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| **Assurance of Student Learning Report****2020-2021** |
| Ogden College of Science and Engineering | Department of Chemistry |
| Chemistry, Ref. 623 |
| Les Pesterfield, Professor, Department of Chemistry |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages.*** |
| **Student Learning Outcome 1:**  Our graduates will have the ability to communicate effectively in written form. |
| **Instrument 1** | **Laboratory reports from CHEM 451 (Physical Chemistry Lab)** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 2:** Our graduates will have the ability to read and interpret data about chemical systems. |
| **Instrument 1** | **American Chemical Society Exam in Analytical Chemistry** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 3:** Our graduates will have an understanding of structure-property-function relationships for a variety of molecules |
| **Instrument 1** | **American Chemical Society Exam in Organic Chemistry** |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| 1. Rubric for lab reports was refined to reflect input from multiple faculty evaluators.
2. A question analysis was performed on the national ACS exams for Quantitative Analysis and the Organic Chemistry sequence. Based on the content analysis, individual questions were developed by faculty and used to assess student understanding over the duration of the semester. This is opposed to the end-of-the-semester national exam assessment. An increase in student performance was observed for both courses.
3. The faculty will explore the use of a combination of in-term and end-of-term assessments to gauge student short term vs long term understanding and performance during the Fall 2021 semester. Results from the Fall semester in-term and end-of-term assessments will be used to evasluate the efficancy of the assessment tools in judging student learning.
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| **Student Learning Outcome 1** |
| **Student Learning Outcome**  | Our graduates will have the ability to communicate effectively in written form. |
| **Measurement Instrument 1**  | **Laboratory reports from CHEM 451 (Physical Chemistry Lab)**The lab report for the Crystal Violet (CVL) and Adiabatic Expansion (AEL) Laboratories were chosen, as it requires students to collect and analyze data and report on the results of the experiment in a clear fashion. Students are expected to analyze the data and arrive at accurate (reasonable) conclusions from this data. They are further required to communicate these results in a clear and effective way in scientific writing. The CVL is perform early in the semester and the AEL is performed later in the term.The instrument was assessed in a fashion consistent with the Written Communication VALUE Rubric from AAC&U. Basic parameters for *Context, Content, Conventions, Sources, and Syntax* were rated on the 1 to 4 scale. A maximum score of 20 was possible |
| **Criteria for Student Success** | Students should score a total of 13 or higher over the 5 areas on the rubric. For the CVL, overall scores ranged from 10 to 20 with an average 12.7. For the AEL, overall scores ranged from 12 to 40 with an average of 14.1. |
| **Program Success Target for this Measurement** | 75% | **Percent of Program Achieving Target** | 54% for CVL 77% for AEL |
| **Methods**  | All 14 students in CHEM 451 course in 2020-2021 were scored on the two lab reports.The reports were all assess/rated by the instructors of record of the course for Fall 20 and Spring 21. |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| A wide range of writing ability continues to be observed in the students. The use of example reports has shown to help students avoid formatting errors. However on an individual basis, students continue to struggle with stylistic/syntax errors.  |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The rubric will continue to be evaluated and refined for appropriateness for scientific writing. Sample reports will continue to be used to provide students with examples from which to work. Students having difficulties with syntax/grammar will be referred to the university Writing Center.Students do show improved performance on the writing assignments over time, as observed in the increase in the percent of students achieving the target going from 54% to 77% during the semester. Having multiple writing assessments allows students to review and correct their mistakes. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to assess this outcome again next year using a slightly refined rubric. |

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| **Student Learning Outcome 2** |
| **Student Learning Outcome**  | Our graduates will have the ability to read and interpret data about chemical systems. |
| **Measurement Instrument 1** | **American Chemical Society Exam in Analytical Chemistry**This is a nationally-normed 50-question multiple choice exam given at the conclusion of the CHEM 330 (Quantitative Analysis) course (required of all majors and minors).  |
| **Criteria for Student Success** | 50%-tile ranking or higher  |
| **Program Success Target for this Measurement** | 50% of students taking the exam | **Percent of Program Achieving Target** | 73% |
| **Methods**  | Assessments were given to all students in the course. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) |
| Course content is being evaluated in the context of exam topics. This exam is made available in an updated version approximately every two years. This update cycle allows the exam to reflect the current topical content recommended by the exam committee.Due to exam-security restrictions put in place by the American Chemical Society for the administration of the national exam, the Department was not able to give the ACS exam for the 20-21 AY. To maintain continuity with the designated SLO, faculty teaching the CHEM 330 course identified topic areas on the national exam and write questions focused on the identified topic areas for inclusion on assessments given in the course.A question level analysis was completed for the Fall 2020 semester and content specific questions were developed to assess the content areas on the national exam. Specific content areas identified and assessed were acid/base chemistry, statistics, electrochemistry, chromatography and spectrophotometry. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The increase in the percentage of students achieving the target percentile of content mastery are a function of two changes in the course. First, students were provided a content review opportunity before each assessment. And second, content areas were assessed over the extent of the semester with multiple assessment tools as opposed to an end-of-the-semester single assessment. Both of these types of assessment (during the term vs end of term) are useful in providing insight into student learning in the selected content areas. During-the-term assessments give faculty a chance to respond in student misconceptions and deficiencies in real time. While end-of-the-term assessments allow faculty to collect data on the students’ ability to retain and apply concepts in the long term.  |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to assess this outcome again next year. |

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| **Student Learning Outcome 3** |
| **Student Learning Outcome**  | Our graduates will have an understanding of structure-property-function relationships for a variety of molecules. |
| **Measurement Instrument 1** | **American Chemical Society Exam in Organic Chemistry**This is a nationally-normed 50-question multiple choice exam given at the conclusion of the CHEM 342 (Organic Chemistry 2) course. |
| **Criteria for Student Success** | 50%-tile ranking or higher |
| **Program Success Target for this Measurement** | 50% of students taking the exam | **Percent of Program Achieving Target** | 69% |
| **Methods**  | Assessments were taken by all students in the course. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| Course content is being evaluated in the context of exam topics. This exam is made available in an updated version approximately every two years. This update cycle allows the exam to reflect the current topical content recommended by the exam committee.Due to exam-security restrictions put in place by the American Chemical Society for the administration of the national exam, the Department was not able to give the ACS exam for the 20-21 AY. To maintain continuity with the designated SLO, faculty teaching the CHEM 340 and 342 courses identified topic areas on the national exam and write questions focused on the identified topic areas for inclusion on assessments given in the course.A question level analysis was completed for the Fall 2020 semester and content specific questions were developed to assess the content areas on the national exam. Specific content areas identified and assessed were acid/base chemistry of organic molecules, sterochemistry, electrophilic substitution reactions, reactions of alcohols, ethers and carboxylic acids.  |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| The increase in the percentage of students achieving the target percentile of content mastery are a function of two changes in the course. First, students were provided a content review opportunity before each assessment. And second, content areas were assessed over the extent of the semester with multiple assessment tools as opposed to an end-of-the-semester single assessment. Both of these types of assessment (during the term vs end of term) are useful in providing insight into student learning in the selected content areas. During-the-term assessments give faculty a chance to respond in student misconceptions and deficiencies in real time. While end-of-the-term assessments allow faculty to collect data on the students’ ability to retain and apply concepts in the long term.  |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We plan to reassess this outcome next year. |