End of Year Assessment Report for Programs

Program: Chemistry	Semester/year: Spring 2021
Program Director: Scott Pattenaude	Submission date: 5-21-2021
Year in Operational Plan: Year 1	

Assessment Methods and Benchmarks

Program Objective	Introducing	Developing	Mastering
PO 1: Demonstrate an understanding of major concepts, theoretical principles and experimental findings in chemistry	Course Activity: CHEM 111	Course Activity: CHEM 201	Course Activity: CHEM 321
	Benchmark: >70% on Exams	Benchmark: >70% on Homework	Benchmark: >75% on Test 1
	Evidence: 75% of students met benchmark	Evidence: 100% of students met benchmark	Evidence: 100% of students met benchmark
	Course Activity: CHEM 111	Course Activity: CHEM 201	Course Activity:
	Benchmark: >70% on Safety Quiz	Benchmark: >70% on Exams	Benchmark: >75% on gas thermometry lab report
	Evidence: 87.5% of students met benchmark	Evidence: 71% of students met benchmark	Evidence: 90% of students met benchmark
	Course Activity: CHEM 111		
	Benchmark: > 70% on Laboratory Notebooks		
	Evidence: 94% of students met benchmark		

Analysis of Assessment Findings

This is my first year as the program director, so therefore, I have few comparisons that I can make when comparing to previous years. Making any comparisons to past data may be difficult since the department has had 100% faculty turnover in the past two years. The Chemistry Operational Plan has been revised this past year, and I arbitrarily chose to start my first year in the assessment cycle in "Year 1".

The following are what I have learned from the assessment data for Program Objective 1.

1) Strengths and weaknesses in program: One strength appears to be our ability to teach developmental and mastery skills to out chemistry majors. A weakness appears to be our ability to introduce conceptual knowledge to our general chemistry students.
2) Strengths and weaknesses in the assessment process: I question the usefulness of much of the assessment data in assessing our program as is pertains to chemistry majors. These assessment activities appear to be focused on getting chemistry majors through I, D, then M levels. Much of the CHEM 111 data where introductory skills are assessed is diluted with students in other fields such as sports medicine. If we were assessing the majors, it seems more logical to break this down by majors/nonmajors (like we do for the final grades on FCARS). I am struggling to find many strengths to these data. A practice at GU suggests that I should use whatever data that I have (however limited it may be) to make conclusions. As a scientist, this philosophy makes little to no sense to me. In science, bad data is more likely to lead you to the wrong conclusions. When I see these assessment results, I have a hard time making conclusions about the program's ability to assess chemistry majors at the introductory level in any meaningful way. I think assuming that the chemistry majors struggle with CHEM 111 is an unlikely assumption (even though the assessment data may suggest this for the class as a whole).
3) Impacts of recent program changes: All of these classes have had significant changes in the past year considering that the program faculty are all new. In light of COVID, things have been much different. I view this year as setting an initial baseline for the assessment process. In coming years I hope to improve due to coming our of COVID and because I expect natural improvement as I teach the classes for a second time.
4) Impact of recent changes to assessment process on data quality: I recently wrote the chemistry operational plan, and I obviously made significant mistakes. This has limited my ability to gain quality data, but I am optimistic that this will improve. I plan to continue to modify the operational plan to make changes that give me more valuable insights into the course objectives.

Sharing and Discussion of Assessment Findings

Chemistry has only one full time faculty member, so sharing these results isn't much of a concern in the program. We do utilize one adjunct faculty member who taught the CHEM 321 sequence this year. He is a former program director for chemistry at GU and has years of experience. He is familiar with our assessment strategies and we often need in person to discuss the required documentation. He has shared his FCARs with me via email this year. Additionally, we have discussed in person the findings from our standardized exams in all of our classes (CHEM 321 is the only one being assessed in this yearly cycle). Moving forward I need to develop strategies to communicate our process and findings with new adjunct faculty and/or new full time faculty members (if applicable).

Use of Assessment Findings for Program Improvement (Action Plan)

(A) I plan to make significant modifications to the assessment process in the coming year as I make it fit my educational philosophies. Our program is limited by arbitrary cutoffs (usually 70%) in most categories. In my grading for most lab-based classes, I expect different levels of success in different categories. For example, I like to challenge students on exams, writing them hard so that students end our missing a lot of points in this category. One goal of this strategy is to teach students that success isn't always 90/80/70% in life. This teaches students that it is okay to miss a lot of points and still be successful. Mental health is a MAJOR problem in chemistry graduate problems. One contributing factor is likely the expectation of students and their abilities to get everything correct. In a research setting, chemists often have strong knowledge in some areas, but are almost always weaker in other applicable areas. It is becoming increasingly more difficult (impossible) to know all of the conceptual facts about a modern chemical problem. In other areas however, students should be expected to be nearly perfect (lab notebooks for example). For my teaching style, assessing these two assignments (exams and lab notebooks) with the same benchmark doesn't give quality data. Another strategy of mine is to teach for retention rather than breadth of knowledge. Many of our students aren't going to graduate school in chemistry, but rather into medicine. I anticipate that many of the organic chemistry "facts" will be lost if they don't use them regularly. Therefore, teaching for breadth of content wouldn't be effective for them in their careers if the just forget most of what they learned after a few years. I likely move slower in that class than most other organic chemistry sequences (covering less material) because I am focused more on long-term retention for my specific students. This is, however, punished with our current assessment strategies. My students will inherently score lower on the standardized exam since we didn't cover as much of the material. My hope is, however, that they would be more confident in the answers that they get correct and retain that content for longer. To assess this, I would like to change the model to a multi-year assessment strategy for exams in particular classes. For example, I would like to assess the organic chemistry sequence by giving the ACS standardized exam when the complete the course sequence, and then again one year later. Comparing the dropoff in knowledge (along with the starting point at the end of the sequence), would give me more robust assessment data as I seek to investigate the effectiveness of this strategy.

(B) Last years' action plan was not referenced in this assessment cycle due to the faculty turnover and new program director. This plan was rendered obsolete.

(C) My plan is to modify the chemistry operational plan in the coming year to better assess benchmark values and to better assess retention for particular courses and course objectives at different levels. The implementation of the retention analysis will inherently take some time since I will need to do follow up analysis in 1-2 years. The timeline for implementation of this is likely 3 years.

(D) One of the main communication breakdowns at CDL results from majors interacting with different majors. Though we focus on communication within our field, we don't train for communication of results across disciplines. We could better promote this amongst our students by having them present their data in classes as if they were talking with the general public or (perhaps a better strategy) would be to have them present their findings to a different discipline and critique results from a different discipline. We are currently working on this at the department level in two ways. 1) in UNIV 101 (the section that is reserved for science major) we are discussing presenting their data to the general public. 2) The faculty from different disciplines (currently agribusiness, finance, biology, and

chemistry) are working on data sets from each of the disciplines to be analyzed by the majors together. This will hopefully grow to promote discussion of data analysis strategies across disciplines.

(E) Experiential learning will be promoted in the department by:

1) increasing speakers to campus (pizza colloquium) and trips for students to engage with different careers in chemistry. I am currently working on a trip to a chemical waste incineration facility, which will allow students to see where their chemical waste goes and reflect on what environmental considerations should be prioritized (this connects with my faith integration plan as well).
2) Diversify the research on campus. Promote mid-semester research (which tends to be more multidisciplinary) and expand summer research opportunities to promote more chemistry research (current projects are steering more to environmental biology). Incorporate more science research into the UNIV 401 program and strengthen partnerships at health-related facilities (local hospital/health departments).
3) Move the lab model from "teaching labs" to "doing labs". This requires me to risk a listen to student interests in the class, come up with investigative ideas in that area, and give the students the problem/tools. This requires that I don't actually clean up the lab for them and often carries a potential for complete failure of the study. These labs can be scary as an instructor but setting expectations with the students allows them to embrace the messiness of the lab sections and allows them to embrace/explore their own problem-solving strategies. I have found that students value these experiences more.