Assessment Cycle 2021 – 2022

Bachelor of Science (BS) in Physical Science (637)

School of Biological and Physical Sciences

College: Arts and Sciences

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Northwestern Mission. Northwestern State University is a responsive, student-oriented institution committed to acquiring, creating, and disseminating knowledge through innovative teaching, research, and service. With its certificate, undergraduate, and graduate programs, Northwestern State University prepares its increasingly diverse student population to contribute to an inclusive global community with a steadfast dedication to improving our region, state, and nation.

College of Arts and Sciences' Mission. College of Arts and Sciences' Mission. The College of Arts & Sciences, the largest college at Northwestern State University, is a diverse community of scholars, teachers, and students, working collaboratively to acquire, create, and disseminate knowledge through transformational, high-impact experiential learning practices, research, and service. The College strives to produce graduates who are productive members of society equipped with the capability to promote economic and social development and improve the overall quality of life in the region. The College provides an unequaled undergraduate education in the social and behavioral sciences, English, communication, journalism, media arts, biological and physical sciences, and the creative and performing arts, and at the graduate level in the creative and performing arts, English, TESOL, and Homeland Security. Uniquely, the College houses the Louisiana Scholars' College (the State's designated Honors College), the Louisiana Folklife Center, and the Creole Center, demonstrating its commitment to community service, research, and preservation of Louisiana's precious resources.

School of Biological and Physical Sciences. The School of Biological and Physical Sciences will become a reputable leader in public higher education by providing a transformative science educational experience using innovative instructional methods and through the scholarly achievements of our faculty, staff, students, and alumni. The School serves and inspires the students of Northwestern State University and the public through the development of lifelong learners who are excited about science, are disciplined in analytical and critical thinking skills, and are socially, environmentally, and ethically responsible. The school delivers Associate degrees in Veterinary Technology, Bachelor of Science degrees in Biology (with concentrations in Biomedical, Clinical Laboratory Science, Forensic Science, Natural Science, and Veterinary Technology), Applied Microbiology (with concentrations in Environmental and Applied Microbiology and Medical and Health Profession), and Physical Sciences. The school also offers minors in Biology, Microbiology, Wildlife Management, and Chemistry.

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Physical Science Program Mission Statement. The mission of the Northwestern State University Physical Science program is to provide a comprehensive education in chemistry and physics for all our majors and to create a unique training environment for students wishing to pursue graduate or professional education.

Purpose (optional): The primary goal of the Physical Science program is to prepare students to enter the job market competitively at the bachelor level or to further their education in either graduate or professional school.

Methodology: The assessment process for the Physical Science program is as follows:

(1) Data from assessment tools (both direct – indirect, quantitative and qualitative) are collected and returned to the program coordinator;

(2) The program coordinator will analyze the data to determine whether students have met measurable outcomes;

(3) Results from the assessment will be discussed with the program faculty;

(4) The program coordinator, in consultation with the director of the School of Biological and Physical Sciences as well as the faculty of the school, will propose changes to measurable outcomes and/or assessment tools for the next assessment period and, where needed, curricula and program changes.

Student Learning Outcomes:

NOTE: The Bachelor of Science in Physical Science is a relatively new program with low enrollment. Therefore, data collection was limited to only three students who took a required, major course.

SLO 1. Students will identify the basic components of the atomic structure.

Course Map: Tied to the course syllabus objectives

CHEM1030: General Chemistry I

Measure 1.1. (Direct – knowledge)

Throughout the course, students will learn the structure of atoms and the importance of each subatomic particle. Each student is required to pass a quiz covering these concepts. The target is to have 75% of students attain a quiz grade of ≥70%.

Findings: Target Not Met

Analysis: In AC 2020 – 2021 there were no Physical Science students to assess in CHEM 1030. In AC 2021 – 2022, 43% (3/7) of the Physical Science students assessed obtained a quiz grade of ≥ 70%. This performance is below (-27%) the goal of 70% of students earning a target of ≥ 70% on this assessment. This implies that the students were not able to demonstrate appropriate knowledge of the structure of atoms and the importance of each subatomic particle. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 1030 course by using a new textbook. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Measure 1.2. (Indirect – survey)

At the end of the course, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts of atomic structure covered in the course. The target is to have 75% of the students report an above average or excellent knowledge of the indicated concepts.

Findings: Target Not Met.

Analysis: In AC 2020 – 2021 there were no Physical Science students to assess in CHEM 1031. In AC 2021 – 2022, 43% (3/7) of the physical science students assessed gauged their understanding of the basic concepts of atomic structure covered in the course as above average or excellent. This performance is below (-32%) the goal of 75% of students expressing a level of understanding of above average or excellent on this assessment. This implies that 68% (4/7) of the physical science students gauged their appraisal of their understanding of the basic concepts of atomic structure covered in the course as average or below. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 1030 course. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

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SLO 2. Students will be able to classify the natural laws of thermodynamics and mechanics.

Course Map: Tied to the course syllabus objectives

CHEM 1040: General Chemistry II
PHYS 2510: General Analytical Physics I.

Measure 2.1. (Direct – knowledge)

Throughout the course, students will learn about the various natural laws of thermodynamics. Each student is required to pass a quiz covering the concepts of thermodynamics (CHEM 1040). The target is to have 75% of students attain a quiz grade of ≥70%.

Findings: Target Not Met

Analysis: In AC 2020 – 2021 there were no Physical Science students to assess in CHEM 1040. In AC 2021 – 2022, 67% (2/3) of the physical science students assessed earned a quiz grade of ≥70. This performance is below (-3%) the goal of 70% of students earning a target of ≥ 70% on this assessment. This implies that 33% (1/3) of the Physical Science students scored below the target 70% in the quiz. This implies that the students were not able to demonstrate appropriate knowledge of the natural laws of thermodynamics. Because no physical science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will begin using a new textbook for CHEM 1040. The faculty will improve informational delivery in the CHEM 1040 course. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of the AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Measure 2.2. (Direct – knowledge)

Throughout the course, students will learn about the various natural laws of mechanics. Each student is required to pass a quiz covering the concepts of mechanics (PHYS 2510). The target is to have 75% of students attain a quiz grade of ≥70%.

Findings: Target Not Met

Analysis: In AC 2020 – 2021 there were no Physical Science students to assess in PHYS 2510. In AC 2021 – 2022, 0% (0/1) of the Physical Science students earned a quiz

grade of ≥70%. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the PHYS 2510 course by assigning a new faculty member to teach the course. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

SLO 3. Students will be able to communicate scientific information.

Course Map: Tied to the course syllabus objectives

CHEM 4920: Scientific Communication
PHYS 4940: Scientific Communication

Measure 3.1. (Direct – ability)

Throughout all sections of the Scientific Communication courses, students will learn about the various aspects of communication in the sciences. Each student will write a scientific article and will be assessed using a standard rubric. The target is to have 70% of students earn a final score of ≥ 70% on the assignment.

Findings: Target Met.

Analysis: In AC 2021 – 2022, 100% (1/1) of the Physical Science students attained a score of ≥70% on the assignment. This was the first year that this was assessed.

Due to the new quality enhancement requirements (QEP) which states that each student must complete six hours of experiential learning, CHEM 4910, CHEM 4920, PHYS 4930, and PHYS 4940 have been incorporated into the Physical Science core curriculum to make capstone experiences consistent across BIOL, PHYS, and CHEM disciplines. The same assessments will be adopted once identified and implemented.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4920 and PHYS 4940 courses by providing rubrics that will delineate the key components of a scientific article and their relative importance. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the

School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Measure 3.2. (Direct – ability)

Throughout all sections of the Scientific Communication courses, students will learn about the various aspects of communication in the sciences. Each student will give an oral presentation of a scientific article/project developed by the student; the presentation will be assessed using a standard rubric. The target is to have 70% of students attain a final score of ≥ 70% on the assignment.

Findings: Target Met.

Analysis: In AC 2021 – 2022, 100% (1/1) of the physical science students earned a score of ≥70%. This was the first year that this was assessed.

Due to the new quality enhancement requirements which states that each student needs to complete six hours of experiential learning, CHEM 4910, CHEM 4920, PHYS 4930, and PHYS 4940 have been incorporated into the Physical Science core curriculum to make capstone experiences consistent across BIOL, PHYS, and CHEM disciplines. The same assessments will be adopted once identified and implemented.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4920 and PHYS 4940 courses by including additional resources to the students and discussion of how to properly present a scientific project. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

SLO 4. Students will employ critical thinking to interpret scientific literature.

Course Map: Tied to the course syllabus objectives

CHEM 4910: Capstone Course for Chemistry
PHYS 4930: Capstone Course for Physics

Measure 4.1. (Direct – Ability)

Throughout all sections of the capstone courses, students will read scientific articles from the primary literature and be required to pass quizzes over the material. The target is to have 70% of students earn a final average quiz grade of ≥ 90%.

Findings: Target Met.

Analysis: In AC 2020 - 2021 there were no physical science students to assess in CHEM 4910 or PHYS 4930. In AC 2021 – 2022, 75% (3/4) of the physical science students attained a quiz grade of ≥ 90%. This indicates that 75% of the students assessed were able to identify key ideas from a peer-reviewed scientific article. On the other hand, 25% (1/4) of the students struggled to identify key ideas in a peer-reviewed scientific article. Because no physical science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4910 and PHYS 4930 courses by including additional resources for the students and additional discussion on peer-reviewed publications and how to analyze them. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Measure 4.2. (Direct – Ability)

Throughout all sections of the capstone courses, students will write a proposal about their capstone project. The target is to have 70% of students earn a final written assignment grade of ≥ 90% using a standard rubric.

Findings: Target Met.

Analysis: In AC 2020 – 2021, there were no Physical Science students to assess in CHEM 4910 or PHYS 4930. In AC 2021 – 2022, 100% of the Physical Science students assessed earned a scored of ≥ 90% on the assignment based on a standard rubric. This indicates that the students assessed were able follow a structure given for a science-based proposal, determine a proper timeframe and budget for their proposed project, and justify the experiments proposed. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4910 and PHYS 4930 courses by providing rubrics that will delineate the key components of a proposal and their relative importance. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

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SLO 5. Students will demonstrate professional development.

Course Map: Tied to the course syllabus objectives

CHEM 4910: Capstone course for Chemistry
PHYS 4930: Capstone course for Physics.

Measure 5.1. (Direct – Skill)

Students will be required to give a final presentation assessed using a standard rubric across all sections of capstone classes. The target is to have 100% of students give a final presentation that meets ≥70% of the prescribed guidelines.

Findings: Target Met.

Analysis: In AC 2020 – 2021, there were no Physical Science students to assess in CHEM 4910 or PHYS 4930. In AC 2021 – 2022, 100% of the Physical Science students assessed attained a scored of ≥ 70% based on a standard rubric. This indicates that the students were able to successfully present the results of their capstone project to an open audience, correctly answering most of the questions posed by the public, and within a timeframe specified by the instructor of the course. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4910 and PHYS 4930 courses by including a practice session before the presentation to the public. NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Measure 5.2. (Direct – Skill)

Students will be required to relate their project to a specific entry level-job that conforms to guidelines set forth in the course. The target is to have 100% of students relate their capstone projects to available workforce opportunities that meets ≥ 90% of the prescribed guidelines.

Findings: Target Met.

Analysis: In AC 2020 – 2021, there were no Physical Science students to assess in CHEM 4910 or PHYS 4930. In AC 2021 – 2022, 100% of the Physical Science students assessed earned a scored of ≥ 90% based on a standard rubric. Because no Physical Science students were assessed in AC 2020 – 2021, no comparisons can be made.

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Decision: Based on the analysis of the AC 2021 - 2022 results, in AC 2022 - 2023, the faculty will implement the following changes to drive the cycle of improvement. The faculty will improve informational delivery in the CHEM 4910 and PHYS 4930 courses. The entry-level jobs are selected in consultation with the instructor of the course based on the students' indicated preferred career path. To continue improvement, NSU has approved a Coordinator for Physical Science who will oversee the assessment process for the Physical Science Program. At the start of AC 2022 – 2023, the Physical Science Coordinator, in consultation with the Director of the School of Biological and Physical Science, will meet with the instructors and discuss delivery of content and the timing of assessments.

Comprehensive summary of key evidence of improvements based on analysis of results. The following reflects all the changes implemented to drive the continuous process of seeking improvement in AC 2021-2022. These changes are based on the knowledge gained through the analysis of AC 2020-2021 results.

- Because no students were assessed in AC 2020 – 2021, there were no improvements measured in AC 2021-2022 because there were no Physical Science students to assess in the various courses selected for SLO's. This made it impossible to establish a baseline with which to measure improvement over time.
- The SLO 1 and SLO 2 targets were not met for AC 2021 – 2022.
- The SLO 4 and SLO 5 target were met for AC 2021 – 2022.
- Prior to the start of AC 2020-2021 year, the Director met with the instructors and discussed delivery of the content and the timing of the assessment processes, goals, and requirements.
- New capstone classes CHEM 4910, 4920 and PHYS 4930, 4940 were added to the core of the Physical Science degree to comply with the University's QEP; thus, new assessments were created and offered to reflect this new experiential learning curriculum.

Plan of action moving forward:

- Review the assessment and make sure that it's representative of physical science major's core classes and that the assessments are distributed through a variety of grade classifications.
- A new textbook and online assignment platform will be adopted for CHEM 1030 – 1040.
- A new physics instructor will be hired to assist in the implementation of the SLO's relevant to the physics portion of the physical science curriculum.

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- Standardized assessment across capstone sections will be evaluated to reflect the SLO associated with experiential learning.
- New assessments will be created and offered to reflect this new experiential learning curriculum.