WEST VIRGINIA STATE UNIVERSITY

1891

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Academic Affairs Assessment of Student Learning
Report for Academic Year 2018-2019

Department/Program Chemistry
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1. **Which learning outcomes did you measure this past year?** [Please indicate whether any of these measures were conducted as follow-up to a previous year's issues or in response to Program Review. Be specific.]

Program Learning Outcomes, PLOs 1 and 3 will be measured during the 2018-2019 academic year.

- PLO 1. Explain the fundamentals in organic, analytical, physical, inorganic, and biological chemistry.
- PLO 3. Apply problem-solving strategies to scientific problems

2. **In which course(s) were assessments conducted?**

For the Fall 2018 the following courses were used to evaluate learning outcomes 1 and 3.

PLOs Assessed	Assessment point	Assessment tool (Direct or Indirect)
1 and 3	Chem. 106 General Chemistry II	ACS 2nd semester General Chemistry Exam (Direct)
1 and 3	Chem. 206 Organic Chemistry II	ACS two semester Organic Chemistry Exam (Direct)
1 and 3	Chem. 301 Physical Chemistry I	ACS 1st semester Physical Chemistry Exam (Direct)

•ACS: American Chemical Society

For the Spring 2019 semester the following courses were used to evaluate learning outcomes 1 and 3.

PLOs Assessed	Assessment point	Assessment tool (Direct or Indirect)
1 and 3	Chem. 106 General Chemistry II	ACS• 2nd semester General Chemistry Exam (Direct)
1 and 3	Chem. 206 Organic Chemistry II	ACS two semester Organic Chemistry Exam (Direct)
1 and 3	Chem. 450 Senior Seminar	ACS DUCK** Exam (Direct)
1 - 6	Chem. 450 Senior Seminar	Department Graduate Exit Survey (Indirect)

•ACS: American Chemical Society

**DUCK: Diagnostic of Undergraduate Chemistry Knowledge (DUCK test)

3. **How did you assess the selected program learning outcomes?** (i.e., what did you assess – group project, skills demonstration, presentation, performance, debate, lab experiment, online discussion, etc. *and*- what tool (measure) did you use - rubric, nationally or state-normed exam, item analysis, pre-posttest design, skills inventory, survey, etc.)

The American Chemical Society is the world's largest scientific professional society. It has a Committee on Education and a national test center that develops a test for numerous classes in the standard chemistry curriculum. The department decided to use this standardized test sequence due to its ability to place students in a national percentile so we can determine how our students stack up against other nationally. The 2018-2019 the ACS is working on getting national data to develop percentile scores for the new examinations. Each of the tests can be further broken down to give use data on where our students are struggling in the sub disciplines of general, organic, physical, and chemistry overall Diagnostic of Undergraduate Chemistry Knowledge (DUCK test).

4. How many students were included in the assessment(s) of each PLO in a course?

The number of students who took each examination is broken down in the following table. The Chemistry 106 and 206 had a significant percentage of Biology majors taking the test while the Chemistry 301 and 450 assessment tool was strictly chemistry majors.

Assessment Evaluation	Number of students who completed the assessment tool
Second term General Chemistry test – Chemistry 106	35
Second term Organic Chemistry test – Chemistry 206	24
First Term Physical Chemistry test – Chemistry 301	9
Senior Seminar – Chemistry 450 – DUCK Test	7
Graduate Assessment Survey	8

5. **How were students selected to participate in the assessment of each outcome (**Helpful details might include- whether this assessment represents all students, a sample of students in a class, or a sample of students across sections)?

Every student who completed the courses in question were given a copy of the exam as part of their course work. All graduates for the corresponding survey were sent a copy of the graduate survey and asked to complete the survey. With reminders the surveys were completed and submitted to the College Administrative Assistant until after graduation to protect the anonymity of the graduate submitting the survey.

6. In general, describe how each assessment tool (measure) was constructed (i.e. in-house, national, adapted).

The course assessment examinations were written by faculty from across the country in their professional service the American Chemical Society's Division of Chemical Education Examination. The graduate survey was written by faculty within the Department.

7. Who analyzed results and how were they analyzed

The professor who taught the course is the faculty member who was responsible to do the assessment for the examination. The Assessment Coordinator then compiles the assessment for the Department Reports. The Course examinations were broken down into the content areas to determine where students achieved the poorest scores.

Assessment examination	Faculty responsible for assessment
Chemistry 106 General Chemistry II	Ernest Sekabunga
Chemistry 206 Organic Chemistry II	Micheal Fultz
Chemistry 301 Physical Chemistry	Sundar Naga
Chemistry 450 Senior Seminar	Micheal Fultz
Graduation Survey	Micheal Fultz

8. **Provide a summary of the results/conclusions from the assessment of each measured Program Learning Outcome.** *Report scores for this assessment, as well as students' strengths and weaknesses relative to this learning outcome.*

Based on the individual tests given during the 2018-2019 academic year the following items were noted.

- ACS 2nd semester General Chemistry Exam: An item analysis of student test scores by topic or concept showed student difficulty in; Acids and Bases, Chemical Kinetics, and thermodynamics.

- ACS two semester Organic Chemistry Exam: The results of the two sections of students who took this exam during the academic year has been item analyzed by topic. Each question was classified into one of six topic/concept areas – general organic, alkenes, conformations, mechanisms, synthesis, and spectroscopy. Based

on the item analysis data, the students' area of greatest weakness was synthesis chemistry in which 37% of the student responses were correct.

- ACS 1st semester Physical Chemistry Exam: An item analysis of student test scores by topic or concept showed student difficulty in; adiabatic processes, isothermal compressibility and pressure vs composition phase diagram.

- ACS Diagnostic of Undergraduate Chemistry Knowledge (DUCK) Exam: This exam is given to graduating seniors in Senior Seminar at the end of the Spring 2018 semester. Student scores in chemistry sub-disciplines increased in the following respective order; Analytical, Inorganic, Physical, Biological, and Organic.

- Department Graduate Exit Survey: The graduation survey, aligned to the Department's PLOs, solicits graduating students' opinions on how well the department is achieving its PLOs. They were asked to respond as Extremely Well, Very Well, Adequately Well, Not Very Well, or Not at all. PLO 1, then worded as "Explain the fundamentals in organic, analytical, physical, inorganic, and biological chemistry" was subdivided into the five sub-disciplines of chemistry listed.

Since its introduction seven years ago the department collected and sealed ten surveys out of a possible twelve semesters. These surveys were unsealed at the end of the Spring 2019 period. The numbers indicate the number of students who responded that way.

Program Learning Outcome

1. Demonstrate a conceptual understanding and integration of the fundamentals in organic, analytical, physical, inorganic, and biological chemistry.

Organic Chemistry

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
6	1	1		

Comments:

a. Dr. Fultz has been super helpful in the development of my career, during Organic Chemistry and even after exiting his course.
b. I think the SI program was not helpful. It allowed the professor to not answer questions. She ignored the questions. The lab was very informative.

c. The professor for this course is tough but it is beneficial to thoroughly learning and understanding the material. He engages the class by asking questions frequently to make students think deeply about the subject.
d. Dr. Fultz does an excellent job at teaching this course. By far my favorite class and professor.

Analytical Chemistry

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
1	3	3		

Comments:

a. The pacing became a bit rushed toward the end
b. I enjoyed analytical chemistry. I found that the long lecture periods made it difficult for me to stay focused for the entire class. Usually I was zoned out after the first hour or so. The labs were very repetitive and the equipment did not always function properly.
c. Assigning more practice problems for homework would help.
d. The lab portion of the course was helpful in learning proper lab techniques although the lecture could use more structure, for PowerPoint to stay on topic. On the other hand, the lecture was beneficial due to the professor having the students work out problems on the board.

Physical Chemistry

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
4	2	2		

Comments:

a. The class was very informative. I did not appreciate the lab section being an extended lecture period.
b. Having lecturing materials during the lab time was conducive to more content being covered, however it has proven to be inconvenient for those who only take the lecture portion as they have to end up going to Dr. Naga's office to learn what was taught in the lab.
c. Difficult to understand the nontraditional student with fulltime job. Scheduling of course was difficult because it is always offered in the middle of the day.
d. I feel like I have gained a deep understanding of the course because the professor was very particular in grading and how the students understood the material.
e. Dr. Naga does a great job teaching this course. He goes above and beyond helping the students understand the content.

Inorganic Chemistry

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
1	1	2	4	

Comments:

a. The professor never gave me a graded item. I had no idea what my standing in the classroom was. I loved the lab it was very informative. I enjoyed producing something that was useful in the lab.
b. Did not cover much material. Felt very overwhelmed on the ACS exam.
c. The class was very interesting but we did not have time to cover some of the material.
d. The course only covered a few chapters.

Biological Chemistry

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
1	3	2	2	

Comments:

a. Taken during the first undergrad degree
b. Half the labs did not work when I had the course.
c. A new biochem instructor has been hired but unfortunately I did not have this new teacher. My experience with the previous instructor was less than stellar.

2. Perform practical, standard laboratory procedures and techniques with a high level of precision and safety.

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
7	1			

3. Apply critical thinking and fundamental problem-solving strategies to scientific problems ranging from hands-on laboratory research to theoretical concepts.

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
4	4			

4. Demonstrate effective use of chemical literature through identifying various information sources in conjunction with the retrieval and critical analysis of scientific literature.

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all

3	5			

5. Demonstrate effective oral, written, and computer-aided communication skills pertaining to chemical applications.

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
4	3	1		

6. Conduct independent systematic research.

Extremely Well	Very Well	Adequately Well	Not Very Well	Not at all
4	2	1		

Any other comments regarding the department.

a. The computer lab used for computer chemistry, physical chemistry, organic chemistry, and any other course that uses the programs housed on those laptops in that lab needs its laptops updated to better laptops.

9. **What are next steps?** (e.g., will you measure this same learning outcome again? Will you change some feature of the classroom experience and measure its impact? Will you try a new tool? Are you satisfied?)

While it is the job of every faculty member is to improve the comprehension of their students in the classes they teach. This does not stop, there is always room for improvement. To help with that there are several areas where the department is working to improve.

General Chemistry 106 – The General Chemistry II laboratory book is undergoing a complete revision to remove outdated procedures and activities, add clarity in concept description, and improve procedure clarity.

Organic Chemistry 206 – To add additional support in spectroscopy which is an area of weakness all laboratories where students synthesize materials will be analyzed via IR, H NMR, and ^{13}C NMR as they are covered in in the lecture. This will provide additional practice for the students. To help increase the scores in the lowest achieving areas additional practice problems in organic synthesis will be given to the students.

Graduate Survey – Graduates of our program have noted that several of our instruments are old and need to be upgraded. Based off from previous years comments from faculty and students the department knew we needed to replace the UV-Vis spectrophotometer (grant purchased and replaced) and 10 new desktops were purchased and placed in the chemistry computer labs. The computers replace the old lap tops that did not have the computing power to run modern programs and kept crashing.

10. **Please attach an example of the assessment tool used to measure your PLO(s).** These can be added as an appendix, a link to the assessment, or sent separately in email with your report.

    While we are not able to share a copy of the assessment evaluations from the American Chemical Society due to the test security guarantees signed by the Department Chair. A copy of the graduate survey is attached.