

BA/BS Chemistry Annual Assessment Report 2015-16

1. What learning outcome(s) did you assess this year?

Learning Outcome 2. Students will demonstrate the ability to conduct laboratory work of high quality including handling chemicals and other laboratory hazards in a safe, ethical, and socially responsible manner, keeping accurate, clear, concise, and complete records of their laboratory work in a notebook, properly using standard laboratory equipment and instruments, and evaluating the reliability and significance of laboratory data, all within professional ethical guidelines. (ACS Standards 7.1, 7.3, 7.6)

2. What instruments did you use to assess them?

Method A2 - Laboratory Notebook Rubric. From the SOAP: *“This rubric will be used by instructors to provide feedback to students and assess the quality of the students’ laboratory notebooks and record keeping. It may be applied to individual laboratories or to the notebook as a whole. When used for program assessment, a minimum of 15% of the class or four students (whichever is less) are scored by two or more faculty members to ensure consistent application of the rubric. Each student passing the course is expected to earn an average of 1.5 of 3 with no more than one poor (0) score.”*

For the B.S. Chemistry program, laboratory notebooks were collected in the Spring 2016 CHEM 124 course (Synthesis and Characterization, a senior level lab course taken exclusively by B.S. Chemistry majors). Notebooks were evaluated by a faculty member according to the established rubric (SOAP Appendix A2).

For the B.A. Chemistry program, laboratory notebooks were collected in the Spring 2016 CHEM 156 course (Biochemical Laboratory Techniques, a senior level lab course taken by B.A. Chemistry and B.S. Biochemistry majors). Notebooks were evaluated by two course instructors according to the established rubric (SOAP Appendix A2), with six students assessed.

Method A3 –Instructor Evaluation Rubrics. From the SOAP: *“Instructor Evaluation Rubric – This rubric will be applied primarily in laboratory courses as a check on the quality and ethics of student laboratory work along with their ability to function in teamwork and collaborative assignments. When used for program assessment, a minimum of 15% of the class or four students (whichever is less) are scored by two or more faculty members to ensure consistent application of the rubric. Each student passing the course is expected to earn an average of 1.5 of 3 with no more than one poor (0) score.”*

For the B.S. Chemistry program, the established rubric (SOAP Appendix A3) was used by the instructor in the Spring 2016 CHEM 124 course.

For the B.A. Chemistry program, the established rubric (SOAP Appendix A3) was used by the instructors in the Spring 2016 CHEM 156 course.

Method B1 – Employer Focus Group. From the SOAP: “On a periodic basis the department will solicit feedback on graduate skills from alumni and their employers using either surveys or focus groups. These mechanisms may allow the department to reevaluate the target student outcomes to match changing needs in the chemistry community. The department expects that all numerical responses on this survey will be a 3 or higher and that written responses will be generally positive, yet constructive in improving department programs.”

The established employer survey was deployed online and sent to several companies known to have employed our graduates in recent years.

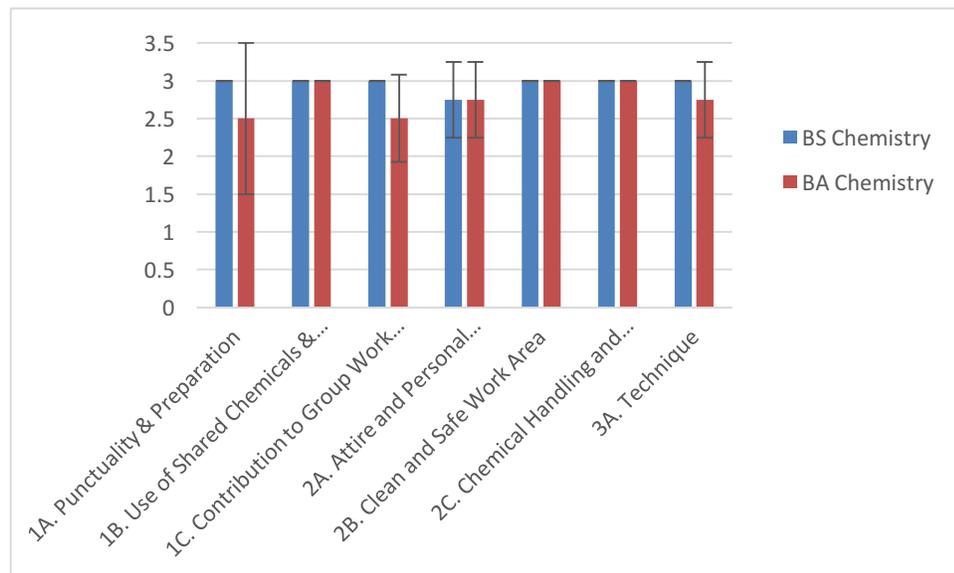
Method B4 – Faculty Feedback on Laboratory Performance. From the SOAP: “The department will periodically collect feedback from faculty and instructors on their perceptions of student strengths and weaknesses.”

Results from assessments A1 and B3 were shared with department faculty and the topic was discussed at a department meeting.

3. What did you discover from these data?

Instructor Evaluation

The results of the laboratory instructor evaluation are summarized in the Figure below.



BS Chemistry

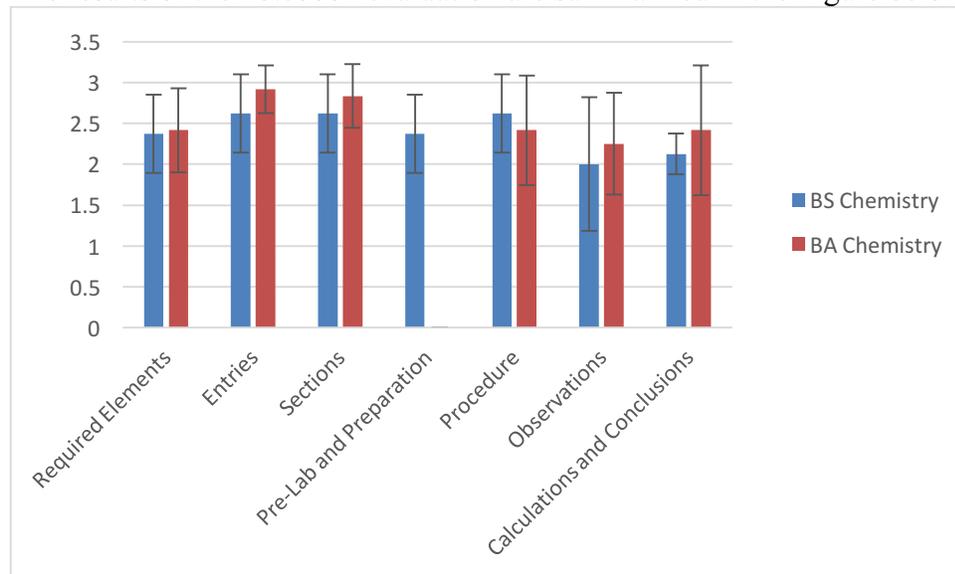
With the exception of one student in one category (2A. Attire and Personal Protective Equipment), all of the students evaluated were scored as excellent. While the sample size is small (4 students), the data indicate that the B.S. Chemistry program is successful developing all of the required laboratory skills and habits.

BA Chemistry

As with the BS Chemistry evaluation, average scores in all categories were well above expectations. The lowest student average for the rubric was 2.6, and no student scored below 1 in any category. The data indicate that the B.A. Chemistry program is successful developing all of the required laboratory skills and habits.

Notebook Evaluation

The results of the notebook evaluation are summarized in the Figure below.



BS Chemistry

Student scores on the rubric ranged from 2.2 to 2.7, with no students scoring below 1 in any category. The categories with the lowest scores for the class were Observations (2.0) and Calculations and Conclusions (2.1).

BA Chemistry

As with the BS Chemistry evaluation, average scores in all categories were above the expected average of 1.5, with scores in the range 2.0 to 2.9, and with no students scoring below 1 in any category. Average scores in each category ranged from 2.3 to 2.9. Scores were not assigned to the Pre-lab and Preparation category since this is not relevant to the structure of the course assessed.

Employer Focus Group

The employer focus group feedback indicated our strengths are in the amount of hands-on training in the laboratory our students receive in comparison to other incoming employees, with recent degrees in the area of chemistry. A weakness was the lack of understanding in how the software is integrated with the instrumentation; students can point and click on the software without understanding how it affects the hardware. The employer feedback was minimal (1 out of 5 employers returned feedback), though this one company has employed over 10+ students from our department.

Faculty Feedback

4. What changes did you make as a result of the findings?

Overall the assessment demonstrates that our students are developing the expected skills in both the B.A. and B.S. Chemistry degrees, indicating that no substantive changes are needed. During the assessment activity, faculty noted that standards and expectations for notebooks are not entirely consistent across all of the laboratory courses in the program. For example, not all courses currently require students to date each page in their lab notebooks. The department will therefore work to develop a set of minimum standards that are the same across all laboratory courses in the B.A. and B.S. Chemistry programs. This discussion is important for preparing our students as future professionals in chemistry.

A second point in the faculty feedback was a discussion with regards to safety training (related to Items 2B and 2C, in the instructor evaluation). While students in laboratory courses are trained on the proper handling, use, and disposal of chemicals, a department-wide policy on safety training was discussed. The Department Safety Committee will meet the AY 2016-17 to discuss how to best train and prepare all faculty, staff, and teaching associates on the best laboratory and safety practices. Since this faculty discussion, the Safety Officer for our Department (Alan Preston, M.S.), along with Lisa Kao (Director, EH&S) have discussed the implementation and piloting of an electronic chemical inventory and tracking system. The Chemistry Department will pilot this software in spring 2017.

5. What assessment activities will you be conducting in the 2016-17 academic year?

BA and BS

Learning outcome 3 will be assessed using instruments A4 and using indirect measure B4.

Learning Outcome 3. Students will complete a literature search in one or more of the five chemical sub disciplines by using common literature search techniques and tools to find recent journal articles from the peer-reviewed literature, critically read these articles to extract relevant information, and communicate the significance of these articles in written or oral formats within professional ethical guidelines. (ACS Standards 7.2 & 7.6)

Instrument A4. Literature Search Rubric – This rubric outlines expectations for a literature search and review that may be completed as an independent assignment or as part of larger written reports or oral presentations. When used for program assessment, a minimum of 15% of the class or four assignments (whichever is less) are scored by two or more faculty members to ensure consistent application of the rubric. Each student passing the course is expected to earn an average score of 1.5 of 3 with no more than one poor (0) score.

Indirect Measure B4. The department will periodically collect feedback from faculty and instructors on their perceptions of student strengths and weaknesses.

6. What progress have you made on items from your last program review action plan?

Please provide a brief description of progress made on each item listed in the action plan. If no progress has been made on an action item, simply state "no progress."

1. Biochemistry Programs. *(From our action plan: Implement, Evaluate, and Improve a new degree in Biochemistry to provide better preparation for students interested in pursuing careers and advanced degrees in biochemistry and biochemical related fields such as pharmacy and medicine.)*

The Biochemistry degree formally began in Spring 2015, and has grown steadily to 137 majors at the beginning of the Fall 16 semester. Fourteen (of the department's 49) graduates in 2015-16 earned the B.S. Biochemistry degree. The department will continue to monitor the growth of the program and evaluate resources available to ensure that we are able to manage this growth.

2. Culminating Experiences. *(From our action plan: The department will strengthen and formalize the opportunities it provides students to apply principles and concepts introduced in coursework to solve problems and answer questions in research and/or industrial settings.)*

No progress in 2015-16.

3. Student Outcome Assessment Plan. *(From our action plan: The department will revise the department SOAPs based on feedback from external reviewers, college level feedback, and new WASC requirements and guidance to achieve a well-structured, meaningful, and sustainable assessment plan that will guide program improvement.)*

The department SOAPs were revised during the 2013-14 academic year and were formally adopted during summer 2014. Our assessment activities in 2015-16 have been in-line with those outlined in the SOAPs.

4. Advising and Enrollment Management. *(From the action plan: The department will continue efforts to strengthen advising, manage enrollments, and provide tutoring and other support services to increase retention and reduce time-to-graduation for STEM majors.)*

The department works closely with the College's Advising and Resources Center (ARC) to ensure that our students receive accurate and timely advising (and other supports) to address retention and graduation rates. The department has also worked closely with the Division of Undergraduate Studies to link scheduling to student demand. This has resulted in an increase of almost 500 seats in General Chemistry (CHEM 1A, 1B and 3A) in 2015-16 compared to the prior academic year.

Appendix A2 – Laboratory Notebook Rubric

1. Organization

1A. Required Elements

Excellent (3 pt.):	Every page contains an appropriate title, date, student name, consecutive page numbers, and a signature at the bottom of the page.
Good (2 pt.):	Most pages include the required elements listed under 'excellent'.
Average (1 pt.):	Missing elements make finding and identifying key information difficult.
Poor (0 pt.):	Required elements are consistently missing.

1B. Entries

Excellent (3 pt.):	All entries are in ink, made at the time work was conducted (not transcribed), and errors are corrected using single line strikeouts rather than erasure, whiteout, or obliteration.
Good (2 pt.):	Many of the entries meet the criteria required for 'excellent'.
Average (1 pt.):	Many key entries are missing or illegible.
Poor (0 pt.):	Most entries are missing or illegible.

1C. Sections

Excellent (3 pt.):	Each laboratory entry is divided clearly into titled pre-, in-, and post-lab sections with appropriate subsections as required in the course lab policies or the laboratory instructions. The table of contents includes entries for the laboratory and these sections.
Good (2 pt.):	Most entries are divided into sections that meet the criteria for 'excellent'.
Average (1 pt.):	Many entries are not divided into appropriate sections/subsections. The table of contents is missing or incomplete.
Poor (0 pt.):	Laboratory entries are not divided into sections as required in course lab policies. The table of contents is missing.

2. Content

2A. Pre-Laboratory Preparation

- Excellent (3 pt.): The pre-lab is well written, organized, and neat. It contains all required elements: title, introduction, chemicals table, equations/reactions, and anticipated procedure. Appropriate references including MSDS, CRC, and other sources have been used and cited for chemical and safety information.
- Good (2 pt.): The pre-lab is well written but is missing some elements/information.
- Average (1 pt.): The pre-lab is missing key elements that are needed for the successful completion of the lab. Appropriate references are missing.
- Poor (0 pt.): No pre-lab has been completed.

2B. Procedure (In-Lab)

- Excellent (3 pt.): The in-lab section contains a thorough and clear procedure that describes the actual experience in the laboratory. Deviations, modifications, and errors are recorded in a chronological sequence of events. Any in-laboratory calculations, such as adjustments to the amount or reagents to use are shown clearly.
- Good (2 pt.): The procedure is clearly described, but deviations and modifications made to the original protocol are missing.
- Average (1 pt.): The procedure is not described clearly enough to be repeated without reference to other documents.
- Poor (0 pt.): The experimental procedure is not described.

2C. Observations (In-Lab)

- Excellent (3 pt.): Observations are plentiful and clearly noted for each experiment with details including color changes, precipitation, temp., etc. Data is recorded directly into the laboratory notebook and is both organized and clearly labeled.
- Good (2 pt.): Most key observations are clearly recorded.
- Average (1 pt.): Some key observations are recorded.
- Poor (0 pt.): Observations are not recorded.

2D. Calculations and Conclusions

- Excellent (3 pt.): All required calculations are complete and correct including the evaluation of experimental error or uncertainty. A written conclusion is present that shows a thorough and accurate analysis of the data and its significance. This includes evaluation of the question or hypothesis tested in the experiment. This conclusion includes answers to any post-lab questions.
- Good (2 pt.): Calculations have completed and include error/uncertainty analysis. An analysis of the data and its significance has been written.
- Average (1 pt.): Calculations have been performed but are not complete/correct. An analysis of the data and its significance is missing or incorrect.
- Poor (0 pt.): Calculations have not been completed.

Appendix A3 – Laboratory Instructor Evaluation

1. Citizenship

1A. Punctuality & Preparation

- Excellent (3 pt.): The student consistently arrives for the laboratory on-time and prepared for work and then stays until their work and preliminary calculations are complete.
- Good (2 pt.): The student arrives for the lab on time and is prepared for work.
- Average (1 pt.): The student is not prepared to work at the start of the lab and is not able to complete the work in the allotted time.
- Poor (0 pt.): The student is consistently late, unprepared, and/or leaves before their work and preliminary calculations are completed.

1B. Use of Shared Chemicals and Equipment

- Excellent (3 pt.): The student is a good citizen in the use of shared materials by avoiding taking excess of the materials, returning containers to their proper location, refilling reagents as needed, emptying waste as needed, leaving shared equipment clean and orderly, and leaving their work area clear and clean at the end of the laboratory period.
- Good (2 pt.): The student is generally a good citizen, and rarely needs reminding/prompting to return/refill shared chemicals, empty full waste containers or clean up the work area.
- Average (1 pt.): The student periodically behaves in a way that inconveniences others in the lab, which may include failure to return shared chemicals to the appropriate location, refill reagents, empty waste bottles when filled or leave equipment and work areas clean at the end of the lab.
- Poor (0 pt.): The student consistently behaves in a way that inconveniences others in the lab, which may include failure to return shared chemicals to the appropriate location, refill reagents, empty waste bottles when filled or leave equipment and work areas clean at the end of the lab.

1C. Contribution to Group Work and Problem Solving

- Excellent (3 pt.): The student is supportive of the instructor and other students. They work effectively with other students on group work and tasks by both contributing and allowing others to contribute to the project. They participate meaningfully in helping address problems that arise during the laboratory period.

- Good (2 pt.): The student works collaboratively with others and makes contributions to group projects.
- Average (1 pt.): The student works within the group but contributions to completion of the assignment are somewhat limited.
- Poor (0 pt.): The student is disruptive or does not participate in group work.

2. Chemical Knowledge and Safety

2A. Attire and Personal Protective Equipment (PPE)

- Excellent (3 pt.): The student consistently dresses appropriately for lab work and wears the required PPE, particularly safety glasses, at all times.
- Good (2 pt.): The student consistently dresses appropriately for lab work and usually wears the required PPE, particularly safety glasses, without prompting.
- Average (1 pt.): The student consistently dresses appropriately for lab work and but needs reminders to wear the required PPE, particularly safety glasses.
- Poor (0 pt.): The student dresses in a way that would pose a safety hazard if not addressed by the instructor. This includes failure to dress appropriately for lab work and/or wear the required PPE.

2B. Clean and Safe Work Area

- Excellent (3 pt.): The student keeps their work area free of chemical spills and hazards such as undue clutter, properly secured reaction setups, appropriate labeling of chemicals, and prompt disposal of waste.
- Good (2 pt.): The student mostly keeps the work area clean and uncluttered.
- Average (1 pt.): The student's work area is not clean and uncluttered at times.
- Poor (0 pt.): The student's work area is not clean. The student must be prompted to address potential safety concerns such as chemical spills and poorly secured reaction setups.

2C. Chemical Handling and Waste Disposal

- Excellent (3 pt.): The student demonstrates an understanding of the chemicals they are using through their handling of the chemicals and the proper disposal of chemicals and reaction waste.
- Good (2 pt.): The student generally handles and disposes of chemicals and waste in an appropriate manner.

Average (1 pt.): The student needs prompting or assistance to correctly handle chemicals and dispose of chemical waste.

Poor (0 pt.): The student does not handle or dispose of chemicals and waste in an appropriate manner.

3. Laboratory Technique

3A. Technique

Excellent (3 pt.): The student develops and demonstrates excellent laboratory technique including the efficient and effective use of laboratory glassware and instrumentation.

Good (2 pt.): The student develops and demonstrates good laboratory technique including appropriate use of laboratory glassware and instrumentation.

Average (1 pt.): The student develops and demonstrates acceptable laboratory technique.

Poor (0 pt.): The student consistently uses poor laboratory technique that will lead to low quality data and/or could damage equipment or instrumentation.