

**Academic Affairs Assessment of Student Learning**

**Report for Academic Year 2019-2020\_\_ .**

**Department/Program \_\_\_\_Chemistry\_\_\_\_\_\_\_\_\_**

**Assessment Coordinator’s Name: Micheal Fultz**

**Assessment Coordinator’s Email Address: mfultz@wvstateu.edu**

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 2019-2020 academic year.

• PLO 1. Explain the fundamentals in organic, analytical, physical, inorganic, and biological chemistry.

• PLO 3. Apply problem-solving strategies to scientific problems

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

For the Fall 2019 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 2020 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)

1. **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. During the 2019-2020 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).

1. **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 | 15 |
| Second term Organic Chemistry test – Chemistry 206 | 15 |
| First Term Physical Chemistry test – Chemistry 301 | 3 |
| Senior Seminar – Chemistry 450 – DUCK Test | 4 |
| Graduate Assessment Survey | 5 |

1. **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.

1. **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.

1. **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 |

1. **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 2019-2020 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: ACS two semester Organic Chemistry Exam: The results of the fall semester section of students who took this exam during the academic year has been item analyzed by topic. Each question was classified into one of five topic/concept areas – general organic, chirality, mechanisms, synthesis, and spectroscopy. Based on the item analysis data, students, areas of greatest weakness was spectroscopy followed by mechanisms, general organic, and synthesis. The greatest proficiency was in chirality.

One limitation with both Chem 106 and 206 data is the limited sample size. The in sequence courses were not able to take the ACS test because the COVID pandemic closed all in person classes. We decided that we could not post the ACS test online so Spring 2020 assessment data is lacking.

* 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 2020 semester. Student scores in chemistry sub-disciplines increased (lowest to highest) in the following respective order; Biological, Inorganic, Physical, Analytical, and Organic. All four students who completed the exam scored above the 72% on the preliminary national percentile rankings.
* 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 2020 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 | 1 | 1 |  |  |

Comments:

* + - * 1. This class was taught by Dr. Fultz and it is definitely one of the main reasons of what made me decide to major in Chemistry. Left this class introduced into a whole different world in chemistry while having a lot of understanding in it.
        2. This was my favorite class load. These classes were taught exceptionally well and set me up for the future.
        3. Dr. Fultz challenges students to achieve the best possible grade in the class. He is a master at inspiring students to learn Organic Chemistry

Analytical Chemistry

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

Comments:

1. Dr. Guetzloff was a fantastic teacher who constantly gave several different methods of teaching.

Physical Chemistry

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

Comments:

1. Dr. Naga is easily one of the most enthusiastic professors who truly loves teaching. He makes sure that the difficult concepts of P Chem are easy to grasp and offers time to any student to catch up.

Inorganic Chemistry

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

Comments:

1. This class made me feel stupid for struggling with some of the material.

Biological Chemistry

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

Comments:

* + - 1. 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 |
| 5 |  |  |  |  |

* + - 1. 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 | 1 |  |  |  |

* + - 1. 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 |
| 4 | 1 |  |  |  |

* + - 1. 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 | 2 |  |  |  |

* + - 1. Conduct independent systematic research.

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

1. **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** – With replacing half the faculty in the department the general chemistry labs will be completely overhauled to improve clarity and content. This is something that has been planned in the past but revisions were never completed.

**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 13C 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** – Based on the comments from our graduates consistently mentioning that biochemistry is our worst performing area. With the departure of one of our faculty members we have recommended hiring a biochemist. This would be the first true biochemist the University has had on staff in recent memory.

1. **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.