Assessment Cycle
2018 – 2019

Bachelor of Science in Physical Science

College: Arts and Sciences

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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. 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: The primary goal of the Physical Science program is to prepare students to enter into 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. During the AY2017-2018, there were only three declared majors and none of these students were enrolled in the mapped major course (CHEM1030). Therefore, no student learning outcome data could be reported for AY2017-2018. During the AY2018-2019, enrollment increased to six declared majors. Student learning outcome data collection was limited to only four of the majors' students enrolled in the mapped major course (CHEM1030) during the AY2018-2019.

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

Course Map: CHEM1030 – General Chemistry I. All majors are required to complete CHEM1030.

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 met.

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Analysis: The target for Measure 1.1 is that 75% of the students would score ≥70% on a quiz covering basic concepts of atomic structure and the importance of each subatomic particle. This assessment was not performed during AY2017-2018. During the Fall semester of AY2018-2019, 75% (3/4) of students reached the target set for this outcome showing that lower-level students at the beginning of the program are able to identify the basic components of the atomic structure and can perform to the level of the assessment target.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 75% of students attaining a quiz grade of ≥70%. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of atomic structure and the importance of each subatomic particle.

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 met.

Analysis: The target for Measure 1.2 is that 75% of the students would report an above-average or excellent knowledge of basic concepts in atomic structure and the importance of each subatomic particle. In AY2017-2018, the assessment of this measure was not performed. During the AY2018-2019, 100% (3/3) of students reported that they had an above-average or excellent understanding of the structure of atoms and the importance of subatomic particles.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 75% of students reporting an above average or excellent understanding of atomic structure and the importance of subatomic particles. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of atomic structure and the importance of each subatomic particle.

SLO 2. Students will be able to classify the various types of atomic bonding.

Course Map: CHEM1030 – General Chemistry I. All majors are required to complete CHEM1030.

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Measure 2.1. (Direct – knowledge)

Throughout the course, students will learn about the various types of atomic bonding and the significance of each type. 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 met.

Analysis: The target for Measure 2.1 is that 75% of the students would score ≥70% on a quiz covering basic concepts of atomic bonding. This assessment was not performed during AY2017-2018. During the AY2018-2019, 75% (3/4) of students reached the target set for this outcome showing that lower-level students at the beginning of the program understand the various types of atomic bonds and the significance of each type.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 75% of students attaining a quiz grade of ≥70%. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of atomic bonds and their significance.

Measure 2.2. (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 in atomic bonding 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: The target for Measure 2.2 is that 75% of the students would report an above-average or excellent knowledge of basic concepts of atomic bonding and the significance of each type of bond. In AY2017-2018, the assessment of this measure was not performed. During the AY2018-2019, 66.67% (2/3) of students reported that they had an above-average or excellent understanding of atomic bonds. This performance is below (-8.33%) our goal of 75% of students reporting above-average or excellent understanding of the basic principles of atomic bonding.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course does not provide students with appropriate knowledge to meet our target of 75% of students reported an above average or excellent understanding of the various types and significance of atomic bonds. We will work to improve informational delivery in our CHEM1030 course. In 2019-2020, the Director of the School of Biological and Physical Sciences will work to reduce class sizes in these introductory-

level courses and encourage faculty to employ active learning strategies in their classrooms to improve students' confidence in their understanding of the basic principles and significance of atomic bonding.

SLO 3. Students will define different properties of solution chemistry.

Course Map: CHEM1030 – General Chemistry I and CHEM1040 – General Chemistry II. All majors are required to complete CHEM1030 and CHEM1040.

Measure 3.1. (Direct – knowledge)

Throughout the courses, students will learn about solution chemistry. Each student is required to pass a quiz covering these concepts. The target is to have 70% of students attain a quiz grade of ≥70%.

Findings: Target not met.

Analysis: The target for Measure 3.1 is that 70% of the students would score ≥70% on a quiz covering various principles of solution chemistry. This assessment was not performed during AY2017-2018. During the AY2018-2019, 50% (2/4) of students reached the target set for this outcome showing that lower-level students at the beginning of the program are not able to define different properties of solution chemistry and cannot perform to the set target.

Decision: Based on the analysis of the AY2018-2019 results, informational delivery in our CHEM1030 course does not provide students with appropriate knowledge to meet our target of 70% of students attaining a quiz grade of ≥70%. The delivery of course material will be altered to improve student comprehension and retention. In 2019-2020, the Director of the School of Biological and Physical Sciences will work to reduce class sizes in these introductory-level courses and encourage faculty to employ active learning strategies in their classrooms to improve students' understanding of the basic principles of solution chemistry. The target of this SLO will be maintained until ≥70% of students to attain a final average quiz grade of ≥70%. With an increase in the number of physical science majors, future results will be more meaningful.

Measure 3.2. (Indirect – survey)

At the end of the courses, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts of solution chemistry 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: The target for Measure 3.2 is that 75% of the students would report an above-average or excellent knowledge of basic properties of solution chemistry. In

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AY2017-2018, the assessment of this measure was not performed. During the AY2018-2019, 66.67% (2/3) of students reported that they had an above-average or excellent understanding of solution chemistry. This performance is below (-8.33%) our goal of 75% of students reporting above-average or excellent understanding of the basic principles of solution chemistry.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course does not provide students with appropriate knowledge to meet our target of 75% of students reported an above average or excellent understanding of solution chemistry. We will work to improve informational delivery in our CHEM1030 course. In 2019-2020, the Director of the School of Biological and Physical Sciences will work to reduce class sizes in these introductory-level courses and encourage faculty to employ active learning strategies in their classrooms to improve students' confidence in their understanding of solution chemistry.

SLO 4. Students will use numerical data to perform chemical calculations.

Course Map: CHEM1030 – General Chemistry I and CHEM1040 – General Chemistry II. All majors are required to complete CHEM1030 and CHEM1040.

Measure 4.1. (Direct – knowledge)

Throughout the courses, students will learn about chemical calculations. Each student is required to pass quizzes covering these concepts. The target is to have 70% of students attain a quiz grade of ≥70%.

Findings: Target met.

Analysis: The target for Measure 4.1 is that 70% of the students would score ≥70% on a quiz covering various chemical calculations. This assessment was not performed during AY2017-2018. During the AY2018-2019, 75% (3/4) of students reached the target set for this outcome showing that lower-level students at the beginning of the program can perform standard chemical calculations and can perform to and exceed (+5%) the set target.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 70% of students attaining a quiz grade of ≥70%. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student usage of numeric data to perform chemical calculations.

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Measure 4.2. (Indirect – survey)

At the end of the courses, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts of chemical calculations 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 met.

Analysis: The target for Measure 4.2 is that 75% of the students would report an above average or excellent knowledge of basic properties of chemical calculations. In AY2017-2018, the assessment of this measure was not performed. During the AY2018-2019, 100% (3/3) of students reported that they had an above-average or excellent understanding of chemical calculations.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 75% of students reporting an above average or excellent understanding of the usage of numeric data to perform chemical calculations. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of using numeric data to perform chemical calculations.

SLO 5. Students will apply critical thinking in the analysis of the periodic table elemental trends.

Course Map: CHEM1030 – General Chemistry I and CHEM1040 – General Chemistry II. All majors are required to complete CHEM1030 and CHEM1040.

Measure 5.1. (Direct – knowledge)

Throughout the courses, students will learn about the periodic table and how the different groupings are used to name chemical compounds. Each student is required to pass quizzes covering these concepts. The target is to have 70% of students attain a quiz grade of ≥70%.

Findings: Target met.

Analysis: The target for Measure 5.1 is that 70% of the students would score ≥70% on a quiz assessing students' ability to apply critical thinking in the analysis of periodic table elemental trends. This assessment was not performed during AY2017-2018. During the AY2018-2019, 75% (3/4) of students reached the target set for this outcome showing that lower-level students at the beginning of the program understand the chemical trends of the periodic table and how to apply that knowledge and can perform to and exceed (+5%) the set target.

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Decision: Based on the analysis of the AY2018-2019 results, informational delivery in our CHEM1030 course provides students with appropriate knowledge to meet our target of 70% of students attaining a quiz grade of ≥70%. However, this finding is likely an artifact of the small student population of Physical Science majors in CHEM1030 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student knowledge of the periodic table and how the different groupings are used to name chemical compounds.

Measure 5.2. (Indirect – survey)

At the end of the courses, a survey is administered to students to gauge their appraisal of their understanding of the basic concepts the periodic table and how the different groupings are used to name chemical compounds 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: The target for Measure 5.2 is that 75% of the students would report an above-average or excellent knowledge of periodic table elemental trends. In AY2017-2018, the assessment of this measure was not performed. During the AY2018-2019, 66.67% (2/3) of students reported that they had an above-average or excellent understanding of the trends of elemental properties in the periodic table. This performance is below (-8.33%) our goal of 75% of students reporting above-average or excellent understanding of periodic table elemental trends.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our CHEM1030 course does not provide students with appropriate knowledge to meet our target of 75% of students reported an above average or excellent understanding of periodic table elemental trends. We will work to improve informational delivery in our CHEM1030 course. In 2019-2020, the Director of the School of Biological and Physical Sciences will work to reduce class sizes in these introductory-level courses and encourage faculty to employ active learning strategies in their classrooms to improve students' confidence in their understanding of periodic table elemental properties.

Comprehensive summary of key evidence of improvements based on analysis of results. Although the program assessment was not performed in AY2017-2018, several initiatives were implemented to improve student performance. Specifically, the Director encouraged faculty to use more active learning exercises/approaches to informational delivery. Such techniques can improve student comprehension and application of knowledge. Additionally, the Director worked to reduce class size to create an environment more conducive for flipped classroom/active learning. Finally, supplemental instruction and weekly faculty- and student-led study groups were formed.

Plan of action moving forward. In some areas, for example knowledge of atomic structure and the use of numeric data in chemical calculations, student performance is

exceeded our target. However, these findings may be an artifact of the small student population of Physical Science majors during the AY2018-2019. If these results remain consistent through AY2019-2020, the target of the assessments with met targets will be modified to increase the challenge to student skills, specifically their understanding of atomic structure and performance of chemical calculations. In those areas in which our assessment targets were not met, newly implemented strategies will drive student improvement and performance.

To further improve student performance, faculty will use upper-level undergraduate science majors as teaching assistants (TA) in CHEM1030 sections. These TAs will attend each class meeting and assist the instructors with the implementation of active learning strategies. This strategy has been successful in a chemistry course taught to nursing/allied health majors so we believe that it can be used to engage physical science majors as well.