Annual Assessment Report to the College 2011-12

College: ____Science and Mathematics_____

Department: _____Chemistry and Biochemistry_____

Program: ____Chem BA, BS, MS; Biochem BS, MS_____

Note: Please submit report to your department chair or program coordinator, the assessment office and to the Associate Dean of your College by September 28, 2012. You may submit a separate report for each program which conducted assessment activities.

Liaison: ___Thomas Minehan_____

1. **Overview of Annual Assessment Project(s) (optional)**

1a. **Assessment Process Overview:** Provide a brief overview of the assessment plan and process this year.

The following assessment activities were planned for this year:

a. Implement a rubric for the evaluation of written research/scientific reports (SLO2, 3).
b. Assess basic knowledge in general chemistry and organic chemistry (SLO1) using standardized exam questions in course finals.
c. Review evidence pertaining to SLO2m: Organize and communicate scientific information clearly and concisely, both verbally and in writing.
d. Review evidence pertaining to SLO4: work effectively and safely in a laboratory environment

2. Student Learning Outcome Assessment Project: Answer questions according to the individual SLO assessed this year. If you assessed an additional SLO, report in the next chart below.

2a. Which Student Learning Outcome was measured this year?

SLO 1: Assess basic knowledge in the following areas of chemistry: general chemistry and organic chemistry

2b. Does this learning outcome align with one of the following University Fundamental Learning Competencies? (check any which apply)

Critical Thinking_____√_____
Oral Communication_____
Written Communication_____

May 17, 2012

Quantitative Literacy_____**√**_____
Information Literacy_____
Other (which?)_____

2c. What direct and indirect instrument(s) were used to measure this SLO?
For general chemistry (Chem 101): 25 multiple-choice questions from an American Chemical Society (ACS) standardized exam in general chemistry were embedded in the course final. Relevant questions were chosen from the ACS general chemistry exam, since the comprehensive exam covers topics not presented in Chem 101.
For general chemistry (Chem 102): 4 multiple-choice questions selected from the ACS standardized exams in General Chemistry.
For organic chemistry (Chem 333): 5-10 multiple-choice questions selected from an ACS standardized exam in organic chemistry were embedded in the course final.
For organic chemistry (Chem 334): the entire ACS exam in organic chemistry (70 questions) was given to the students.

2d. Describe the assessment design methodology: For example, was this SLO assessed longitudinally (same students at different points) or was a cross-sectional comparison used (comparing freshmen with seniors)? If so, describe the assessment points used.
A cross-sectional design methodology, in which freshman are compared with sophomores/juniors, was used:
General Chemistry: Chem 101 and Chem 102 are our gateway courses taken by both majors and non-majors, and are typically populated by students in the first year of required chemistry courses for their major. The foundational concepts introduced in this course are crucial for student success in all subsequent courses in the major. Thus, assessment at this introductory stage will allow us to establish a baseline level of student performance useful for comparison with assessments done in later courses in our undergraduate program.
Organic Chemistry: the majority of our majors take Chemistry 333 and 334 after completion of Chem 102. Assessment in this course may provide information on how well our students retain fundamental concepts and apply foundational principles as they progress through the program.

2e. Assessment Results & Analysis of this SLO: Provide a summary of how the evidence was analyzed and highlight important findings from collected evidence.
General Chemistry: According to statistics provided, the overall ACS average score on the 25 questions selected for assessment was 57%. For one Chem 101 instructor, the overall average score for Fall 2011 CSUN students participating in the assessment (55 students) on the 25 selected questions was 61%, and for the Spring 2012 students (58 students) was 69%. The data indicate that the Fall 2011 students performed equally or better than the ACS students on 16 out of the 25 questions; the Spring 2012 students performed equally or better than the ACS students on 20 out of the 25 questions. For another Chem 101 instructor, 48% of students (127 total from both Fall and Spring semesters) achieved the average ACS score (57%) or higher. It appears that our students are performing well relative to the national standard, and have learned the covered topics well. In Chem 102, for the four questions selected from the ACS exam for assessment, students in the spring 2012 courses (167 students from three instructors' classes) answered 59.2% of the questions correctly, which compares favorably with the national average of 51.2% answered correctly. It can be concluded that, at present, our program at the 100-level is meeting expectations relative to the national standard.

Organic Chemistry: According to the ACS statistics provided, a score of 60% represents 50th percentile

for the organic chemistry exam questions chosen for assessment. For Fall 2011 Chem 333 (Organic Chemistry I), 131 students participated in the assessment, and approximately 50% of the students got 60% or more of the selected questions correct. For Spring 2012 Chem 333, 107 students participated in the assessment, and approximately 40% of the students got 60% or better. These results indicate a strong need for our students to obtain additional help in grasping the fundamental concepts in organic chemistry introduced in this course. In Fall 2011 Chem 334 (Organic Chemistry II), 48 students took the entire ACS organic chemistry exam, and only 12.5% (6 students) got a score of 60% or better (50th percentile). The average score for our Fall 2011 students was 44%. A breakdown of the questions on which the students performed poorly indicated that concepts involving reaction mechanisms, acidity/basicity/aromaticity, and predicting chemical structures based on spectroscopic evidence were the most challenging for our students. Addressing some of these areas in Spring 2012 led to a noticeable improvement: 50 students in Chem 334 took the entire ACS organic chemistry exam, and 20% (10 students) scored 60% or higher. The average score for our Spring 2012 students was 51%. While focusing on specific topics in lecture leads to moderate improvements in student performance on the ACS exams, a clear need still exists to emphasize problem-solving skills in the organic chemistry sequence.

2f. Use of Assessment Results of this SLO: Were assessment results from previous years or from this year used to make program changes in this reporting year?
Type of change:
changes to course content/topics covered___√_____
course sequence_____
addition/deletion of courses in program___√_____
describe other academic programmatic changes_____
student support services_____
revisions to program SLOs_____
assessment instruments_____
describe other assessment plan changes_____

The results listed above in section **2e** indicate a need to emphasize problem-solving skills in the organic chemistry sequence. To this end, last year a mandatory discussion session for Chemistry 333 was approved by our department, and will be implemented starting in Spring 2013.
In addition, as described above, the results of the fall 2011 assessment in Chem 334 led to changes in emphasis given to course topics in spring 2012 Chem 334 (reaction mechanisms, acidity/basicity/aromaticity, and spectroscopy). A clear improvement in Chem 334 student performance on the ACS standardized exam was realized at the end of the spring term.

Have any previous changes led to documented improvements in student learning? (describe)

While no results are available yet for the new discussion course, we have previously noted that students taking optional recitation classes for both chemistry 333 and 334 perform better on the whole in the organic sequence than those who do not take the discussion class.

2. Student Learning Outcome Assessment Project: Answer questions according to the individual SLO assessed this year. If you assessed an additional SLO, report in the next chart below.

2a. Which Student Learning Outcome was measured this year?

SLO 2m: Organize and communicate scientific information clearly and concisely, both verbally and in writing.

2b. Does this learning outcome align with one of the following University Fundamental Learning Competencies? (check any which apply)

Critical Thinking_____
Oral Communication_____**√**_____
Written Communication_____
Quantitative Literacy_____
Information Literacy_____
Other (which?)_____

2c. What direct and indirect instrument(s) were used to measure this SLO?

The department has an established oral presentation rubric for evaluating final oral presentations in upper division courses, as well as formal graduate student thesis and literature presentations. Categories in this rubric include organization, understanding of scientific content, style/delivery, use of visual aids, and ability to answer questions.

2d. Describe the assessment design methodology: For example, was this SLO assessed longitudinally (same students at different points) or was a cross-sectional comparison used (comparing freshmen with seniors)? If so, describe the assessment points used.

SLO2m was implemented to assess oral and written communication abilities of students in our MS program.
Advanced Analytical Chemistry (Chem 522) is a 3-unit, graduate-level course typically populated by MS students and advanced undergraduate students. For graduate students, this course is typically taken before the graduate literature presentation and well before the oral thesis defense. As such, it serves as an early check of students' scientific communication skills in the MS program. For undergraduate students, this course serves as an upper division elective course for Chemistry and Biochemistry majors. Undergraduates taking this course should thus be performing at the mastery level with respect to our BA/BS SLO2. For Spring 2012, 18 students completed the class, of which 15 were graduate students and 3 were undergraduate.

2e. Assessment Results & Analysis of this SLO: Provide a summary of how the evidence was analyzed and highlight important findings from collected evidence.

For Chem 522, students were required to give a 12-minute oral presentation about a topic relevant to the course based on the scientific literature. The department-wide rubric for student presentations was used to evaluate student presentations, and the scores obtained contributed to the students' overall course grade; a total of 10 points was assigned to each rubric category, so overall the presentations were worth a total of 50 points. The average score for the class was 40.2/50 (80.4%), and the breakdown of scores by rubric category is informative: organization, average score=7.0/10; understanding of scientific content, average score=8.1/10; style/delivery, average score=8.1/10; use of visual aids, average score=8.2/10; and ability to answer questions, average score=8.3/10. From these data it appears that our students overall are doing quite well relative to department standards, where

the benchmark level of performance for all categories is 75%. It was found that students were performing below the benchmark in one category, organization, which is related to the time they took to deliver their presentation (many students exceeded the allotted time). Organizational skills may be improved for students by emphasizing practicing their talk in front of classmates/colleagues before giving the formal presentation.

2f. Use of Assessment Results of this SLO: Were assessment results from previous years or from this year used to make program changes in this reporting year?
Type of change:
changes to course content/topics covered_____
course sequence_____
addition/deletion of courses in program_____
describe other academic programmatic changes_____
student support services_____
revisions to program SLOs_____
assessment instruments_____√_____
describe other assessment plan changes_____

Although a rubric for evaluating student oral presentations (thesis seminars, literature seminars) in our MS program has been utilized for over three years, the use of this rubric in our upper division chemistry courses to evaluate final student oral presentations has been limited thus far. It is anticipated that the successful use of the departmental rubric for Chem 522 will encourage other instructors of upper division courses to also assess student oral communications skills using the rubric.

Have any previous changes led to documented improvements in student learning? (describe)

2. Student Learning Outcome Assessment Project: Answer questions according to the individual SLO assessed this year. If you assessed an additional SLO, report in the next chart below.

2a. Which Student Learning Outcome was measured this year?

SLO 4: Work effectively and safely in a laboratory environment

2b. Does this learning outcome align with one of the following University Fundamental Learning Competencies? (check any which apply)

Critical Thinking_____
Oral Communication_____
Written Communication_____
Quantitative Literacy_____
Information Literacy_____
Other (which?)_____laboratory skills/safety_____

2c. What direct and indirect instrument(s) were used to measure this SLO?

Accident report forms must be completed and filed with our department safety officer for any accident

that occurs in our instructional laboratories. Thus these reports provide a direct means of assessing safety in our labs.

2d. Describe the assessment design methodology: For example, was this SLO assessed longitudinally (same students at different points) or was a cross-sectional comparison used (comparing freshmen with seniors)? If so, describe the assessment points used.

The accident report forms are reviewed periodically to assess a) the types of accidents occurring in our instructional laboratories, and b) the incidence level of accidents occurring in our instructional laboratories.

2e. Assessment Results & Analysis of this SLO: Provide a summary of how the evidence was analyzed and highlight important findings from collected evidence.

Over the past 5 years, the most common lab accidents resulting in injury involved cuts from broken or sharp glassware (especially thermometers) and burns arising from coming in contact with acids or bases, hotplates, hot reaction flasks, or sandbaths. The incidence of these accidents is relatively low (less than ten reported accidents per academic year; approximately 1,200 students are enrolled in instructional labs per semester, and for AY 2011-2012 a total of 2,327 students were enrolled) and at a consistent level from year to year. At the beginning of each semester, our Department safety officer gives a 30-minute safety presentation for all laboratory instructors, with the intent that the instructors will relay this information to the students. Students are warned about the dangers of acids and bases, easily broken glassware, and hotplates in safety lectures given at the beginning of lab courses and throughout the semester when particular experiments carry these inherent dangers. We can conclude that our department has established adequate protocols for monitoring safety in our labs and for preventing accidents to the extent possible.

While fires and explosions in the instructional labs are very rare, one recent incident in which a tightly-capped waste bottle exploded in a designated waste hood after hours caused significant damage to the lab. As a result, proper waste segregation and storage protocols have been implemented in our instructional labs by our safety officer. Again, this information is conveyed first to all lab instructors and subsequently students at the beginning of each semester in mandatory lab safety lectures.

2f. Use of Assessment Results of this SLO: Were assessment results from previous years or from this year used to make program changes in this reporting year?

Type of change:

changes to course content/topics covered_____
course sequence_____
addition/deletion of courses in program_____
describe other academic programmatic changes_____
student support services_____
revisions to program SLOs_____
assessment instruments_____
describe other assessment plan changes____√_____

As indicated above, the incidence of accidents in our instructional laboratories is low, but when accidents occur, prevention and safety information is then relayed from our department safety officer to lab instructors and then to students at the beginning of each lab course, so that the overall safety of our

lab curriculum may continue to improve over time.

Have any previous changes led to documented improvements in student learning? (describe)

n/a

3. How do your assessment activities connect with your program's strategic plan?

Department assessment closely aligns with our ongoing efforts to improve the quality of teaching in our Department. As part of the process for departmental accreditation, we have recently carefully reviewed our curriculum and course requirements to ensure that they are in line with rigorous standards put forward by the American Chemical Society. Furthermore, by identifying areas of weakness for our students with respect to our SLO's, our faculty are continuing to make necessary changes to course content and instructional approaches or propose new preparatory, pre-requisite or co-requisite courses (such as discussion sessions) to assist students in gaining the necessary foundational knowledge so that they can progress through the core courses in their degree. As mentioned above, we have recently approved a mandatory recitation session for our Organic Chemistry I course, since our assessment results clearly indicated a need for our students to practice problem solving and acquire critical thinking skills. We anticipate that this program modification will greatly improve student learning and allow students to progress through to the upper division courses in a more timely fashion. Also, instructors of upper division courses are now beginning to utilize our established department oral presentation rubric for assessing verbal communication skills; continued assessment in this area will identify weaknesses which may be addressed in other courses within our program. Finally, the assessment activities described in section 4b below help ensure that the teaching activities of our non-tenure track faculty are of a high standard.

4. Other information, assessment or reflective activities or processes not captured above.

a.) A rubric for assessing written assignments in chemistry, relevant to department student learning outcomes 2 and 3, has been implemented. Categories in the new rubric include Abstract/Introduction/Theory, Materials and Methods, Discussion, Conclusions, References, Grammar, and Formatting. The rubric is intended to be used for evaluating student research reports in Chem 499 (independent study), Chem 495 (directed research), and other upper division courses, as well as thesis abstracts and literature review abstracts for our graduate program. The results from the use of this rubric will be reviewed as part of next year's assessment of SLO's 2 and 3.

b.) Several years ago the Department developed and adopted a formal set of procedures for evaluating the teaching effectiveness of non-tenure track faculty. The department continues to thoroughly review and advise all non-tenure track faculty who receive teaching assignments from the Department. This evaluation consists of a class visit, a comprehensive review of all written instructional materials including syllabi, quizzes, handouts, and tests, and an examination of student evaluations for all lecture sections taught. The evaluation report is discussed with each faculty member under review by a

member of the Department Evaluation Committee, and each faculty member is encouraged to share this information with his or her faculty mentor. The faculty mentorship program ensures that there is a dedicated faculty contact for each non-tenure track faculty, available for discussions about optimal teaching strategies, advice on interacting with students, and other concerns.

The Department is in the fourth year of this annual evaluation process. In most instances the faculty under review have improved in areas of concern noted in their evaluation. In the past this process did identify an instructor who was not re-hired by the Department because of a failure to address concerns that were repeatedly raised.

5. **Has someone in your program completed, submitted or published a manuscript which uses or describes assessment activities in your program? Please provide citation or discuss.**

No