



2021 Academic Program Assessment Report

Chemistry BS

Program current assessment plan here:

https://www.csupueblo.edu/assessment-and-student-learning/_doc/results-and-reports/2013/plans/Chemistry.pdf

Program prior assessment report here:

https://www.csupueblo.edu/assessment-and-student-learning/_doc/2020/report/chemistry-bs-assessment-report-2020.pdf

Report Completed By: David Dillon

Date Report Completed: July 14, 2021

Faculty members involved in this Assessment: No formal involvement – anecdotal comments included (MC, RF, JC, NE)

Please describe this year's assessment activities and follow-up for your program below. (Separate sheet for each undergraduate major, stand-alone minor, certificate, and graduate program in your department.) Please also submit any addenda such as rubrics which are not available in your assessment plan. The reports will be available to the Dean of your college/school and to the Executive Director for Assessment as well as faculty peer reviewers.

Brief Statement of Program Mission and Goals:

I. Assessment of Student Learning Outcomes (SLOs) in this cycle. Including processes, results, and recommendations for improved student learning. Use Column H to describe improvements planned for the year based on the assessment process.

A. Your program SLOs are pasted here verbatim from your assessment plan. Please enter info in columns B-H only for those assessed during this annual cycle.

B. When was this SLO last reported on prior to this cycle? (semester and year)

C. What method was used for assessing the SLO? Please include a copy of any rubrics used in the assessment process.

D. Who was assessed? Please fully describe the student group(s) and the number of students or artifacts involved (N).

E. What is the expected proficiency level and how many or what proportion of students should be at that level?

F. What were the results of the assessment? (Include the proportion of students meeting proficiency.)

G. What were the department's conclusions about student performance?

H. What changes/improvements to the program are planned based on this assessment?

<p>1. Students will exhibit a comprehensive knowledge of the fundamental theories and concepts necessary in the chemical sciences. This learning outcome is core to the program's mission of high standards of education.</p>	<p>Data are collected at the end of every semester and assessed annually. The SLO was last assessed in Spring 2021.</p>	<p>The ACS Exams Institute provides standardized exams that cover all the major sub-disciplines within chemistry. The chemistry program uses these exams where appropriate (general, organic, physical, analytical, inorganic, and biochemistry). Because of continuation of remote delivery in fall 2020 and spring 2021 related to COVID-19, secure ACS exams were only available for General Chemistry and Organic Chemistry. The Major Field Achievement Test (MFAT) is also required of all graduating seniors and is used to assess student knowledge in chemistry. Again related to COVID-19 campus closure, the Chair overlooked scheduling the MFAT in spring 2021 until late in final exams week and was unable to make contact with the graduates.</p>	<p>All students taking General Chemistry and Organic Chemistry courses took the ACS exams in non-secure online format (see explanation in item C). Assessment in other courses was by instructor-developed assignments and exams. The number of students in each course for fall 2020 were: 121 - 56 122 - 31 301 - 36 302 - 18 317 - 4 322 - 6 411 - 15 420 - 6 The number of students in spring 2021 courses were: 121 - 48 122 - 33 301 - 14 302 - 18 321 - 8 323 - 2 412 - 1 413 - 3 419 - 2</p>	<p>Due to COVID-19 campusclosure, the only spring 2021 courses assessed using ACS exams were General Chemistry and Organic Chemistry. However, ALL instructors associated with these courses are skeptical of using the norms on exams administered under non-secure conditions. For this academic year, assessment of chemical knowledge was dependent on instructor evaluation of assignments and exams.</p>	<p>As notes in columns B and C, standardized ACS exams were only provided for non-secure online delivery during fall 2020 and spring 2021. Using the ACS-suggested method of deriving norms for these exams, student performance was well above usual levels in both General Chemistry and Organic Chemistry courses. None of the instructors involved in these courses trust the validity of the results. CHEM core or majors courses with % ABC grades for fall 2020 were: 121-1 = 61% 121-3 = 56% 122-1 = 32% 301-1 = 64% 302-1 = 83% 317-1 = 25% 322-1 = 100% 411-1 = 88% 420-1 = 67% CHEM core or majors courses with %ABC for spring 2021 were: 121-1 = 50% 121-2 = 28% 122-1 = 88% 122-2 = 59% 301-1 = 71% 302-1 = 89% 321-1 = 63% 323-1 = 50% 412-1 = 100% 513-1 = 100% 419-1 = 50%</p>	<p>Based on instructor experience with historical trends in student performance, it is the consensus that remote delivery had a noticeable but variable adverse effect on student comprehension of course concepts. Lack of the option to use ACS standardized exams with reliable national norms leaves us unable to draw substantiated conclusions about student performance in COVID-interrupted courses. However, we believe it is significant that many students did adapt well to online delivery. At least for the Chair, anecdotal observation is that those students who were most engaged in the synchronous online format performed at a noticeably higher level than those who were merely "present" or who elected not to participate.</p>	<p>Historically, the most significant area for improvement in SLO performance has been with students in early chemistry courses, especially General Chemistry. Math skills are closely linked to success in General Chemistry, and a solid high school or introductory chemistry course also helps the success rate. Concurrent with the shift to Banner, we are implementing use of a pre-assessment test to distinguish students who are ready for General Chemistry from those who need Introductory Chemistry. We believe these changes will positively impact success rates in General Chemistry and subsequent courses that build up it. As the scheduling uncertainty related to COVID is resolved and enrollment supports it, we plan to continue the parallel offerings of General Chemistry in both traditional and the smaller studio formats that were initiated in fall 2017. The smaller studio classes had to be discontinued due to staffing issues going into the 2019-2020 AY and could not be resumed during COVID restrictions. At least one instructor has continued with the flipped classroom approach for General Chemistry. Evaluation of the results from parallel sections has not been completed.</p>
<p>2. Students will exhibit the mathematical and problem-solving skills necessary in the chemical sciences. This learning outcome is core to the program's mission of high standards of education.</p>	<p>Data are collected at the end of every semester and assessed annually. The SLO was last assessed in Spring 2021.</p>	<p>Due to lack of availability of secure ACS standardized exam during AY 2020-2021, math skills and problem solving ability was assessed only via instructor-developed exams and assignments.</p>	<p>All students in core chemistry courses were assessed for performance on relevant math and problem-solving skills using instructor-developed exams and assignments. For numbers of students in each courses, see above.</p>	<p>Without secure ACS exams during this academic year to provide independent assessment, student proficiency was judged on the basis of C-level or better performance on instructor-developed assignments and exams.</p>	<p>No independent assessments with reliable statistics based on secure administration was available during to COVID closures (i.e. ACS exams), so for this AY, proficiency was judged on the basis of C level of better performance in the respective courses. See %ABC grades in CHEM core and majors courses in this column under item 1 above.</p>	<p>Similar conclusions as SLO 1 above. But one positive aspect of the COVID interruption in traditional assessment is that it brings to light the need to independently assess chemical concept mastery and math skills masters (the latter especially for the CHEM 121 and 122 courses and higher heavily math-dependent courses such as CHEM 321, 322, and 323.)</p>	<p>Similar conclusions as SLO 1 above. At least one additional instructor is looking at incorporating a flipped classroom approach into courses next year, and at least one is exploring ways to more thoroughly engage students in a hybrid course environment, at least in terms of instructor-led supplemental instruction activities.</p>
<p>3. Students will be able to research, review and understand the current chemical literature and be able to critically evaluate, write about and professionally present such material. This learning outcome is core to the program's mission of high standards of education, primarily with respect to research (currency in the discipline) and promoting scientific inquiry.</p>	<p>Data are collected at the end of every semester and assessed annually. The SLO was last assessed in Spring 2021.</p>	<p>Although aspects of Learning Outcome Three are incorporated into much of the curriculum, assessment of the third learning outcome takes place during the required senior seminar course, Chem 493 and in other higher level courses. All faculty are expected to attend the student's senior seminar and an evaluation tool is distributed to every member present. Sample evaluation tool included.</p>	<p>Development of the skills required for this SLO occur throughout the curriculum. However, final assessment occurs as part of the CHEM 493-Senior Seminar Course.</p>	<p>Faculty evaluations of the senior seminar are pooled and included in the student's grade for the course which is compiled by the instructor of record. Evaluations are given on a 100-point scale and faculty expect students to achieve an average of 70 or better for satisfactory performance.</p>	<p>Enrolled for CHEM 493 during fall 2020 (not offered in spring 2021) were 4 students. All 4 students enrolled in CHEM 493 course were assessed at the 70% mark or better (two As and two Bs).</p>	<p>Generally speaking students have developed the needed skills throughout the chemistry curriculum to meet this SLO. This is demonstrated by performance at or above the expected level of achievement in CHEM 493 as assessed by the department faculty as a whole.</p>	<p>Given the performance in meeting this SLO the aspects of the chemistry curriculum designed to meet it appear appropriate at this time. No changes are deemed necessary at this time.</p>
<p>Comments on part I:</p>	<p>Restrictions on course dynamics and delivery in response to COVID were extremely disruptive to not only the ability to engage with students but to evaluate their progress and mastery. This was especially harsh on lab courses but, at least for core and majors courses, some lab experiences were able to be maintained by amending F2F activities with online supplementary assignments either related to experiments that were carried out in F2F format or experiments that had to be cut from the schedule in order to maintain room occupancy limits.</p>						

II. Closing the Loop. Describe at least one data-informed change to your curriculum during the year cycle. These are those that were based on, or implemented to address, the results of assessment from previous cycles.				
A. What SLO(s) or other issues did you address in this cycle? Please include SLOs verbatim from the assessment plan, as above.	B. When was this SLO last assessed to generate the data which informed the change? Please indicate the semester and year.	C. What were the recommendations for change from the previous assessment column H and/or feedback?	D. How were the recommendations for change acted upon?	E. What were the results of the changes? If the changes were not effective, what are the next steps or the new recommendations?
SLO 1 and 2	Data are collected at the end of every semester. The SLO was last assessed in Spring 2021.	Due to the interruption in course delivery modes and instructor contact with students, some of the strategies that were being evaluated prior to COVID had to be modified. Chief among these were the studio section approach and the flipped classroom approach that were being used previously in General Chemistry. Faculty have been making plans going forward for a resumption of traditional classroom modes and pedagogies. With lower enrollments during the 2020-2021 cycle, at least one of the summer courses (CHEM 302) that has been offered under the SAFE approach will be discontinued for summer 2022 due to adverse effect on fall course enrollment.	With the shift to online and hybrid modes of delivery during 2020-2021, faculty focused on converting new courses to online/ hybrid format and on improving online (asynchronous) study materials for students.	Since national norms were unavailable or even unreliable for ACS General Chemistry and Organic Chemistry courses, and no standardized exams were available for other core courses, no firm evaluation of outcomes was made for the 2020-2021 academic year. Assuming return to "normal" course delivery modes, or at least the ability to administer secure ACS exams in the 2021-2022 academic year, faculty in core courses where such exams are available will resume their use.
Comments on part II: One positive outcome of our experience with the effect of COVID on course delivery has been the development of some asynchronous online study and review materials that can be carried over to use in subsequent semesters as supplements to more fully address more difficult course materials.				