



## Program Assessment Report (PAR)

Chemistry, BA/BS (CHM) Baccalaureate Degree

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ACADEMIC YEAR COVERED BY THIS REPORT: 2021-2022

### I. PROGRAM LEARNING OUTCOMES

The Chemistry Department is an American Chemical Society Certified program. We follow the guidelines put forth in the document "ACS Guidelines and Evaluation Procedures for Bachelor's Degree Programs" by the Committee on Professional Training.

The guidelines lists the following student skills that students should possess before entering the workforce of pursuing graduate degrees.

- 1) Chemistry content knowledge in five sub-disciplines; analytical, biochemistry, inorganic, organic, and physical
- 2) Problem solving skills
- 3) Chemical literature and information management skills
- 4) Laboratory safety skills
- 5) Communications skills
- 6) Team skills
- 7) Ethics

Approved programs are required to regularly evaluate the curriculum, pedagogy, faculty, and infrastructure needs relative to the teaching and research mission of the program.

### II. PROCEDURES USED FOR ASSESSMENT

#### A. Direct Assessment

- 1) Chemistry content knowledge in five sub-disciplines; analytical, biochemistry, inorganic, organic, and physical

The chemistry content knowledge is assessed in "foundation" course exams. ACS has standardized exams that our students take in specific courses as they

matriculate. Standardized exams are given to students in first-year courses (CHM 1210 and CHM 1220), organic chemistry I & II (CHM 2110, CHM 2120), and in physical chemistry (CHM 3510), a course usually taken in the third or fourth year.

In CHM 1210, CHM 1220, CHM 2110, and CHM 2120, the exam is given to all students in the course, not just chemistry majors, so the data are not separated out by major.

## 2) Problem solving skills

These are generally assessed by students participating in undergraduate research (CHM 4990) and third and fourth year courses with laboratories particularly quantitative analysis (CHM 3510) and instrumental analysis (CHM 4350).

## 3) Chemical literature and information management skills

Students can take CHM 3190 Chemical Literature and Composition as a required course. Students take a pre- and post-test.

Students can also take CHM 4900 Critical Literature Analysis as an elective to learn about the literature and how to find and evaluate research papers.

## 4) Laboratory safety skills

Each laboratory has a safety education component.

## 5) Communications skills

Students are required to write laboratory reports in physical chemistry (CHM 3510). Students are required to write a term paper and also present the findings to the class orally (CHM 3190). They also may participate in undergraduate research and present their findings at professional meetings (CHM 4990).

Students may take CHM 4020 Advanced Environmental Chemistry and Analysis as an elective. This is a Service-Learning Intensive course in which students work as a team to collect and analyze samples from the WSU woods. They present their results to the public at the Annual Wright State Runkle Woods Symposium. Feedback at the public presentation is the way their communication skills are assessed. The presentations are recorded and posted online in the WSU CORE Scholar site for the symposium.

## 6) Team skills

Students who take CHM 4990 Special Problems in Chemistry (undergraduate research) will have the opportunity to discuss the ethics of their research and the presentation of research data with their research team and their advisor.

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information is also posted online for anyone to download for free. Students in chemistry are trained to be lone wolves. They struggle with working and being graded as a team. In CHM 4020, students are required to write Reflection papers in which they discuss how they are developing with regard to being the member of a team. A grading rubric is used to assess reflection papers.

#### 7) Ethics

CHM 3190 has a class period dedicated to discussions of ethics in chemistry. A quiz is used to have students reflect on ethics delimas. Students who take CHM 4020 Advanced Environmental Chemistry and Analysis as an elective will be introduced to the idea of being and scientist and a citizen. The course includes many discussions related to ethics in the workplace and ethics regarding the representation of data. Students are asked questions relating to ethics on exams.

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### **B. Scoring of Student Work**

1) Chemistry content knowledge in five sub-disciplines; analytical, biochemistry, inorganic, organic, and physical

Assessed through exams, and specifically using ACS standardized exams in the first and fourth years. Exams are scored by faculty and graduate teaching assistants.

2) Problem solving skills

Assessed directly by faculty working with students in undergraduate research CHM 4990. Students receive a grade from their advisor.

3) Chemical literature and information management skills

Assessed using quizzes in CHM 4900 that were scored by faculty. Pre- and post-tests were scored by faculty in CHM 3190.

4) Laboratory safety skills

This is not formally assessed, particularly if the student is not injured. Some quizzes may have safety questions incorporated in them.

5) Communications skills

Students' laboratory reports are graded by graduate teaching assistants and faculty in CHM 3510 and CHM 4530.

Students who participate in research, CHM 4990, are encouraged to prepare talks or posters to present at local, regional, and national meetings. They have the opportunity to win awards for their presentations.

Students in CHM 3190 prepare a term paper and present their findings to the class. For the term papers, each student is assigned a writing partner with whom to review and discuss drafts of the final paper. Each student is given an assessment rubric to fill out for each presentation. They are collected and used in grading of the assignment.

This is assessed by the questions from the public at the public presentation in CHM 4020 Advanced Environmental Chemistry and Analysis public presentation of research project results. A grade is given by the instructor for the final presentation.

#### 6) Team skills

Team skills are assessed in CHM 4020 Advanced Environmental Chemistry and Analysis by the instructor as part of their preparation for the public presentation of their research project results.

#### 7) Ethics

Ethics are assessed as a conversation between a research advisor and student in the research course, CHM 4990.

Ethics are assessed in CHM 4020 Advanced Environmental Chemistry and Analysis in question given on written exams scored by the instructor.

### **C. Indirect Assessment**

There is no additional assessment of student perceptions of learning in addition to the university administered online course evaluations, except for CHM 4020, however CHM 4020 was not offered in Fall 2021.

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The department is working on a survey to assess student perception of learning to be administered in their last semester.

### III. ASSESSMENT RESULTS/INFORMATION:

1) Learning of course content using ACS Standardized Exams in CHM 1210 General Chemistry I

2) Learning of course content using ACS Standardized Exams in CHM 1220 General Chemistry II

3) Learning of course content using ACS Standardized Exams in CHM 2110 Organic Chemistry I

4) Learning of course content using ACS Standardized Exams in CHM 2120 Organic Chemistry II

5) Learning of course content using ACS Standardized Exams in CHM 3510 Physical Chemistry I

6) Communication and ethics with pre- and post-test in CHM 3190

1) Fall 2021, 29 mean, national average is 40  
Data includes all students, not just chemistry majors

2) Fall 2021, no testing was done in online course  
Spring 2022, 35 mean, national average was 36

3) Fall 2021, 39 mean, national average was 38  
Spring 2022, 34 mean, national mean was 36  
Data includes all students, not just chemistry majors

4) Spring 2022, 36 mean, national mean was 39  
Summer 2022, 32, national mean was 39

5) Fall 2021, 34 mean, national average was 38  
Data includes only chemistry majors

6) Spring 2022, Students scores improved by 13% on the post-test

1) Chemistry students are at the national average

- 2) Chemistry students are at the national average
- 3) Chemistry students are just below the national average, but in previous years have been just at or slightly above the national average
- 4) Students ultimately enjoyed the teamwork and communication aspects of the course even though some were resistant in the beginning.

#### **IV. ACTIONS TO IMPROVE STUDENT LEARNING**

Results on the ACS Standardized Exams are shared with the American Chemical Society Committee on Professional Training.

Hundreds of students take first- and second-year chemistry courses each year but only a small percentage of them are chemistry majors.

Internal assessment is now being done in the department. The department is tracking ACS exam scores.

The department now has a First-Year Teaching Committee and a First-Year Experience Committee that are charged with evaluating and improving teaching methods and learning outcomes. The department will develop a way to assess the student experience at every level of progress and track chemistry majors after they complete their degrees.

In the future, the department will separate out exam results for chemistry majors from the classes in CHM 1210, CHM 1220, CHM 2110, and CHM 2120.

#### **V. SUPPORTING DOCUMENTS**

Additional documentation, when provided, is stored in the internal Academic Program Assessment of Student Learning SharePoint site.