

## Assessment Cycle 2022 – 2023

Program: **Bachelor of Science (BS) in Physical Science (637)**

School of Biological and Physical Sciences

College: Arts and Sciences

Prepared by: Dr. Daniel Rivera-Vazquez

Date: 06/02/2023

Approved by: Dr. Francene J. Lemoine

Date: 06/14/2023

**Northwestern Mission.** Northwestern State University is a responsive, Student-oriented institution that is committed to the creation, dissemination, and acquisition of knowledge through teaching, research, and service. The University maintains as its highest priority excellence in teaching in graduate and undergraduate programs. Northwestern State University prepares its students to become productive members of society and promotes economic development and improvements in the quality of life of the citizens in its region.

**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.

## Assessment Cycle 2022 – 2023

**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:** 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  $\geq 70\%$ .

**Findings:** Target not met

## Assessment Cycle 2022 – 2023

**Analysis:** In AC 2021 – 2022, 43% (3/7) of the Physical Science students assessed obtained a quiz grade of  $\geq 70\%$ . The target was not met for AC 2021 – 2022.

In AC 2022–2023, 67% (2/3) of the Physical Science students assessed obtained a quiz grade of  $\geq 70\%$ ; therefore, the target was not met. This performance is below (-3%) the goal of 70% of students earning a target of  $\geq 70\%$  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.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, a new textbook and online platform was used for CHEM 1030/1040 during AC 2022–2023. When comparing the results from AC 2021–2022, there is an increase in percentage of students meeting the target (+24%).

**Decision:** Based on the analysis of the AC 2022-2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. Our faculty will rotate between the courses of CHEM 1030/1031 and CHEM 1040/1041 to ensure the content presented is current and aligns with pre-requisite content for future courses. At the start of AC 2023–2024, the Physical Science assessment 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 above average or excellent knowledge of the indicated concepts.

**Findings:** Target not met

**Analysis:** 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. The target was not met in AC 2021–2022.

In AC 2022–2023, 67% (2/3) of the Physical Science students gauged their understanding of the basic concepts of atomic structure covered in the course as above average or excellent; therefore, the target was not met. This performance is below (-8%) the goal of 75% of students expressing a level of understanding of above average or excellent on this assessment. This implies that 33% (1/3) 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.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning

## Assessment Cycle 2022 – 2023

of AC 2022–2023. As a measure to drive improvement, a new textbook and online platform was used for CHEM 1030/1040 during AC 2022–2023. When comparing the results from AC 2021–2022, there is an increase in percentage of students meeting the target (+24%).

**Decision:** Based on the analysis of the AC 2022-2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. Our faculty will rotate between the courses of CHEM 1030/1031 and CHEM 1040/1041 to ensure the content presented is current and aligns with prerequisite content for future courses. At the start of AC 2023–2024, the Physical Science assessment 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 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  $\geq 70\%$ .

**Findings:** Target not met

**Analysis:** In AC 2021–2022, 67% (2/3) of the physical science students assessed earned a quiz grade of  $\geq 70\%$ . The target was not met in AC 2021–2022.

In AC 2022–2023 50% (3/6) of the physical science students assessed earned a quiz grade of  $\geq 70\%$ ; therefore, the target was not met. This performance is below (-25%) the goal of 70% of students earning a target of  $\geq 70\%$  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.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, a new textbook and online platform was used for CHEM 1030/1040 during AC 2022–2023. When comparing the

## Assessment Cycle 2022 – 2023

results from AC 2021–2022, there is a decrease in percentage of students meeting the target (-17%).

**Decision:** Based on the analysis of the AC 2022-2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. Our faculty will rotate between the courses of CHEM 1030/1031 and CHEM 1040/1041 to ensure the content presented is current and aligns with prerequisite content for future courses. At the start of AC 2023–2024, the Physical Science assessment 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  $\geq 70\%$ .

**Findings:** Target met

**Analysis:** In AC 2021–2022, 0% (0/1) of the Physical Science students earned a quiz grade of  $\geq 70\%$ . The target was not met in AC 2021–2022.

In AC 2022–2023 100% (2/2) of the physical science students assessed earned a quiz grade of  $\geq 70\%$ ; therefore, the target was met. This performance is above (+25%) the goal of 70% of students earning a target of  $\geq 70\%$  on this assessment. This implies that 0% (0/2) of the Physical Science students scored below the target 70% in the quiz.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, a different instructor was assigned to teach PHYS 2510 during AC 2022 – 2023

**Decision:** Based on the analysis of the AC 2022-2023 results, in AC 2023-2024, 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 effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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

## Assessment Cycle 2022 – 2023

**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  $\geq 70\%$  on the assignment.

**Findings:** Target met

**Analysis:** In AC 2021–2022, 100% (1/1) of the Physical Science students attained a score of  $\geq 70\%$  on the assignment. The target was met in AC 2021–2022.

In AC 2022-2023, 100% (5/5) of the physical students attained a score of  $\geq 70\%$  on the assignment; therefore, the target was met. This implies that 100% (0/5) of the students assessed were not to successfully meet the target.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022 – 2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4920/PHYS 4940 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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  $\geq 70\%$  on the assignment.

**Findings:** Target met

**Analysis:** In AC 2021–2022, the target was met with 100% (1/1) of the physical science students earned a score of  $\geq 70\%$ .

## Assessment Cycle 2022 – 2023

In AC 2022-2023, the target was met with 100% (5/5) of the physical students attained a score of  $\geq 70\%$  on the assignment. This implies that 0% (0/5) of the students assessed were not able to successfully meet the target.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4920/PHYS 4940 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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  $\geq 90\%$ .

**Findings:** Target not met

**Analysis:** In AC 2021–2022, 75% (3/4) of the physical science students attained a quiz grade of  $\geq 90\%$ . The target was met in AC 2021–2022.

In AC 2022–2023, 67% (2/3) of the physical science students attained a quiz grade of  $\geq 90\%$ . This indicates that 67% of the students assessed were able to identify key ideas from a peer-reviewed scientific article; therefore, the target was not met. On the other hand, 33% (1/3) of the students struggled to identify key ideas in a peer-reviewed scientific article. When comparing the results from AC 2021–2022, there is a decrease in percentage of students meeting the target (-8%).

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning

## Assessment Cycle 2022 – 2023

of AC 2022–2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4910/PHYS 4930 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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  $\geq 90\%$  using a standard rubric.

**Findings:** Target met

**Analysis:** In AC 2021–2022, the target was met with 100% (4/4) of the Physical Science students assessed earned a score  $\geq 90\%$  on the assignment based on a standard rubric.

In AC 2022–2023, the target was met with 100% (3/3) of the Physical Science students scored  $\geq 90\%$  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. When comparing the results from AC 2021–2022, there is no change in the percentage of students meeting the target.

Based on the analysis of the AC 2021-2021 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4910/PHYS 4930 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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 5. Students will demonstrate professional development.**



## Assessment Cycle 2022 – 2023

**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  $\geq 70\%$  of the prescribed guidelines.

**Findings:** Target met

**Analysis:** In AC 2021–2022, the target was met with 100% (4/4) of the Physical Science students assessed attained a score of  $\geq 70\%$  based on a standard rubric.

In AC 2022–2023, the target was met with 100% (3/3) of students give a final presentation that meets  $\geq 70\%$  of the prescribed guidelines. 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.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters. When comparing the results from AC 2021–2022, there is no change in the percentage of students meeting the target.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4910/PHYS 4930 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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  $\geq 90\%$  of the prescribed guidelines.

**Findings:** Target met

## Assessment Cycle 2022 – 2023

**Analysis:** In AC 2021–2022, the target was met with 100% (4/4) of the Physical Science students assessed earned a score of  $\geq 90\%$  based on a standard rubric.

In AC 2022–2023, the target was met with 100% (3/3) of students relate their capstone projects to available workforce opportunities that meets  $\geq 90\%$  of the prescribed guidelines.

Based on the analysis of the AC 2021-2022 results, the director and program assessment coordinator met with the faculty of the physical science department prior to the beginning of AC 2022–2023. As a measure to drive improvement, instructors were rotated between the Fall 2022 and Spring 2023 semesters. When comparing the results from AC 2021–2022, there is no change in the percentage of students meeting the target.

**Decision:** Based on the analysis of the AC 2022–2023 results, in AC 2023-2024, the faculty will implement the following changes to drive the cycle of improvement. The faculty will rotate between the Fall and Spring semester offering of CHEM 4910/PHYS 4930 to ensure that the content presented is current and relevant to the course. NSU has effectively recruited a new physics faculty who will teach in the physical science department. At the start of AC 2023–2024, the Physical Science assessment 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 2022-2023. These changes are based on the knowledge gained through the analysis of AC 2021-2022 results.

- The SLO 1 targets were not met for AC 2022–2023. When compared to the data obtained from AC 2021–2022, the percentage of students meeting the target increased by 24%; this implies that the changes applied for AC 2022–2023 drove improvement, but not to the desired target. As a measure to drive improvement, for SLO 1.1 and SLO 1.2, a new textbook and online platform was adopted for CHEM 1030/1040.
- The SLO 2 targets were partially met for AC 2022–2023. When compared to the data obtained from AC 2021–2022, the percentage of students meeting the target decreased by 17% for SLO 2.1; for SLO 2.2 the percentage of students meeting the target increased by 100%. This implies that the changes applied for AC 2022–2023 drove improvement for SLO 2.2, but not for SLO 2.1. As a measure to drive improvement, for SLO 2.1, a new textbook and online platform was adopted for CHEM 1040. For SLO 2.2, a change in instructor of record was introduced as a measure to drive improvement.
- The SLO 4 and SLO 5 target were met for AC 2021–2022. As a measure to drive improvement, faculty were rotated between Fall 2022 and Spring 2023 semesters for CHEM 4910/4920 and PHYS 4930/4940.

## Assessment Cycle 2022 – 2023

- Prior to the start of AC 2021-2022 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:

- Faculty will 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.
- Faculty will rotate between introductory chemistry courses (CHEM 1030/1031 and CHEM 1040/1041) as well as capstone and scientific communication courses (CHEM 4910/4920 and PHYS 4920/4930)
- 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.
- New assessments will be created and offered to reflect this new experiential learning curriculum.