



# WEST VIRGINIA STATE UNIVERSITY

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## Academic Affairs Assessment of Student Learning Report for Academic Year 2017-2018

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 2017-2018 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 2017 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 1 <sup>st</sup> semester Physical Chemistry Exam (Direct)

\*ACS: American Chemical Society

For the Spring 2018 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 2017-2018 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	26
Second term Organic Chemistry test – Chemistry 206	34
First Term Physical Chemistry test – Chemistry 301	4
Senior Seminar – Chemistry 450 – DUCK Test	8
Graduate Assessment Survey	5

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 constant reminders the survey were completed and submitted to the College Secretary 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 2017-2018 academic year the following items were noted.

- ACS 2<sup>nd</sup> 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, carbonyls, mechanisms, synthesis, and spectroscopy. Based on

the item analysis data, students, area of greatest weakness was carbonyl chemistry in which 31% of the student responses were correct.

- ACS 1<sup>st</sup> 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; Inorganic, Biological, Physical, Organic, and Analytical.
- 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 six 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 2018 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
3	2			

#### Comments:

- a. I feel extremely knowledgeable in organic concepts.
- b. This is the area I give the highest score. The two professors do a great job with organic and I have talked to friends at larger universities and we have it a lot better here at State with our Organic chemistry program. This is also the best lab program we have in my opinion.
- c. Most challenging and best taught. I didn't put forth the effort I should have so I'm a little shaky in this area. The enthusiasm and helpfulness of the professors means anyone

can get an A. I have compared my organic chemistry education to that of my friends at WVU and UC and they did not learn all that we did.

#### Analytical Chemistry

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

#### Comments:

- Instruments were broke and/or outdated for Instrumental Analysis. I feel as if I learned a lot in analytical however.
- I feel thoroughly prepared to report analytical data with accuracy and precision.
- Analytical had many different applications that carried over to the other chemistry classes, such as inorganic. It is a very small class size which made a lot of one on one time. I put Instrumental in this category and I thought that class was very helpful not only in the classroom but when it came time to apply for jobs.

#### Physical Chemistry

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

#### Comments:

- This class was hard for me to understand, but the professor explained to the best of his ability.
- I don't possess a stellar math background, but my preparedness in Physical Chemistry concepts is very strong.
- This is another class we only had one semester of that could have hurt us in our ACS scoring but I thought in a great way for us to know as much as possible for that test. The lab could have been better though. We only had a couple of experiments in the lab, not dry labs, and they were fairly plain.

#### Inorganic Chemistry

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

#### Comments:

- Point group symmetry gave me some difficulty, but overall, I feel like I have grasped many of the key concepts that inorganic has to offer.
- Inorganic was a good class that was a continuation of general chemistry. I do think not having two semesters of it will hurt us in our ACS scores, but I do not think it should be a reflection of what we learned.

#### Biological Chemistry

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

Comments:

- a. This is the area that needs the most work. Although I highly enjoyed the biochemistry class here at State, it was taught by a biologist and considered a chemistry class. It was a good class but could have been better.
- b. I do not have a strong biology background, so that worked against me, but I do feel that I have demonstrated an understanding of the core concepts of biochemistry.
- c. Biochemistry was not a chemistry course at all. A chemistry professor spoke to our class twice and we were not tested on the information. It was challenging and beneficial due to the amount of information.

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
3	2			

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
1	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
2	2	1		

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
3	1	1		

6. Conduct independent systematic research.

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

Any other comments regarding the department.

- a. Overall the faculty was very good, with some outstanding exceptions, and I felt I was given a great amount of personal attention due to small sizes and the professors' interest in their fields of study. Though not always the best organized, and with a few sub-par classes I took part in, I think I was provided a very good education in chemistry at WVSU (though whether my brain retained it well is yet to be seen).

- b. Like I said above, I believe the organic program is the best and the biological chemistry is worst here. Another thing I did like and should be continued here at State is the Junior Seminar and Senior Seminar classes. I do not know if they have always been this helpful or just with Dr. Fultz, but I believe that these two, no matter what we do in the future will probably help us more than anything. Everyone, especially in chemistry needs to know how to communicate their findings, both written and orally.
- c. My degree did not require research when I was admitted into WVSU. I'm not sure if it does now, but I believe if it is not, it should be. It took me until my senior year to see how much research and outside, hands on work can help in the classroom. Our professors do a great job of encouraging students to partake in research opportunities, however.

The lack of software for students makes getting work done hard. It is frustrating to have to search for professors and not interrupt professor just to get in a lab. It might be wise to put a few ChemDraw computers in the library as well so we can do our work after Hamblin closes and on the weekends. If we take 19 hours, our day time to get in the lab is very limited.

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 <sup>13</sup>C NMR as they are covered in in the lecture. This will provide additional practice for the students. This year we are also looking to possibly add a laboratory activity in carbonyl chemistry for support in the lowest scoring content area of Chemistry.

**Graduate Survey** – Graduates of our program have noted that several of our instruments are old and need to be upgraded. This year faculty prepared, submitted, and was awarded a grant to replace the polarimeter. We continue to look to upgrade the UV-Vis spectrophotometer and

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.