Institutional Effectiveness
2022-2023

Program: Chemistry MS
College and Department: College of Arts & Sciences, Department of Chemistry
Contact: Jeff Boles
Mission:

The mission of the graduate program in chemistry may be summarized as follows:

1. To provide an ongoing program of study that prepares graduates to successfully pursue scientific careers in industry or to continue their education in a doctoral program or professional school.
2. To provide students with opportunities to reinforce their background and expand their knowledge in areas integrated with their undergraduate coursework, with course offerings in the five major branches of chemistry.
3. To provide an ongoing, stimulating and intellectual atmosphere conducive to the learning process of both students and faculty through low student-to-faculty ratios.
4. To provide the facilities and professional mentorship enabling students to propose, conduct, evaluate, and report in a systemic way on original research and thereby add to the knowledge of humanity.
5. To provide opportunities for students to refine both oral and written communication skills.

The graduate curriculum is designed to acquaint students with the current ideas in the five major areas of chemistry (organic, inorganic, physical, analytical, and biochemistry). The thesis project affords the student practical experience in the methods used to obtain new knowledge and to develop the skills necessary to understand and relate this knowledge. Special topics courses allow individual professors to present specialized material in their area of expertise. The faculty maintains a wide variety of research programs, giving each student an opportunity to conduct, evaluate, and report on original research.

Attach Curriculum Map (Educational Programs Only): *See Appendix 1.

SLO 1: COLLECT AND CITE BACKGROUND INFORMATION SHOWING EFFECTIVE USE OF SCIENTIFIC LITERATURE

Define Outcome:
Students should learn to research the background of a topic through use of the scientific literature (peer-reviewed) with little assistance. This should include electronic database searches such as SciFinder Scholar and other such accessible platforms.

Assessment Methods:
Evaluation is made through the use of the Graduate Advisory Committee Thesis Assessment Form which is completed by each committee member following the successful defense of the students master's degree.

Criteria for Success (Thresholds for Assessment Methods):
The Criteria for success is that 75% of the MS graduates score a 3.33 out of 4 on this assessment.

Results and Analysis:

Student	**Background information**	**Documentation**
Student 1	3.33	2.67
Student 2	4.00	4.00
Student 3	3.50	3.50
Student 4	2.67	3.00
Average	**3.375**	**3.30**

Seventy-five percent of the students scored a 3.33 or above in Background Information gathering and 50% exceeded the threshold in citing literature (documentation). However, the average of all students did meet the threshold.

Use of Results to Improve Outcomes:
Faculty mentors were encouraged to inform graduate students that they have immediate access to journals not held within our library and encourage them to use that resource. At the graduate student orientation this fall, the students will be made aware of the library resources (access to journals and citation software) and encouraged to initiate a conversation with their mentor as soon as their project is selected. Graduate Faculty mentor are responsible for these actions.

SLO 2: PREPARE A HYPOTHESIS, DESIGN AND EXECUTE EXPERIMENTS TO TEST AND REFINE THE HYPOTHESIS, KEEPING COMPLETE EXPERIMENTAL RECORDS.

Define Outcome:
Outcome 2 basically assesses a student's progress toward implementing the scientific method independently, along with developing improved critical thinking skills to refine a hypothesis. As

graduate students, they should make significant progress in this area compared to their ability as an undergraduate.

Assessment Methods:
Evaluation is made through the use of the Graduate Advisory Committee Thesis Assessment Form, which is completed by each faculty committee member following the successful defense of the student's master's degree.

Criteria for Success (Thresholds for Assessment Methods):
The Criteria for success is that 75% of the MS graduates score a 3.33 out of 4 on this assessment.

Results and Analysis:

Student	Thesis Problem	Analysis/Sci. Method	Critical-Thinking
Student 1	3.33	2.33	2.67
Student 2	4.00	3.50	4.00
Student 3	3.50	3.50	3.50
Student 4	3.33	2.00	2.33
Average	**3.54**	**2.83**	**3.13**

All students scored above 3.33 in their thesis problem, however, they scored below the threshold in Analysis/Scientific Method and Critical-Thinking. This shows that while the students performed well in their creative contribution to the hypothesis and that the thesis problem was one of importance, they required more direction in carefully analyzing the collected information and using appropriate critical-thinking to propose further tests of that hypothesis.

Use of Results to Improve Outcomes:

While 50% of the students performed well in all three areas, the other 50% demonstrated room for improvement. Beginning with the next cohort of students, students will be mentored by their research director earlier in their tenure in the areas of data analysis and critical-thinking. Research mentors are responsible for these actions.

SLO 3: EFFECTIVELY COMMUNICATE SCIENTIFIC KNOWLEDGE AND IDEAS THROUGH BOTH ORAL AND WRITTEN COMMUNICATION SKILLS.

Define Outcome:
Science must be communicated in both written and oral forms. Students receiving an MS degree in chemistry should do so effectively.

Assessment Methods:
Evaluation is made through the use of the Graduate Advisory Committee Thesis Assessment Form which is completed by each committee member following the successful defense of the students master's degree.

Criteria for Success (Thresholds for Assessment Methods):
The Criteria for success is that 75% of the MS graduates score a 3.33 out of 4 on this assessment.

Results and Analysis:

Student	**Written Synthesis**	**Oral Synthesis**
Student 1	2.00	3.00
Student 2	3.00	4.00
Student 3	3.00	3.50
Student 4	2.67	2.67
Average	**2.67**	**3.30**

Fifty percent of the students scored above the threshold in Oral Synthesis, however, none of the students scored above a 3.33 in the written synthesis. Each student was encouraged to practice their thesis seminars with both peers and their mentor, however, that practice was insufficient even though the average of all students did reach the threshold of 3.3. To improve writing, each student was encouraged to make use of the writing center on campus, as well, however, none of the students scored above the threshold in that area.

Use of Results to Improve Outcomes:
Faculty mentors will be encouraged to have their students practice their seminars until they improve to a level that will likely result in a score above the threshold. The students will be encouraged to practice multiple times with their peers. Students will be informed of the campus writing center at their orientation and encouraged to seek their assistance early in their

tenure, especially if English is not their native language. Both faculty mentors and students share these actions.

Summative Evaluation:
Seminars presented by graduate students did not receive adequate feedback from faculty and students the past year which limits their opportunity for targeted improvement.

Assessment Plan Changes:
This year, a rubric will be proved to faculty and students in the audience in order to grade and provide feedback to the student giving the seminar.

List of Appendices:
Appendix 1: Curriculum Map, Chemistry MS
Appendix 2: Graduate Advisory Committee Thesis Assessment

Appendix 1: Curriculum Map, Chemistry MS

Chemistry MS Curriculum Mapping

Chemistry, MS: Mapping of the Graduate Curriculum and Student Learning Objectives						
	SLO 1 and 2: Scientific Method				**SLO 3: Communication**	
	Critical Thinking	*Literature*	*Hypothesis & Experiment*	*Statistical Analysis*	*Oral*	*Written*
CHEM 5000					X	
CHEM 5320	X	X	X			
CHEM 5410						
CHEM 5520		X	X	X	X	X
CHEM 6110	X				X	X
CHEM 6210	X	X				X
CHEM 6410	X	X	X	X		X
CHEM 6610		X	X			X
CHEM 6900	X	X	X	X	X	X
CHEM 6910	X	X			X	X
CHEM 6911	X				X	
CHEM 6990	X	X	X	X		X

Appendix 2: Graduate Advisory Committee Thesis Assessment

Graduate Advisory Committee Thesis Assessment

Thesis/Research Defense Assessment **Student Name_____Points_____**

*Point Value	Thesis/ Problem/ Question	Information Seeking/Selecting and Evaluating	Analysis	Written Synthesis	Documentation	Oral Synthesis	Critical Thinking
4	Student contributed to thoughtful, creative hypotheses that engaged them in challenging or provocative research. The research breaks new ground or contributes to knowledge in a focused, specific area.	Student gathered information from a variety of quality electronic and print sources, including appropriate databases. Sources are relevant, balanced and include critical information relating to the thesis or problem. Primary sources were included.	Student carefully analyzed the information collected, applied appropriate statistics and drew appropriate and inventive conclusions supported by data.	Student developed appropriate structure for communicating data and conclusions, incorporating a variety of quality sources. Information is logically and creatively organized with smooth transitions. Little faculty assistance was required (mostly general editing).	Student documented all sources. Sources were properly cited in both written thesis and presentation slides. Documentation is error-free.	Student effectively and creatively used appropriate communication tools to convey their conclusions and demonstrated thorough, effective research techniques. Work displays creativity and originality.	Student demonstrated critical thinking by asking appropriate questions, considering legitimacy of sources and evaluation of data
3	Student contributed to focused hypotheses involving them in challenging research.	Student gathered information from a variety of relevant sources--print and electronic. Some were not very relevant.	Student conclusions shows good effort was made in analyzing the data collected	Student logically organized the methods employed and results generated. Average faculty assistance was required.	Student documented sources are sufficient in general. Few errors noted.	Student effectively communicated the results of research to the audience.	Student demonstrated critical thinking by asking appropriate questions and considering legitimacy of sources.
2	Student contributed little to the hypothesis. Contributions by student lend to readily available answers.	Student gathered information from a limited range of sources and displayed minimal effort in selecting quality resources	Student conclusions could be supported by stronger evidence. Level of analysis could have been deeper.	Student could have put greater effort into organizing the thesis. Much faculty-generated assistance was required.	Student needs to use greater care in documenting sources. Documentation was poor or absent.	Student needs to work on communicating more effectively.	Student needed to ask more critical questions than normal in the process of working through the project.
1	Student relied solely on faculty-generated hypotheses or developed a hypothesis requiring little creative thought.	Student gathered information that lacked relevance, quality, depth and balance.	Student conclusions simply involved restating information. Conclusions were not supported by evidence.	Student work was not logically or effectively structured and required extensive faculty-generated assistance.	Student(s) clearly plagiarized material.	Student showed little evidence of thoughtful research. Presentation does not effectively communicate research findings.	Student did not apply critical thinking to the topic or the sources used in the research.
Comments							

*The maximum number of possible points is 28. Indicate which box best reflects effort/progress in each column with a check and total points using point value in column 1.

Graduate Advisory Committee Members_____ _____