

ASSESSMENT REPORT FOR Group 1: Cycle 1 - Fall 2017 - Summer 2019

Mission Statement

The Mission of Department of Chemistry and Biochemistry includes offering a high quality education with state-of-the-art training in Chemistry. The department offers three undergraduate degree programs. The B.S. in Chemistry is provided for students who are interested in chemistry graduate school or work in the chemical industry at the bachelor's level. The B.S. with a major in Chemistry is for students interested in teaching or in chemistry related fields such as pharmacy or medicine. The new B.S. with a major in Biochemistry and Molecular Biology is for students interested in medical, biochemical, or biological science fields

Goal 1.

Students will master the core chemistry curriculum as outlined by the Education Committee of the American Chemical Society.

Curriculum

Students are required to complete 22-25 hours of core technical courses and 12-16 hours in a more specialized area.

Learning Outcome 1.

Students will explain basic and advanced chemistry concepts and apply them in problem-solving.

Measures and Criteria

In addition to the ACS certification process there are many upper level classes and milestones that could be evaluated in assessing the BS/CHEM/BS degree program. We will focus on **CHEM 541L**, Physical Chemistry Lab, for this reporting period. CHEM 541L is taken by all CHEM majors. As this course is taken toward the end of the student's program, assignments in CHEM 541L are designed to evaluate a broad range of knowledge and skill in the Chemistry major. The assignment in CHEM 541L most suitable as a **measure** for program assessment purposes is the **lab report**.

Student performance in CHEM 541L where knowledge of basic and advanced chemistry concepts is required will be analyzed. The department uses a grading rubric as a way to measure lab reports in CHEM 541L. Items/dimensions on the rubric indicate the specific knowledge and skills students should demonstrate as a result of successfully completing the major. The following items indicate how well students meet this learning outcome.

At least 80% of students will perform at a satisfactory level or higher on the following dimensions on selected lab reports in CHEM 541L:

1. Student demonstrates an understanding of the purpose and interpretation of an experiment.
 1. The experimental section of the lab report contains specifics about the apparatus and chemicals used, and any procedure performed, during the experiment.
 2. Student uses appropriate methods for analysis and interpretation of experimental results.
 1. The results section is present and reports all the raw data collected in the laboratory without modification or manipulation.
 2. The discussion section provides an analysis of the raw data including use of propagation of errors to determine the standard deviation of calculated results to draw conclusions .

Methods

Evaluation of a selection of student lab reports for CHEM 541L, as a measure of understanding of

advanced concepts will be performed. This will provide data according to the following scale from the lab report grading rubric.

SCALE: Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

The data will be collected during the SPRING 2016 semester and aggregated during the SUMMER 2016 semester by the director of undergraduate studies. The department chair will review the data with faculty in the FALL 2016 semester and discuss program performance.

Results

Results:

Evaluation of the Physical Chemistry (CHEM 541L) Lab reports for Chemistry majors (109A) using the scale and rubric points included in the plan the following raw data was collected (number of students recorded for dimension falling in each rubric category):

201708 – FALL 2017-28 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.	2.a.	2.b.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	7	6	5	
2 = satisfactory understanding	9	13	15	
3 = excellent understanding	12	9	8	
Percent satisfactory (2) or higher	75%	79%	82%	
Overall satisfactory (2) or higher				79%

201801 – SPRING 2018-21 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2018	1.a.	2.a.	2.b.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	0	1	4	
2 = satisfactory understanding	10	11	9	
3 = excellent understanding	11	9	8	
Percent satisfactory (2) or higher	100%	95%	81%	
Overall satisfactory (2) or higher				92%

201808 – FALL 2018-27 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.	2.a.	2.b.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	4	6	5	
2 = satisfactory understanding	12	15	15	

3 = excellent understanding	11	6	7	
Percent satisfactory (2) or higher	85%	78%	82%	
Overall satisfactory (2) or higher				82%

201901 – SPRING 2019-25 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.	2.a.	2.b.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	0	1	1	
2 = satisfactory understanding	6	14	7	
3 = excellent understanding	19	10	17	
Percent satisfactory (2) or higher	100%	96%	96%	
Overall satisfactory (2) or higher				97%

Use of Results:

After evaluating the data for FALL 2017 some changes were made to provide more detailed instruction on writing lab reports. After the SPRING 2018 data we noticed a difference between Fall and Spring % satisfactory scores. We hypothesized that the Fall semester students were taking physical chemistry laboratory for the first time whereas spring students could have completed the CHEM 542L-physical chemistry laboratory in the fall which would have given them more instruction/practice for writing lab reports. In addition, the added instruction provided could have made a difference. After evaluating Fall 2018 and Spring 2019 there is still a difference in the % satisfactory between Fall and Spring with Spring being consistently higher. Fall 2018 scores are higher than Fall 2017 which could be attributed to the added instruction provided based on Fall 2017 assessment.

Moving forward we will continue to monitor CHEM 541L which is common to all majors in our department. We will develop a plan to take into consideration the order in which a student takes the two physical chemistry labs.

Goal 2.

All students will demonstrate proficiency in written communication of chemistry experimentation and principles

Curriculum

Students will successfully complete written lab reports in majors organic and advanced lab courses. Additionally, an elective technical writing course will be strongly encouraged for students by their faculty advisers

Learning Outcome 1.

Students will write effectively about chemistry concepts, principles, and processes.

Measures and Criteria

In addition to the ACS certification process there are many upper level classes and milestones that could be evaluated in assessing the BS/CHEM/BS degree program. We will focus on CHEM 541L for this reporting period.

Student performance in **CHEM 541L** where communication of chemistry experiments, data and results is

required will be analyzed. CHEM 541L is taken by nearly all CHEM majors. As this course is taken toward the end of the student's program, assignments in CHEM 541L are designed to evaluate a broad range of knowledge and skill in the Chemistry major. The assignment in CHEM 541L most suitable as a **measure** for program assessment purposes is the **lab report**. The department uses a grading rubric as a measure for lab reports in CHEM 541L. Items/dimensions on the rubric indicate the specific knowledge and skills students should demonstrate as a result of successfully completing the major. The following items indicate how well students meet this learning outcome.

At least 80% of Students will perform at a satisfactory level or higher on the following dimensions on selected lab reports in CHEM 541L:

1. The student provides the appropriate background information, including literature review if necessary, to place the experiment in context.
 1. The introduction section is clear, coherent, and relevant and contains at least two properly cited references.
2. Student summarizes and presents data in response to the experiment objectives.
 1. The discussion section exists and describes any equations used for the interpretation of the data and provides at least one key graph or analysis for a numerical result.
3. Student demonstrates evidence of systematic and thorough documentation of experimental detail.
 1. The experiment section of the lab report contains specifics about the apparatus and chemicals used and any procedure performed during the experiment.

Methods

In addition to the ACS certification process there are many upper level classes and milestones that could be evaluated in assessing the BSChEM/BS degree program. We will focus on CHEM 541L for this reporting period.

Evaluation of selected student lab reports for CHEM 541L, as a measure of understanding of the communication of chemistry experiments and data analysis, will be performed. This will provide data according to the following scale from the lab report grading rubric.

SCALE: Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

The data will be collected during the SPRING 2016 semester and aggregated during the SUMMER 2016 semester by the director of undergraduate studies. The department chair will review the data with faculty in the FALL 2016 semester and discuss program performance.

Results

Results:

Evaluation of the Physical Chemistry (CHEM 541L) Lab reports for Chemistry majors (109A) using the scale and rubric points included in the plan the following raw data was collected (number of students recorded for dimension falling in each rubric category):

201708 – FALL 2017-28 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.	2.a.	3.a.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	5	6	5	
2 = satisfactory understanding	5	13	11	

3 = excellent understanding	18	9	12	
Percent satisfactory (2) or higher	82%	79%	82%	
Overall satisfactory (2) or higher				81%

201801 – SPRING 2018-21 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2018	1.a.	2.a.	3.a.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	0	3	2	
2 = satisfactory understanding	5	9	16	
3 = excellent understanding	16	9	3	
Percent satisfactory (2) or higher	100%	86%	91%	
Overall satisfactory (2) or higher				92%

201808 – FALL 2018-27 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2018	1.a.	2.a.	3.a.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	2	6	4	
2 = satisfactory understanding	11	16	12	
3 = excellent understanding	14	5	11	
Percent satisfactory (2) or higher	92%	78%	85%	
Overall satisfactory (2) or higher				85%

201901 – SPRING 2019-25 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2019	1.a.	2.a.	3.a.	
0 = not applicable	0	0	0	
1 = unsatisfactory understanding	0	1	2	
2 = satisfactory understanding	8	22	10	
3 = excellent understanding	17	2	13	
Percent satisfactory (2) or higher	100%	96%	92%	
Overall satisfactory (2) or higher				96%

Use of Results

Use of Results:

After evaluating the data for FALL 2017 some changes were made to provide more detailed instruction on writing lab reports and discussing experiments orally and in written format. After the SPRING 2018 data we noticed a significant difference between Fall and Spring % satisfactory scores. We hypothesized that the Fall semester students were taking physical chemistry laboratory for the first time whereas spring students could have completed the CHEM 542L-physical chemistry laboratory in the fall which would have given them more instruction/practice for writing lab reports. In addition, the added instruction provided could have made a difference. After evaluating Fall 2018 and Spring 2019 there is still a difference in the % satisfactory between Fall and Spring with Spring being consistently higher. Fall 2018 scores are higher than Fall 2017 which could be attributed to the added instruction provided based on Fall 2017 assessment.

Moving forward we will continue to monitor CHEM 541L, which is common to all majors in our department, as an assessment indicator. We will develop a plan to take into consideration the order in which a student takes the two physical chemistry labs.

Goal 3.

Students will have basic computer programming and library/electronic literature search skills.

Curriculum

Students will complete a computer programming course and will complete literature search activities in advanced chemistry courses. These skills are taught in upper level CHEM labs and in CSCE 145 or 206.

Learning Outcome 1.

Students will apply basic computer programming and information retrieval skills to questions and problems in chemistry.

Measures and Criteria

In addition to the ACS certification process there are many upper level classes and milestones that could be evaluated in assessing the BS/CHEM/BS degree program. We will focus on CHEM 541L for this reporting period.

Student performance in **CHEM 541L** where the application of basic computer programming and information retrieval skills is required will be analyzed. CHEM 541L is taken by nearly all CHEM majors. As this course is taken toward the end of the student's program, assignments in CHEM 541L are designed to evaluate a broad range of knowledge and skill in the Chemistry major. The assignment in CHEM 541L most suitable as a **measure** for program assessment purposes is the **lab report**. The department uses a **grading rubric** as a measure for lab reports in CHEM 541L. Items/dimensions on the rubric indicate the specific knowledge and skills students should demonstrate as a result of successfully completing the major. The following dimensions indicate how well students meet this learning outcome.

At least 80% of Students will perform at a satisfactory level or higher on the following dimensions of selected lab reports in CHEM 541L:

1. The student provides the appropriate background information, including literature review, to place the experiment in context.
 1. The introduction section is clear, coherent, and relevant and contains at least three properly cited references.
2. The student uses appropriate methods for analysis and interpretation of experimental results.
 1. The Discussion provides at least one key graph or analysis for a numerical result (3pts)
 2. The discussion provides the necessary computer generated graphs and analysis for results.
 3. The Discussion uses propagation of errors to determine the standard deviation of calculated results based on the parameters that combine to give the result.

Methods

Evaluation of student lab reports for CHEM 541L, as a measure of understanding of computer programming and information retrieval, will be performed. This will provide data according to the following scale from the lab report grading rubric.

SCALE: Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

The data will be collected during the SPRING 2016 semester and aggregated during the SUMMER 2016 semester by the director of undergraduate studies. The department chair will review the data with faculty in the FALL 2016 semester and discuss program performance.

Results

Results:

Evaluation of the Physical Chemistry (CHEM 541L) Lab reports for Chemistry majors (109A) using the scale and rubric points included in the plan, the following raw data was collected (number of students falling in each rubric category recorded for each dimension):

201708 – FALL 2017-28 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.	2.a.	2.b.	2.c.	
0 = not applicable	0	0	0	0	
1 = unsatisfactory understanding	2	5	5	7	
2 = satisfactory understanding	6	11	10	13	
3 = excellent understanding	20	12	12	8	
Percent satisfactory (2) or higher	93%	82%	82%	75%	
Overall satisfactory (2) or higher					83%

201801 – SPRING 2018-21 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2018	1.a.	2.a.	2.b.	2.c.	
0 = not applicable	0	0	0	0	
1 = unsatisfactory understanding	1	3	2	3	
2 = satisfactory understanding	4	6	15	5	
3 = excellent understanding	16	12	4	13	
Percent satisfactory (2) or higher	95%	86%	91%	86%	
Overall satisfactory (2) or higher					89%

201808 – FALL 2018-27 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2018	1.a.	2.a.	2.b.	2.c.	
0 = not applicable	0	0	0	0	

1 = unsatisfactory understanding	5	3	4	5	
2 = satisfactory understanding	12	17	15	21	
3 = excellent understanding	10	7	8	1	
Percent satisfactory (2) or higher	82%	89%	85%	82%	
Overall satisfactory (2) or higher					85%

201901 – SPRING 2019-25 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2019	1.a.	2.a.	2.b.	2.c.	
0 = not applicable	0	0	0	0	
1 = unsatisfactory understanding	0	1	2	2	
2 = satisfactory understanding	14	8	8	23	
3 = excellent understanding	11	16	15	0	
Percent satisfactory (2) or higher	100%	96%	92%	92%	
Overall satisfactory (2) or higher					95%

Use of Results:

After evaluating the data for FALL 2017 some changes were made to provide more detailed instruction on data analysis as applied to physical chemistry experiments in the laboratory. After the SPRING 2018 data we noticed a difference between Fall and Spring % satisfactory scores (less significant than Goals 1 and 2). We hypothesized that the Fall semester students were taking physical chemistry laboratory for the first time whereas spring students could have completed the CHEM 542L-physical chemistry laboratory in the fall which would have given them more instruction/practice for data analysis. In addition, the added instruction provided could have made a difference. After evaluating Fall 2018 and Spring 2019 there is still a difference in the % satisfactory between Fall and Spring with Spring being consistently higher. Fall 2018 scores are slightly higher than Fall 2017 which could be attributed to the added instruction provided based on Fall 2017 assessment.

Moving forward we will continue to monitor CHEM 541L, which is common to all majors in our department, as an assessment indicator. We will develop a plan to take into consideration the order in which a student takes the two physical chemistry labs.

Goal 4.

Students will be skilled in advanced problem solving and those receiving the ACS certified degree will be skilled in experimental design.

Curriculum

Completion of 13 credit hours of advanced chemistry course-work, including at least three hours of undergraduate research. In addition, at least 3 hours of math beyond vector calculus.

Learning Outcome 1.

Students will explain advanced chemistry topics and apply them in the chemical research process.

Measures and Criteria

In addition to the ACS certification process here are many upper level classes and milestones that could be evaluated in assessing the BS/CHEM/BS degree program. We will focus on the final written report in CHEM 399, or one of CHEM 496-499 as a measure for program assessment purposes for this reporting period.

Student performance in CHEM 496 (all sections) will be analyzed.

At least 80% of Students will perform at a satisfactory level or higher on the following dimensions on the final written report for CHEM 399, 496, 497, 498, or 499.

2. Students organize information collected or generated.
 1. The introduction/background section is clear, coherent, and relevant and contains at least three properly cited references.
3. Students communicate knowledge and the processes used to generate it
 1. The student provides an appropriate and concise description of the experimental design, techniques used to gather data, and the results and conclusions ascertained.
4. Students synthesize and analyze and apply new knowledge
 1. The discussion section provides an analysis that clearly describes the results as related to the stated hypothesis.

Methods

Selected reports written by students participating in undergraduate research will be reviewed. The grade in undergraduate research courses depends upon the student's initiative, creativity, and accomplishment in the lab and upon a written report. The reports are written in a rigorous format comparable to a journal article. The reports provide experience with typical written communication. However, it will include written communication of very detailed information that will likely be needed by subsequent researchers to reproduce and advance the work. This experience provides students with a first look at the pressure associated with building a professional reputation through writing skills.

Evaluation of student reports as a measure of understanding of the chemical research process will be performed. This will provide data according to the following scale from the lab report grading rubric.

SCALE: Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

The data will be collected during the SPRING 2016 semester and aggregated during the SUMMER 2016 semester by the director of undergraduate studies. The department chair will review the data with faculty in the FALL 2016 semester and discuss program performance.

Results:

Evaluation of the research reports for Chemistry majors (109A), both *BS and *BSC degrees, using the scale and rubric points included in the plan, the following raw data was collected (number of students falling in each rubric category recorded for each dimension):

201708 – FALL 2017-11 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.		2.a.		3.a.		
Degree type*	BS	BSC	BS	BSC	BS	BSC	
0 = not applicable	0		0		0		
1 = unsatisfactory understanding	0	0	0	0	3	0	

2 = satisfactory understanding	0	0	3	0	2	0	
3 = excellent understanding	9	2	6	2	4	2	
Percent satisfactory (2) or higher	100%	100%	100%	100%	67%	100%	
Overall satisfactory (2) or higher				BS = 89%		BSC = 100%	

*BS=Bachelor of Science, BSC=Bachelor of Science in Chemistry (American Chemical Society degree)

201801 – SPRING 2018-10 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

SPRING 2018	1.a.		2.a.		3.a.		
Degree type*	BS	BSC	BS	BSC	BS	BSC	
0 = not applicable	0	0	0	0	0	0	
1 = unsatisfactory understanding	0	0	1	0	1	0	
2 = satisfactory understanding	3	0	1	0	2	0	
3 = excellent understanding	3	4	4	4	3	4	
Percent satisfactory (2) or higher	100%	100%	83%	100%	83%	100%	
Overall satisfactory (2) or higher				BS = 89%		BSC = 100%	

*BS=Bachelor of Science, BSC=Bachelor of Science in Chemistry (American Chemical Society degree)

201808 – FALL 2018-9 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2018	1.a.		2.a.		3.a.		
Degree type*	BS	BSC	BS	BSC	BS	BSC	
0 = not applicable	0	0	0	0	0	0	
1 = unsatisfactory understanding	1	0	0	0	1	0	
2 = satisfactory understanding	1	0	1	0	1	0	
3 = excellent understanding	3	4	4	4	3	4	
Percent satisfactory (2) or higher	80%	100%	100%	100%	80%	100%	
Overall satisfactory (2) or higher				BS = 87%		BSC = 100%	

*BS=Bachelor of Science, BSC=Bachelor of Science in Chemistry (American Chemical Society degree)

201901 – SPRING 2019-11 students

Not applicable = 0, unsatisfactory understanding = 1, satisfactory understanding = 2, excellent understanding = 3.

FALL 2017	1.a.		2.a.		3.a.		
Degree type*	BS	BSC	BS	BSC	BS	BSC	
0 = not applicable	0	0	0	0	0	0	

1 = unsatisfactory understanding	0	0	0	0	1	0	
2 = satisfactory understanding	0	0	4	1	3	2	
3 = excellent understanding	8	3	4	2	4	1	
Percent satisfactory (2) or higher	100%	100%	100%	100%	88%	100%	
Overall satisfactory (2) or higher					BS = 96%		BSC = 100%

*BS=Bachelor of Science, BSC=Bachelor of Science in Chemistry (American Chemical Society degree)

Use of Results:

Students participating in research usually volunteer for a semester before registering for credit. During this time the Principle Investigator, post-doctoral fellows, and graduate students in the lab mentor the student. This prepares the student to perform better at hand-on tasks and writing and presenting research data. The mentoring continues for the duration of the course. A student can register for research credit through CHEM 496, 497, 498, and 499 (3 credits each course). After evaluating the data more emphasis will be placed on 2a and 3a during the mentoring process.