

Program-Level Assessment: Annual Report

Program Name (no acronyms): Chemistry MS	Department: Chemistry
Degree or Certificate Level: Graduate	College/School: Science & Engineering
Date (Month/Year): September 2023	Assessment Contact: Marvin Meyers
In what year was the data upon which this report is based collected? 2022-2023	
In what year was the program's assessment plan most recently reviewed/updated? 2018	
Is this program accredited by an external program/disciplinary/specialized accrediting organization? No	

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please list the full, complete learning outcome statements and not just numbers, e.g., Outcomes 1 and 2.)

This is Year 3 of a three year cycle. The Outcomes 2, 3 and 5 were evaluated according to the program assessment plan.

Outcome 1: Demonstrate advanced level knowledge in both (i) synthesis and materials chemistry and (ii) analytical and physical chemistry methods, with a higher level of knowledge expected in the student's area of focus.

Outcome 2: Use standard search tools and retrieval methods to obtain information about a topic, substance, technique, or an issue relating to chemistry and assess relevant studies from the chemical literature.

Outcome 3: Communicate scientific findings from literature and original findings from the student's own advanced research in written publications and oral presentations.

Outcome 4: Acquire the basic tools, including chemical practices and theories, needed to conduct advanced chemical research. Students will become proficient in their specialized area of chemistry and complete an advanced research project.

Outcome 5: Adhere to accepted ethical and professional standards in chemistry.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe the artifacts in detail and identify the course(s) in which they were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

For Outcome 2, using a scale of 1 to 4 (1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent), a rubric on the student's "Background Knowledge" for the MS final defense was used.

For Outcome 3, the overall score out of 100 points on a rubric for the research paper from CHEM 5470 Medicinal Chemistry was used. Criteria used for assessment was as follows:

>90% Exceeds expectations

70 - 89% Meets expectations

65 - 69% Approaching expectations

<65% Not meeting expectations

For Outcome 5, we devote a class period in CHEM-5000, our introductory research course, devoted to discussion of research ethics. Students are given real world examples as pre-reading, preparing them to participate in discussion.

No courses were offered online. Madrid does not have a graduate program in Chemistry.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and **include them in/with this report document** (please do not just refer to the assessment plan).

Rubrics (attached) were used for the artifacts. These were completed by the student's research mentors or course instructors.

4. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

For Outcome 2 (*Use standard search tools and retrieval methods to obtain information about a topic, substance, technique, or an issue relating to chemistry and assess relevant studies from the chemical literature*), using a scale of 1 to 4 (1 = Poor, 2 = Fair, 3 = Good, 4 = Excellent), a rubric on the student's "Background Knowledge" for the MS final defense was used.

MS Thesis (written)	Individual Students					Median	# in each category				Total #
	1	2	3*	4*	5		4 (Excellent)	3 (Good)	2 (Fair)	1 (poor)	
Thesis Format	3	3	4	3		3	1	3	0	0	4
Background Knowledge	3	3	3	2		3	0	3	1	0	4
Presentation of Advanced Research	3	3	3	3		3	0	4	0	0	4
Written Communication	4	3	3	2		3	1	2	1	0	4
Overall (avg)	3.25	3	3.25	2.5	#DIV/0!						

Assessment of Outcome 2: These are all students at the end of completing their MS degree. 3 of 4 students received "Good" ratings while one received a "Fair" rating. The student with the Fair rating was under a lot of stress to finish up due to family and job pressures. Overall, these meet our expectations.

For Outcome 3 (*Communicate scientific findings from literature and original findings from the student's own advanced research in written publications and oral presentations*), the overall score out of 100 points on a rubric for the research paper from CHEM 5470 Medicinal Chemistry was used.

Assessment of Outcome 3: Due to the low number of MS students, we used data from the past 3 years. 3 of 4 exceeded expectations and 1 of 4 did not meet expectations. The latter was due to not turning the assignment in on time and overall poor performance on the assignment.

For Outcome 5, we devote a class period in CHEM-5000, our introductory research course, devoted to discussion of research ethics. Students are given real world examples as pre-reading, preparing them to participate in discussion. All students participated in this discussion.

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

As our chemistry grad program has grown, we now have many more students pursuing PhDs rather than MS degrees. Roughly half of those obtaining the MS degree do so due to pressure to get a job for improved income or due to struggling in graduate school. This is reflected in the results where some students are strong and leave early for industry jobs while some of the others struggle and decide not to pursue a PhD instead electing to complete the MS degree. Most of our MS students are finishing the program, meeting our expectations.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of

assessment?

The results and findings were communicated via the department's Microsoft Teams meeting portal and opened for discussion online and in the department faculty meeting.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies

- Course content
- Teaching techniques
- Improvements in technology
- Prerequisites

- Course sequence
- New courses
- Deletion of courses
- Changes in frequency or scheduling of course offerings

Changes to the Assessment Plan

- Student learning outcomes
- Artifacts of student learning
- Evaluation process

- Evaluation tools (e.g., rubrics)
- Data collection methods
- Frequency of data collection

Please describe the actions you are taking as a result of these findings.

Over the past year, we formed a Graduate Program Review Committee. We reviewed our program to identify improvements which could be made to identify knowledge weaknesses in students earlier in their program. Our written comprehensive exams for third year students were creating a lot of stress over their 2nd summer losing time for research while really only retesting students on knowledge they either should have had upon arrival in the program or had been previously tested on in their graduate coursework. Some students failed this key exam and then were required to leave the PhD program and complete their MS in their third year. We replaced this with "prelims" (standardized ACS subject exams) taken their first week upon arrival in order to identify any deficiencies early in their program so that we can give them opportunity to fill those gaps in knowledge right away (e.g., via auditing the appropriate course) rather than let them struggle for a couple of years. Should they not remedy these deficiencies (as determined by retaking the ACS subject exam), they will know by the end of their first year that they will not be permitted to work towards the PhD and will be completing a MS (should they choose to do so) and can thus finish the MS in a timely manner (2 years total). Some of these changes have already been approved by the SSE faculty council and others will be submitted, along with a revised graduate handbook this fall.

We will develop a quantitative assessment tool for Outcome 5 and incorporate it into our CHEM 5000 class.

If no changes are being made, please explain why.

N/A

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

We have not made any specific changes to our program as our assessment data consistently shows that our students are meeting expectations on our outcomes. However, as noted above, we are making some changes to improve the overall student and faculty experience. Fall 2023 is the first year of those changes.

B. How has this change/have these changes been assessed?

N/A

C. What were the findings of the assessment?

N/A

D. How do you plan to (continue to) use this information moving forward?

We will continue to monitor the progress of our students and as areas of concern arise, we will make adjustments to address issues.

CHEM-5470 Research Paper Rubric

Name _____

Standards	5 - 4 Exemplary	3 - 2 Satisfactory	1 - 0 Weak	Score	Weight	Total Score
Introduction	Provides background research into the topic and summarizes important findings from the review of the literature; describes problem to be solved; explains the significance of the problem to an audience of non-specialists	Provides background research into the topic and describes the problem to be solved	Provides background research into the topic but does not describe the problem to be solved; insufficient or nonexistent explanation of details to non-specialists		x 3	
Discussion	Integration of Knowledge	Discusses at least four topics covered during the course. Demonstrates full understanding and application of concepts learned in course. Chemical detail of structures and discussion is accurate.	Discusses three topics covered during the course. Demonstrates satisfactory understanding and application of concepts learned in course. Chemical detail of structures and discussion are mostly accurate.		x 4	
	Depth	Paper presents a complete story of the discovery of the selected drug, including medical need, biological target or assay, medicinal chemistry optimization, and development.	Paper presents a partial story of the discovery of the selected drug.		x 4	
	Cohesiveness	Addresses the topic with clarity; organizes and synthesizes information; and draws conclusions	Addresses the topic; lacks substantive conclusions; sometimes digresses from topic of focus	Presents little to no clarity in formulating conclusions and/or organization		x 4
Summary	Presents a summary of the topic with clear recommendations and/or implications for future research	Presents a summary of the topic	Missing or does not summarize the topic		x 3	
Mechanics and documentation	Is free or almost free of errors of grammar, spelling, and writing mechanics; appropriately documents sources (ACS style)	Has errors but they don't represent a major distraction; documents sources	Has errors that obscure meaning of content or add confusion; neglects important sources or documents few to no resources		x 2	
Comments				Grand Score (max 100)		

SLU Chemistry Department – MS Thesis

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Thesis Format	<i>The organization of the thesis is confusing and/or the length is not appropriate. The references may not be appropriately formatted.</i>	<i>The organization of the thesis is, in places, confusing and/or the length is not appropriate. References may not be appropriately formatted. More emphasis should be placed on several of the sections.</i>	<i>The thesis is well-organized and is of appropriate length. References are appropriately formatted. More emphasis should be placed on a few of the sections.</i>	<i>The thesis is well-organized and is of appropriate length. Chapters are balanced appropriately. References are appropriately formatted.</i>	
Background Knowledge	<i>Demonstrates limited knowledge of chemical principles and the current literature.</i>	<i>Demonstrates adequate knowledge of chemical principles and an awareness of the current literature, but does not identify unanswered questions in the field.</i>	<i>Demonstrates sufficient knowledge of the current literature and chemical principles. Correctly identifies and understands the importance of unanswered questions in the field.</i>	<i>Demonstrates the ability to apply fundamental concepts to advanced topics in chemistry and in-depth knowledge of the current literature. Correctly identifies and illustrates the importance of unanswered questions in the field and presents his/her work within the context of these questions.</i>	
Presentation of Advanced Research	<i>The aims/objectives and/or the rationale for the project are not adequately described. The experimental approach is neither clearly defined nor logical. Results and discussion are limited.</i>	<i>Aims/objectives are described, however, the rationale for the aims/objectives is unclear. The experimental approach is clearly defined and logical, however the results and discussion lack clarity.</i>	<i>Aims/objectives are described. A rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results are presented and interpreted, but additional discussion should be provided.</i>	<i>The aims/objectives are clearly described and provide a logical framework to address a problem. A compelling rationale for the aims/objectives is included. The experimental approach is clearly defined and logical. Results and discussion are complete.</i>	
Written Communication	<i>Fails to clearly communicate results and conclusions.</i>	<i>Adequately communicates results and conclusions, however supporting information and explanations are missing.</i>	<i>Successfully communicates results and conclusions, supporting information and explanations are provided.</i>	<i>Results and conclusions are not only successfully summarized and supported, but are also analyzed in the context of the field.</i>	

Comments:

SLU Chemistry Department – Final Defense Rubric for MS students

	1 (Poor)	2 (Fair)	3 (Good)	4 (Excellent)	Score
Demonstrate advanced level knowledge in both (i) synthesis and materials chemistry and (ii) analytical and physical chemistry methods, with a higher level of knowledge expected in the student's area of focus	<i>Student lacks basic knowledge in chemistry topics.</i>	<i>Student displays knowledge, but is weak in several key concepts.</i>	<i>Student displays knowledge, with minor weaknesses.</i>	<i>Student displays great knowledge chemistry topics.</i>	
Acquire the basic tools, including chemical practices and theories, needed to conduct advanced chemical research. Students will become proficient in their specialized area of chemistry and complete an advanced research project.	<i>Student has make limited progress on an advanced research project.</i>	<i>Some progress has been made on an advanced research project.</i>	<i>Sufficient progress has been made on an advanced research project.</i>	<i>Significant progress has been made on an advanced research project.</i>	
Communicate scientific findings from literature and original findings from the student's own advanced research.	<i>Student unable to clearly communicate chemical topics.</i>	<i>Student can sometimes communicate chemical topics effectively.</i>	<i>Student can effectively communicate chemical topics.</i>	<i>Student can communicate chemical topics effectively and compellingly.</i>	

Comments:

Please return to the Chemistry Graduate Program Coordinator