Student Outcomes Assessment and Success Report AY2019-20 ***Consult with your college dean's office regarding due date and how to submit. Deans will submit reports to the Office of Assessment & Accreditation annually by October 15.***

Unit/Program Name: Chemistry Program; Dept. of Chemistry& Physics **Contact Name(s) and Email(s)** Stephen F. Wolf, wolf@indstate.edu

Part 1a: Summary of Student Learning Outcomes Assessment

NOTE: If data from Spring 2020 is missing due to COVID-19 transition issues, please describe these issues, their impact on your ability to assess student learning, and what, if anything, will change as a result.

a. What learning outcomes did you assess this past year?	**b. (1) What assignments or activities did you use to determine how well your students attained the outcome? (2) In what course or other required experience did the assessment occur?**	**c. What were your expectations for student performance?**	**d. What were the actual data/results?**	**e. What changes or improvements were made or will be made in response to these assessment results or feedback from previous year's report?** *Can expand on this in Part 2.*
1. Outcome #3 - Students pursuing a baccalaureate degree in chemistry will carry out basic laboratory procedures demonstrating appropriate use of instrumentation, quantitative measurement, and data analysis.	1. Assessment of student basic laboratory procedures occur in multiple courses throughout the chemistry curriculum. The 6 categories of lab skills assessed are listed in Part 2 of this report. Courses that had input to this assessment include Chem 340, 351L, 352L, 355, 321L, 431L, and 461L. These courses span a wide range of subdisciplines in chemistry including analytical chemistry, inorganic chemistry, organic chemistry, biochemistry, and physical chemistry and provide students with experience(s) in a wide array of procedures, techniques, and instrumentation. The specific assignments/activities for each class and their outcomes are listed in the Appendix.	1. We have adopted a standardized rubric for each Outcome. Students are evaluated as possessing skills of not acceptable (NA=0), fair (F=1), good (G=2), or very good (VG=3) by the faculty performing the assessment. For each course participating we then calculate a mean, weighted by the number of students assessed for each of the 6 categories and a grand mean calculated across all 6 categories also weighted by the number of students assessed in each category. A single numerical metric analogous to the calculation of a GPA is calculated (except the scale is 0-3). An example of this calculation is given in the Appendix. This approach allows us to conclude whether the overall average results are satisfactory or unsatisfactory and allows us to examine long-term trends. We consider a grand mean score <1.5 to be unsatisfactory and require immediate remediation. A score $\geq$1.5 is deemed to be satisfactory. Our expectations are that the weighted mean of all categories in a given outcome are satisfactory. Results for this cycle are detailed in Part 2 of this report.	1. Data for the six categories of Outcome #3, the weighted mean for each category and a total score are given in Part 2. In all cases (every category and weighted mean) our students scored > 2.0 with a weighted overall score of 2.3.	1. In this cycle we fully implemented the standardized rubric described in Part 1a (box c) in order to standardize our assessment. Additionally, we obtained more quantitative data from more courses due to increased participation by faculty.
2. Outcome #4 - Students pursuing a baccalaureate degree in chemistry will be able to demonstrate professional communication skills.	2. Courses that had input to this assessment include Chem 405, 341, 431L, and 461L. The specific assignments/activities for each class and their outcomes are listed in the Appendix.	2. See description above	2. Data for the two categories of Outcome #4 and the weighted mean for each category are given in Part 2. In all cases (both categories and weighted mean) our students scored 2.0 with a score of 2.0 for Outcome #4.	2. Our current rubric now has separate categories for written and oral communication. And we are using our standardized rubric to aid in our assessment of students in this category. Additionally, we obtained more quantitative data from more courses due to increased participation by faculty

Note: *If you would like to report on more than three outcomes, place the cursor in the last cell on the right and hit "tab" to add a new row.*

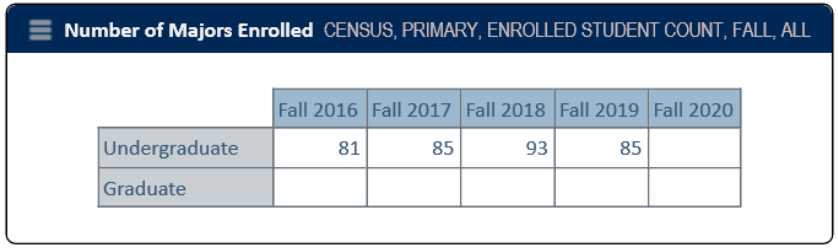
Helpful Hints for Completing this Table

a. Use your outcomes library as a reference. Note any alignment with professional standards, as applicable.
b. Each outcome should be assessed by at least one direct measure (project, practica, exam, performance, etc.). If students are required to pass an examination to practice in the field, this exam should be included as one of the measures. At least one of the program's outcomes must use an indirect measure (exit interview, focus group, survey, etc.). Use your curriculum map to correlate outcomes to courses. Describe or attach any evaluation tools such as rubrics, scales, etc.
c. Identify the score or rating required to demonstrate proficiency (e.g., Students must attain a score of "3" to be deemed proficient; at least 80% of students in the program will attain this benchmark.)
d. Note what the aggregate level of proficiency actually was and the number of students included in the cohort or sample (e.g., 85% of the 25 students whose portfolios were reviewed met the established benchmark).

Part 1b: Review of Student Success Data & Activities

Use Blue Reports to generate the following information (as well as any other information helpful to you). A dashboard has been created in the Chairs view:

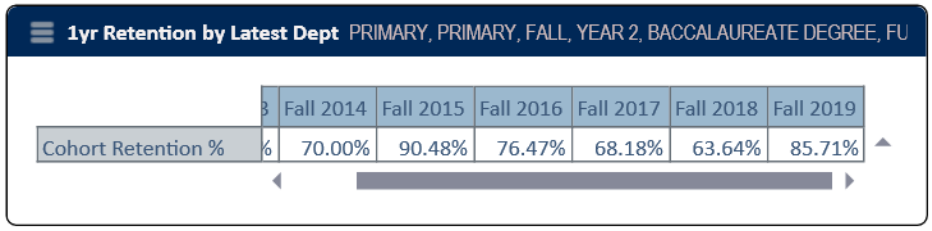
1) Cohort Sizes



Number of Majors Enrolled CENSUS, PRIMARY, ENROLLED STUDENT COUNT, FALL, ALL

	Fall 2016	Fall 2017	Fall 2018	Fall 2019	Fall 2020
Undergraduate	81	85	93	85	
Graduate					

2) Year-to-Year Retention



1yr Retention by Latest Dept PRIMARY, PRIMARY, FALL, YEAR 2, BACCALAUREATE DEGREE, FU

	3	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019
Cohort Retention %	%	70.00%	90.48%	76.47%	68.18%	63.64%	85.71%

3) 5-Year Graduation Rate (undergraduate); Average time to completion (graduate)

Fall 2009	Fall 2009	Fall 2010	Fall 2010	Fall 2011	Fall 2011	Fall 2012	Fall 2012	Fall 2013	Fall 2013	Fall 2014	Fall 2014
Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %	Cohort Total	Cohort Graduation %
6	50.00%	13	38.46%	13	23.08%	12	58.33%	18	55.56%	12	33.33%

What worked well in supporting student success this year?

We provided opportunities for 15-20 undergraduates to participate in hands-on chemistry research under the direct mentorship of a faculty member during the summer through the 2019 Summer Undergraduate Research Experiences (SURE) program, and during the regular semesters for credit (CHEM 399 or 499).

We secured Supplemental Student Wages to fund the Science Help Center—a free, drop-in tutoring service for students in freshman- and sophomore-level chemistry and physics courses.

We encouraged Chemistry majors and minors to participate in the American Chemical Society (ACS) Student Affiliate. Participation in this groups fosters a sense of community among Chemistry majors and gives the students opportunities to interact with the faculty in an informal, small-group setting. They get career and graduate school advice from faculty in such a setting and learn more about the profession of chemistry.

We employ chemistry majors as tutors in the Science Help Center and as lab assistants and teaching assistants for General and Organic Chemistry lab courses. When students have to "teach" other students as a tutor or in a lab, they learn the material better themselves—this helps solidify their knowledge of fundamental concepts and makes it more likely that they will perform well in their upper-level chemistry courses. The habits and skills they develop in these settings are also directly relevant to career readiness, for example, communication skills, working with others, content knowledge, and exercising flexibility and adaptability.

What are the most significant opportunities for improvement upon which to focus in the coming year?

As a department we struggle with how to "teach" problem-solving skills to students. We believe students develop these skills in part through multiple opportunities to solve problems in a variety of courses. Given that we will be assessing problem-solving skills in the coming year, we will be looking for ways to build more of these opportunities into our courses. It could include assigning more homework in lower-level courses or assigning projects in upper-level courses with small enrollments.

Part 1c: Summary of Career Readiness Activities – required for undergraduate programs; optional for graduate programs

If you submitted a report last year, you only need to resubmit if there are changes to your current career readiness competencies map.

We submitted a career readiness competencies curriculum map for the AY2018-19 cycle. There are no changes for the AY2019-20 cycle.

If you have not previously done so, please submit your Career Readiness Competencies curriculum map along with this report as a separate attachment. You can find the template here: https://www.indstate.edu/assessment/plan-components

Part 2: Continuous Quality Improvement

Reflect on the information shared above regarding student learning, success, and career readiness. In no more than one page, summarize:

1) **the discoveries assessment and data review have enabled you to make about student learning, success, and career readiness** (ex: What specifically do students know and do well—and less well? What evidence can you provide that learning is improving? How might learning, success, and career readiness overlap? What questions do your findings raise?)
2) **findings-based plans and actions intended to improve student learning and/or success (expansion of Part 1a, box e as needed)**
3) **what your assessment plan will focus on in the coming year**
4) **how this information will be shared with other stakeholders**

1.With respect to Outcome #3, results of laboratory skills assessment indicate that, on average, >95% of our students were judged to be performing fair (F) or better in the 6 assessed categories. Greater than 50% were judged to be performing at our highest level (VG) on average. These results show that student laboratory skills for the AY19-20 cohort were comparable to the AY17-18 cohort. We expect that these levels should be stable given the amount of laboratory time students are required to take for their major.

This said, one instructor assessed 18.5% of students as performing not acceptable (NA) for Category 4 based on two experiments that the AY19 and 20 cohorts both performed in CHEM 321L (see Appendix A). The overall weighted average score for this category is 12.7% NA. Closer examination of the data indicate a distinct bimodal distribution for this Category. Apparently there were 10 students who struggled with the manual dexterity required for this exacting category. The reason for this is uncertain; observations by the faculty indicate that some students just don't care, or don't know, how to make careful measurements. As freshmen, many of these students are enrolled in "double sections" of Chem 105L and do not receive as much attention from the instructors as they would in a single section. Additionally, some students transfer from other institutions and did not receive their general chemistry training at ISU.

2. With respect to Outcome #4, our quantitative results of the assessment of student written and oral communication skills, indicates that >90% of our students are, on average, meeting our criteria of performing at a level appropriate for the course. We identify that the category of written communication is an area of potential improvement (as many as 22.8% of our Seniors were performing at the level fair (F) in this category). Written communication is both difficult to assess and to address due to the differences in courses and faculty expectations. We perform additional assessment across our curriculum via an *ad hoc* focus group composed of several faculty who teach courses identified as having written/oral communication skill components in their courses and as to whether students satisfy our stated expectations of performance. There is a basic consensus that this is an area that needs additional attention. The use of more internal, and/or external consultants could potentially be utilized to assist students in this outcome. This has been discussed in Assessment Committee meetings but not implemented fully.

3. In AY 2020-21 we will focus on: Outcome #1 (knowledge of fundamental concepts in chemistry) and Outcome #2 (problem-solving skills). For knowledge of fundamental concepts we utilize a standardized "Major Fields Test" in chemistry which allows us to compare our students' abilities over time as well as compare our results to those at other institutions. Problem-solving skills are assessed by faculty in courses that span the range of subdisciplines in chemistry.

4. Upon its completion this report will be submitted to the Chair of the Department of Chemistry and Physics (Jennifer Inlow) who will, upon her approval, forward it to the Dean of the College of Arts and Sciences and subsequently the Office of Assessment for review. Once approved by the Chair, information contained in this assessment report will be discussed at a departmental meeting. Feedback from this assessment cycle will also be addressed at future departmental assessment committee meetings and departmental meetings of all faculty. Interested faculty will be encouraged to assist in gathering data for future assessment cycles.

Outcome #3: Laboratory skills	**NA**	**F**	**G**	**VG**
(1) Students are able to synthesize moderately complex compounds using contemporary techniques.	4.0%	8.0%	24.0%	64.0%
(2) Students are able to perform standard chemical compound purity procedures.	0.0%	10.3%	30.8%	59.0%
(3) Students are able to operate standard modern chemical instruments and interpret the results.	4.3%	24.3%	22.9%	48.6%
(4) Students are able to accurately carry out classical and instrumental quantitative methods of chemical analysis.	12.7%	10.1%	25.3%	51.9%
(5) Students are able to assess both accuracy and precision of analytical results.	0.0%	27.1%	35.4%	37.5%
(6) Students are able to use commercially available software for scientific calculations and data analysis.	2.1%	11.3%	36.1%	50.5%
Grand mean	**4.5%**	**15.4%**	**29.6%**	**50.5%**
Overall Score: 2.3				

Outcome #4: Communication	**NA**	**F**	**G**	**VG**
(1) Written communication	4.9%	23.0%	42.6%	29.5%
(2) Oral communication	5.6%	22.5%	36.6%	35.2%
Grand mean	**5.2%**	**22.8%**	**40.2%**	**35.2%**
Overall Score: 2.0				

Thank you so much for sharing your assessment process and findings for AY 2019-20 with the Assessment Council. You will find feedback and ratings on the rubric below. It is understood that some of the feedback might encompass practices that you already engage in but were not documented in this report. As the purpose of this evaluation is focused on recognizing great work and helping faculty improve assessment practice, it is not necessary to retroactively add documentation. Please feel free to let me know if you have any questions or if there is any way I can assist you in further developing assessment practice and use in your program.

This report will be shared with the Associate Dean(s) and Dean of your college and summarized findings will be shared as composite college/institutional data with the President's Office and the Provost's team.

Sincerely,

Kelley (x7975)

Program: B.S. Chemistry	**Overall Rating: Exemplary (3.00/3.00)**
Strengths	**Recommendations**
• Learning outcomes are clear, specific, and measureable. • Measures of student learning are tied to each outcome and include problem-based, hands-on learning that ties knowledge and skills together in application. Data from measures comes from multiple courses and is evaluated by faculty on a common rubric. • Expectations for student learning are created to help faculty understand student achievement over time. • Data is clearly reported (and thanks for the sample calculation to help illustrate), and multiple faculty contribute to the data through use of an analytical rubric that allows delineated scoring by learning outcome. • Display of data by rubric level and discussion of findings provides a deep, thoughtful analysis of student learning and how assessment is best used internally to drive improvement and support continuing strong practice. • Assessment is clearly a shared and transparent practice among faculty, and findings are put to use and shared throughout the cycle.	•

Student Outcomes Assessment & Success Report Rubric **Unit/Program: BS Chemistry**
Office of Assessment & Accreditation, Indiana State University **Evaluation Date: Fall 2020**

Evaluation Criteria	3 Exemplary	2 Mature	1 Developing	0 Undeveloped
Student Learning Outcomes	Identified, aligned learning outcomes are specific, measurable, student-centered, and program-level. Outcomes directly integrate institution or college-level learning goals. Outcomes are consistent across modes of delivery (if applicable). More than one outcome is assessed this cycle, and rationale is provided for why they were selected for assessment.	Identified, aligned learning outcomes are specific, measurable, student-centered, and program-level. Outcomes support institution or college-level learning goals. Outcomes are consistent across modes of delivery (if applicable). At least one outcome is assessed this cycle, and rationale is provided for why it was selected for assessment.	Learning outcomes are identified and alignment with courses is demonstrated. Outcomes are consistent across modes of delivery (if applicable). At least one outcomes is assessed this cycle.	No ***(program)*** learning outcomes are identified, and/or alignment of learning outcomes to courses is not demonstrated (e.g. – curriculum map).
Performance Goals & Measures	Performance goals are clear and appropriate, and rationale is provided for why these were selected. Identified measures and tools are assigned to each outcome, are clear and intentionally designed to address student performance on aligned outcomes, and rationale and examples are provided (e.g. – rubrics, checklists, exam keys). Most are direct measures, and their design enhances the validity of findings. Licensure exams and high-impact practices are reflected in measures (if applicable).	Performance goals are clear and appropriate. Identified measures and tools are assigned to each outcome, are clear and intentionally designed to address student performance on aligned outcomes, and examples are provided (e.g. – rubrics, checklists, exam keys). At least one direct measure is included.	Performance goals are identified with little rationale or clarity. Identified measures are poorly suited to performance goals, underdeveloped, or are solely indirect measures.	No goals for student performance of learning outcomes are identified, and/or no measures are provided.

Analysis & Results	Data collection process is clear and designed to produce valid/trustworthy results. The process is useful to those collecting and/or interpreting data. Data is collected and analyzed with clear rationale and description. Results are provided with thoughtful discussion of analysis and description of conclusions that can be drawn.	Data collection process is clear and designed to produce valid/trustworthy results. Data is collected and analyzed with clear rationale and description. Results are provided with some discussion of analysis.	Description of data collection is unclear as to process and quality. Some data is collected and analyzed with little rationale or description. Some results are provided with no discussion of analysis.	No information is provided about the data collection process, and/or no data is being collected. No results are provided
Sharing & Use of Results for Continuous Improvement	A plan for sharing information and included program faculty and appropriate staff in discussion and planning is detailed and enacted. Outcomes and results are easily accessible on the program website or other appropriate designated area. Plans for improvement or change based on results are clear and connected to results. If few students met performance goals, this is included in discussion and plans. Reflection if offered about results or plans moving forward, and compares prior year plans to current outcomes in an effort to foster continuous improvement as a result of assessment process.	A plan for sharing information broadly across program faculty is detailed and enacted. Plans for improvement or change based on results are clear and connected to results. If few students met performance goals, this is included in discussion and plans. Reflection is offered about results or plans moving forward.	Information is provided about sharing results, but sharing is limited in scope or content. Plans for improvement or change based on results are incomplete, vague, or not clearly connected to results. Little reflection is offered about results or plans moving forward.	No information is provided about sharing results and/or plans for improvement or change based on results. No evidence of reflection on results in provided.
Overall Rating	□ **Exemplary**	□ **Mature**	□ **Developing**	□ **Undeveloped**

Please see reviewer notes for more details.