment retreat for Science Education departmental self study, and collaborative work with COTS chairs. The addition of this outcome also supports dispositional assessment through the CTL.
• Developed a dispositional survey with the COTS natural science department chairs. This survey will be used at entry and exit from all natural science programs, beginning Fall 2010.
• Developed an electronic rubric to track elementary, middle level, and secondary candidate performance during science teaching practica.
• Changes in the program portfolio rubric prompted a change in the assessment timeframe. Current results reflect SLO performance since 9-2008 when changes to portfolio rubrics were made.
• Based on ongoing data collection and Standard V changes, we plan to revise the Chemistry Teaching Portfolio to include measures of candidate impacts on K-12 student learning.

6. Questions or suggestions concerning Assessment of Student Learning at Central Washington University:

The Departments of Chemistry and Science Education recommend the following changes to student learning assessment at CWU:

• Provide more opportunities for training and professional development for how to conduct assessment. Graduate training typically does not include assessment; therefore it is important to not assume faculty know why or how to conduct assessment. Many faculty members may experience a steep learning curve.
• The due dates for the annual Assessment Plans should correspond more closely with annual departmental planning and CTL Assessment Report so that necessary changes have the greatest chance of being implemented.
• Provide necessary infrastructure for program assessment. This may include financial and intellectual resources including focused release time, collaboration, and dissemination of best practices across colleges and departments.
• Effective sharing of materials should minimize the reinvention of the wheel, as it were. Examples of rubrics (which will figure prominently in performance evaluations) should be shared as most faculty members are not highly familiar with the use of rubrics.
• Each department should have an assessment coordinator with reasonable workload release. This person should coordinate efforts, not remove assessment responsibility from other faculty.

References