

Institutional Effectiveness Report

Name of Program/Department:	Chemistry
Year:	2017-2018
Name of Preparer:	Pete Peterson, IE Coordinator and Department Chair

Program Mission Statement

The mission of the chemistry department is to provide a dynamic and inquiry based curriculum in chemistry that provides knowledge and skills needed for students to be successful in their professional and life-long endeavors. Accordingly, the department offers introductory, foundation, and in-depth chemistry courses that satisfy requirements in liberal arts, pre-professional programs, the basic chemistry degree, and the American Chemical Society approved degree program. The department strongly encourages undergraduate research and networking within the scientific community.

Program Learning Outcomes (PLOs)

Program Learning Outcomes

Graduates with a Chemistry degree from Francis Marion University will:

PLO #1 – Demonstrate that they have the knowledge and skills needed that will allow them to communicate chemistry effectively in both oral and written form.

PLO #2 – Demonstrate that they can apply critical thinking skills in chemistry.

PLO #3 – Demonstrate an understanding of core concepts, methods and limits of scientific inquiry that will allow them to successfully solve integrated problems in chemistry.

PLO #4 – Demonstrate that they can adequately apply their knowledge of chemistry. .

PLO #5- Demonstrate that they can adequately use the scientific literature.

PLO #6 - Demonstrate an understanding of safe laboratory skills and procedures for laboratory experiments that they perform.

Executive Summary of Report (one-page maximum)

Presented in this report are the Chemistry Department's Mission, Program and Student Learning Outcomes, the assessment and results of each, and action items for academic year 2017-2018. Achievement of our senior chemistry majors on communication skills, concept knowledge and critical thinking skills was assessed with Capstone writing assignments, the ACS *Diagnostic of Undergraduate Chemical Knowledge (DUCK)* Exam, ratings of presentations in senior-level courses, and a chemical safety exam.

Students in Chemistry 499, which is our senior capstone course, performed at a 100% pass rate on five capstone writing assignments that assessed their understanding of key chemical concepts SLO (# 1). Our goal was 80% for this (SLO # 1). Therefore, our target was achieved.

Students in Chemistry 499 Senior Capstone scored on average at the 30.20 Percentile on the ACS (American Chemical Society) Diagnostic of Undergraduate Chemical Knowledge (DUCK) exam (SLO # 2). Although our score is at the mean national score on the Duck (national score is 31.37% , Sts error = 3.70%), our very optimistic goal for the 50th Percentile for SLO # 2 was not met.

Students in Chemistry 499 Senior Capstone, on average, performed at the 91.00% level when demonstrating competency in presenting technical information on their written communication skills on a chemistry topic of their choosing that was approved by the chemistry faculty (SLO # 3). Our goal for SLO # 3 was 80.00%. Therefore, our target was achieved.

Students in Chemistry 499 Senior Capstone, on average, performed at the 81.88% level when demonstrating competency in presenting technical information on their oral communication skills on the same chemistry topic in as in SLO # 3 of their choosing that was approved by the chemistry faculty (SLO # 4). Our goal for SLO # 4 was 80.00%. Therefore, our target was achieved.

All students enrolled in Chemistry 201 demonstrated a satisfactory understanding of laboratory safety procedures at or above the 70% level (SLO # 5). Our goal for SLO # 5 was 70%. Therefore, our target was achieved.

To address matters associated with improving all SLO's that were identified in the evaluation of data from the 2017-2018 academic year, the Chemistry Department will continue to review and modify its current action plan from previous years to be implemented during the 2018-2019 academic year.

Based on the IE assessment data from 2017-2018 and looking toward the 2018-2019 academic year, the Chemistry Department faculty will continue to look for ways to improve the writing and oral presentation rubrics. These rubrics will be made available to all chemistry majors starting at the freshman level, with goal that they will be better prepared at the senior level. Next, the Department will continue to develop its online component of the Chemistry 499 Capstone course on the Blackboard platform that will enable students to access review materials and practice tests earlier during the 2018-2019 Academic year in order for them to have more time to review and prepare for the DUCK exam.

All department efforts dedicated toward improving SLO's will be discussed and decided upon at our Department's biweekly meetings.

Student Learning Outcomes (SLOs)

SLO# 1.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level, on a pass/fail basis, or above on capstone writing assignments that assess their understanding of key chemical compounds.

SLO# 2.0: 80% of graduating Chemistry students will, on average, perform at the 50th percentile or above when demonstrating their understanding of integrated chemical concepts based on their performance on a nationally standardized chemistry exam.

SLO #3.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through written communication.

SLO #4.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through oral communication.

SLO #5.0: 100% of students enrolled in Chemistry 201 will demonstrate an Understanding of laboratory safety procedures at the 70% level or above.

Assessment Methods

SLO# 1.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above on capstone writing assignments that assess their understanding of key chemical concepts as measured by four (4) writing assignments administered over the course of the semester and measured by a departmentally developed rubric.

Assessment Method SLO# 1.0: Four writing assignments were administered throughout the course of the senior Chem 499 Capstone course during the spring of 2018. The assignments were graded on a pass/fail basis. A passing grade was assigned if the student presented adequate knowledge of the chemical concept tested. Otherwise a grade of fail was assigned.

SLO# 2.0: 100% of graduating Chemistry students will, on average, perform at the 50th percentile or above when demonstrating their understanding of integrated chemical concepts based on their performance on a nationally standardized chemistry exam.

Assessment Method SLO# 2.0: Graduating Chemistry students were administered the *Diagnostic of Undergraduate Chemical Knowledge (DUCK)* exam, a standardized exam that is produced by the American Chemical Society (ACS). The exam consists of several chemistry scenarios testing multiple concepts, each of which is followed by several multiple choice questions based on it. There are a total of 60 questions in all.

SLO #3.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through written communication.

Assessment Method SLO# 3.0: To assess their written communications skills, each student in the Chemistry Senior Capstone course wrote a term paper based on a technical chemistry topic they select and then was faculty approved. Each paper was graded by the Capstone instructor using a standard, department generated grading rubric for scientific term papers.

SLO #4.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through oral communication.

Assessment Method SLO# 4.0: To assess their oral communications skills, each student in the Chemistry Senior Capstone delivered an oral presentation on the same chemistry topic as their written topic, which is described in SLO 3.0. Each presentation was graded by all of the available chemistry instructors using a standard, department generated grading rubric for scientific term papers.

SLO #5.0: 100% of students enrolled in Chemistry 201 will demonstrate an understanding of laboratory safety procedures at the 70% level or above.

Assessment Method SLO# 5.0: All students enrolled in Organic Chemistry 201, a foundation course that is required for all chemistry majors, are taught a lab module on chemical safety during the first couple of weeks of the course. This is followed by their taking a comprehensive and cumulative lab safety exam that is produced and administered by the Chemistry Department. They must score at least 60% on the safety exam to remain in the course.

Assessment Results

SLO# 1.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level, on a pass/fail basis, or above on capstone writing assignments that assess their understanding of key chemical concepts.

Assessment Results for SLO# 1.0: Students in 499 Chemistry Senior Capstone on average, performed at a 100% pass rate for the 2017-2018 academic year for SLO # 1. Our target of 80% for SLO # 1 was therefore achieved, and it surpassed last year's results.

SLO# 2.0: 80% of graduating Chemistry students will, on average, perform at the 50th percentile or above when demonstrating their understanding of integrated chemical concepts based on their performance on a nationally standardized chemistry exam.

Assessment Results for SLO# 2.0: On average, graduating FMU chemistry majors scored at the 30.20 Percentile mark on the DUCK exam for the 2017-2018 academic year. Although our target for 80.00% at or above the 50th Percentile for SLO # 2.0 was not achieved, it represents an increase of 9% over last year's percentile.

SLO #3.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through written communication in the form of a chemistry term paper.

Assessment Results for SLO# 3.0: Students in 499 Chemistry Senior Capstone, on average, performed at the 91.00% level on their chemistry term paper as graded by the Chemistry 499 Capstone instructor using a standard scientific term paper rubric. Our target for SLO # 3 was 80.00%. Therefore, our target was achieved.

SLO #4.0: Students in the Chemistry Senior Capstone course, on average, will perform at the 80% level or above when demonstrating competency in presenting technical information through oral communication.

Assessment Results for SLO# 4.0: Students in 499 Chemistry Senior Capstone, on average, performed at the 81.88% level on their chemistry oral presentation as graded by the chemistry faculty using a standard

scientific, department generated rubric. Our target for SLO # 4 was 80.00%. Therefore, our target was achieved.

SLO #5.0: 100% of students enrolled in Chemistry 201 will demonstrate an understanding of laboratory safety procedures at the 70% level or above.

Assessment Results for SLO# 5.0: 100% of students enrolled in Chemistry 201 demonstrated an understanding of laboratory safety procedures at the 70% level or above based on a comprehensive and cumulative lab safety exam that was produced and administered by the Chemistry Department.

Action Items

To address matters associated with improving all SLO's that were identified in the evaluation of data from the 2017-2018 academic year, the Chemistry Department will continue to review and modify its current action plan from previous years to be implemented during the 2018-2019 academic year.

Based on the IE assessment data from 2017-2018 and looking toward the 2018-2019 academic year, the Chemistry Department faculty will continue to look for ways to improve the writing and oral presentation rubrics. These rubrics will be made available to all chemistry majors starting at the freshman level, with goal that they will be better prepared at the senior level. Next, the Department will continue to develop its online component of the Chemistry 499 Capstone course on the Blackboard platform that will enable students to access review materials and practice tests earlier during the 2018-2019 academic year in order for them to have more time to review and prepare for the DUCK exam.

All department efforts toward improving SLO's will be discussed and decided upon at our Department's biweekly meetings.

Appendix

Chemistry 499 Capstone Course 2018

Chemistry Term Paper Rubric

Student's Name _____

Faculty Reviewer _____

	Category	Scoring Criteria	Score Range	Reviewer's Score
1	Abstract	(a) Main points are briefly presented, (b) keywords accurately describe information in report, (c) abstract is less than 200 words long	0-5 5 being the highest	
2	Introduction	(a) effectively communicates the purpose and importance of the research topic in the context of chemistry, (b) supplies and demonstrates understanding and proper use of needed information and terms, (e) lays out the framework for the rest of the paper	0-15 15 being the highest	
3	Body	(a) shows command of topic, (b) chemistry content is sufficient (c) describes experimental procedures and results and makes valid interpretation of results, (d) contains accurate information, (e) draws on multiple areas, (f) content backed up by multiple, refereed, and credible sources	0-25 25 being the highest	
4	Conclusion	(a) Communicates a logical conclusion that follows from the body, (b) summarizes and evaluates the major points, strengths and possible weaknesses of the research, (c) discusses further research needed in the area	0-20 20 being the highest	
5	References and Appendices	(a) Cite at least six references from at least three different peer review journals, (b) references are complete and numbered, (c) references follow acceptable format (see ACS Style Guide or the reference style of one of the journals cited), (d) supplementary materials are located at the back of report, (e) sources of information including graphics are appropriately cited and referenced	0-10 10 being the highest	
6	Appearance and Format	(a) makes effective use of headings and subheadings, (b) pages are numbered and bound in a folder, (c) uses appropriate font sizes, the height of the letters must not be smaller than 10 point type density, including characters and spaces, must be no more than 15 characters per 2.5 cm, for proportional spacing, the average for any representative section of text must not exceed 15 characters per 2.5 Cm, (d) no more than 6 lines of type within in a vertical space of 2.5 cm, left and right margins are justified and must be at least 2.5 cm	0-5 5 being the highest	
7	Writing Style and Grammar	(a) writing is coherent, clear, concise, engaging, and gets point across (b) no sentence fragments, comma splices, or fused sentences, (c) no errors in punctuation, spelling, and/or in the placement of words, (d) makes good use of strong nouns and action verbs	0-10 10 being the highest	
8	Other Relevant Factors	(a) Title is sufficiently narrowed down and reflects the content of the paper (b) shows some understanding of other relevant areas outside of chemistry, (c) engaging, (d) good choice of topic, (e) new and interesting ideas	0-10 10 being the highest	
9	Faculty Comments and Recommendations for Rubric Improvements		100 Pts maximum	Reviewer's Total Score _____

Chemistry 499 Capstone Course 2018
Chemistry Research Oral Presentation Rubric

Student's Name _____

Faculty Reviewer _____

	Category	Scoring Criteria	Score Range	Reviewer's Score
1	Introduction	(a) Good opening statement, (b) effectively communicates the purpose and importance of the talk and research in the context of chemistry, (c) supplies and demonstrates understanding of background information, (d) lays out the framework for the rest of talk	0-10 10 being the highest	
2	Chemistry Content	(a) Describes experimental procedures and results relating to chemistry, (b) contains accurate information, (c) draws on multiple areas, (d) good use and explanation of visual aids (e.g., data charts, illustrations, and drawings), (e) content backed up by multiple, refereed, and credible sources	0-30 30 being the highest	
3	Knowledge of Topic	(a) Understands basic chemical terms and principles relevant to the research for the level of senior chemistry majors, (b) evaluates the research (e.g., strong and weak points) at the level of senior chemistry majors, (c) answers questions adequately without a distractive use of notes, internet, or other persons	0-30 30 being the highest	
4	Conclusion	(a) Communicates a logical conclusion, (b) summarizes the major points, strengths and possible weaknesses of the research, (c) discusses further research needed in the area	0-10 10 being the highest	
5	Delivery	(a) Speaks clearly and presentation does not seem to be read from a scripted text, (b) well organized, (c) effective and smooth transitions, (d) dresses appropriately, (e) good body language, (f) delivers presentation adequately and generally not reading from prepared notes (g) does not go to internet to answer questions from the audience, (h) presentation done within the 15 minute (not counting Q&A's) allotted time	0-10 10 being the highest	
6	Other Relevant Factors	(a) Adequately understands other relevant areas outside of chemistry, (b) engaging; (c) creativity; (d) topic choice; (e) new and interesting ideas; (f) answers questions adequately without the use of note cards, internet, or other persons	0-10 10 being the highest	
7	Faculty Comments and Recommendations for Rubric Improvements		100 Pts maximum	Reviewer's Total Score <hr/>

