Assessment Cycle 2022-2023

Program: Bachelor of Science (BS) in Applied Microbiology (619)

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.

Applied Microbiology Program Mission Statement. The mission of the Northwestern State University Applied Microbiology program is to provide a comprehensive education in microbiology for all of our majors to give them an understanding of the current state of technology to address problems in both environmental and/or medical microbiology.

Purpose (optional): The primary goal of the Applied Microbiology 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 Applied Microbiology 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 AC 2017-2018 was the first full academic in which students could declare a major in Applied Microbiology. Therefore, the data collection for this program is limited as less than twenty majors are enrolled.

SLO 1. Students will demonstrate their knowledge of the scientific method.

Course Map: Tied to the course syllabus objectives

BIOL 2060: Microbiology I. All majors are required to complete BIOL 2060.

Measure 1.1. (Direct – knowledge)

Throughout the BIOL 2060 course, students will learn the essential parts/steps of the scientific method and how to apply that knowledge to scientific problems/questions. Each student is required to pass a quiz covering these concepts. The target is to have 100% of students attain a quiz grade of ≥70%.

Findings: Target not met.

Analysis: In AC 2021-2022, the target was met. One hundred percent (100% or 6/6) of students completed the scientific method assessment with a score of ≥70%. The Director met with the faculty and discussed the creation of additional resources for this topic and expanded the amount of time spent on these topics.

In AC 2022-2023, the target was not met with 71% (5/7) of students completing the scientific method assessment with a score of ≥70. This was 29% below the target goal of 100% and the results from last cycle. The coordinator created additional resources to reinforce these topics, and the Director met with faculty to again discuss how to emphasize this topic using the new resources. One student failed to take the quiz. Students were unable to apply the scientific method when questions were posed to them. Understanding the purpose of hypotheses and controls was not well understood.

Decision: Based on the analysis of AC 2022-2023, the faculty will implement the following changes in AC 2023-2024 to drive the cycle of improvement. Prior to the start of the next cycle, the Department Head will meet with faculty to discuss what worked in 2022-2023 cycle and how to incorporate that into the next academic cycle. The Department Head will ensure that the additional materials generated last year are being used and that due dates for this assessment are clear and easily accessible to students. The faculty will spend extra time focusing on hypotheses and controls to ensure that students understand these concepts.

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 parts and application of the scientific method. The target is to have 70% of the students report an above average or excellent knowledge of the indicated concepts.

Findings: Target not met.

Analysis: In AC 2021-2022, the target was met with 100% (6/6) of students completing the assessment indicating they had above average or excellent knowledge of the scientific method. This performance exceeds (+30%) the goal of 70% of the students reporting above average or excellent knowledge of the indicated concepts. Students felt confident that they could use the scientific method which was confirmed in measure 1.1.

In AC 2022-2023, the target was not met. The percentage of students that indicated that they had excellent or above knowledge of the scientific method was 25%. This is 45% below the target goal of 70% and 75% below the student's score in AC 2021-2022. This indicates that the students are not confident of their ability to apply the scientific method which is corroborated by the target not being met in measure 1.1.

Decision: Based on the analysis of AC 2022-2023, the faculty will implement the following changes in AC 2023-2024 to drive the cycle of improvement. The Department Head will meet with faculty to discuss placing qualifying statements on the survey to

describe each level of learning. This will give students more guidelines to understand what above knowledge or excellent understanding of the scientific method is. The lecture material for scientific method will be enhanced and more time will be spent to emphasize hypotheses and controls.

SLO 2. Students will demonstrate their knowledge of experimental design.

Course Map: Tied to the course syllabus objectives

BIOL 2090: Microbiology II. All majors are required to complete BIOL 2090.

Measure 2.1. (Direct – knowledge): Throughout the BIOL 2090 course, students will learn how to develop a hypothesis, identify experimental variables, and explain what types of experimental controls should be used to test the hypothesis from a dataset specific for microbiology. Each student is required to pass a quiz covering these concepts in experimental design. The target is to have 100% of students attain a quiz grade of ≥70%.

Findings: Target not met.

Analysis: The target was not met in AC 2021-2022, with 86% (6/7) of Applied Microbiology majors earning ≥70% on the assessment. One student struggled with identifying experimental variables and controls.

In AC 2022-2023, the target was not met with 82% (9/11) of Applied Microbiology majors earning ≥70% on the assessment. This is a decrease of -4% from AC 2021-2022 and is -18% below the target goal. Similar to the prior AC, two students were unable to demonstrate an understanding of experimental variables and controls.

Decision: Based on the analysis of AC 2022-2023, the faculty will implement in AC 2023-2024 the following changes to drive the cycle of improvement. The Department Head will meet with the faculty to discuss how to improve focus and description of experimental variables and controls. This may include the generation of new material to enhance understanding of this topic.

Measure 2.2. (Direct – knowledge)

As part of the final examination for BIOL 2090, students must answer two constructive response questions assessing their understanding of experimental design. The target is to have 100% of the students earn at least 50% of the points on each of those questions.

Findings: Target not met.

Analysis: In AC 2021-2022, the target was not met with 71% (5/7) of the Applied Microbiology students earning at least 50% of the points on each of those questions.

Students were not able to properly identify the experimental controls and variables within the provided experimental design.

In AC 2022-2023, the target was not met with 82% (9/11) of Applied Microbiology majors earning ≥50% on the assessment. This is an increase of +11% from AC 2021-2022 but still 14% below our target goal of 100%. One student struggled with experimental design and the other missed several assignments due to absences.

Decision: In AC 2022-2023, the target was not met. Based on the analysis of 2022-2023, the faculty will implement the following in AC 2023-2024 to drive the cycle of improvement. The Department Head will meet with the faculty prior to AC 2023-2024 and discuss how to improve lecture materials for experimental design and include the addition of external resources.

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

Course Map: Tied to the course syllabus objectives

BIOL 4995: Scientific Communication. All microbiology majors are required to complete this course. This new SLO was created and is mapped to a new upper-level course.

Measure 3.1. (Direct – ability): Throughout all sections of Scientific Communication courses, students will learn about the various aspects of communication in the sciences. Each student will write a scientific article that will be assessed using a standard rubric. The target is to have 70% of students attain a final average quiz grade of ≥70%.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (2/2) of Applied Microbiology students meeting the goal for presentation requirements on the grading rubric. The Director met with the faculty to ensure that rubrics were provided to students to ensure that they understand expectations.

In AC 2022-2023, the target was met with 100% (4/4) of Applied Microbiology students meeting the goal for presentation requirements on the grading rubric. This exceeded (+30%) the targeted goal of 70%. Furthermore, it demonstrates that Applied Microbiology majors can effectively communicate science by writing a scientific article.

Decision: The target goal was met for the second consecutive year. Based on the analysis of AC 2022-2023, the faculty will implement the following in AC 2023-2024 to drive the cycle of improvement. The Department Head will meet with faculty prior to the start of AC 2023-2024, to ensure that all faculty have consistent rubrics that are being provided to Applied Microbiology majors and that enough time is spent in class on this topic.

Measure 3.2. (Direct – ability): Throughout all sections of Scientific Communication courses, students will learn about the various aspects of communication in the sciences.

Each student will give a non-traditional communication of a scientific article/project developed by the student; the communication will be assessed using a standard rubric. The target is to have 70% of students attain a final grade of ≥70% on the assessment.

Findings: Target met.

Analysis: The target was met in AC 2021–2022, with 100% (2/2) of Applied Microbiology majors scoring ≥70% on the assessment. The Director met with the faculty to ensure that rubrics were provided and that due dates were clearly established by the faculty and easily identified by students.

In AC 2022–2023, the target was met with 100% (4/4) of Applied Microbiology majors scoring ≥70% on the assessment. This exceeds (+30%) the target goal of 70% demonstrating that Applied Microbiology students graduating from NSU can effectively communicate science in a non-traditional manner such as a podcast, infographic for social media (*i.e.*, Instagram, *etc*.), or some other manner (*i.e.*, blog) that targets the general public.

Decision: For the second year in a row, the target goal was met. Based on the analysis of 2022-2023, the faculty will implement in AC 2023-2024 the following to drive the cycle of improvement. The Department Head will ensure that rubrics are being provided and that sufficient time is spent in the classroom on this topic.

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

Course Map: Tied to the course syllabus objectives

BIOL 4990: Capstone Course for Microbiology or BIOL 4970, CHEM 4910, or PHYS 4930. All majors are required to complete BIO L4990, 4970, CHEM 4910, or PHYS 4930.

Measure 4.1. (Direct – skill): Throughout all sections of Capstone Courses, students will read the same scientific article from the primary literature and be required to pass quizzes over the material. The target is to have 70% of students attain a final average quiz grade of ≥90%.

Findings: Target met.

Analysis: In AC 2021–2022, the target was met with 80% (4/5) of the Applied Microbiology majors earning a 70% or better on the grading rubric for the project. The student who did not reach the goal was unable to answer questions about the statistical measures used to evaluate the data in the scientific article that was provided. This was the first year that this measure was assessed.

In AC 2022–2023, the target was met with 100% (4/4) of the Applied Microbiology majors earning a 70% or better on the grading rubric for the project. This exceeded the target goal by +30% and was an increase of +20% from AC 2021-2022. Thus, students can

effectively analyze scientific literature and provide meaningful answers to questions based on the literature. The Director encouraged faculty to increase time spent on statistical measurements to analyze scientific data since a student struggled the previous cycle.

Decision: In AC 2022–2023, the target goal was met. Based on the AC 2022-2023 results, the faculty will implement the following in AC 2023-2024 to drive the cycle of improvement. Faculty will dedicate time in class to focus on analyzing scientific data since this is a challenging topic.

Measure 4.2. (Direct - ability)

Throughout all sections of Capstone Courses, students will write a proposal about their capstone project. The target is to have 70% of students attain a grade of ≥90% on the written assignment based on a standard rubric.

Findings: Target met.

Analysis: In AC 2021–2022, the target was met with 100% (5/5) of Applied Microbiology majors scoring ≥90% on the assessment. The Director ensured that a standard rubric was being used among all sections of this course.

In AC 2022–2023, the target was met with 100% (4/4) of Applied Microbiology majors scoring ≥90% on the assessment. This exceeds (+10%) the target goal of 90%. These results suggest that students were capable of designing their own project relating to Applied Microbiology and able to create a proposal to support this idea.

Decision: In AC 2022-2023, the goal was met for the second consecutive year. Based on the results of AC 2022-2023, the faculty will implement in AC 2023-2024 the following to drive the cycle of improvement. Standard rubrics will be provided to students to set clear expectations and these rubrics will be consistent across all sections of Capstone Courses.

SLO 5: Students will demonstrate professional development.

Course Map: Tied to the course syllabus objectives

BIOL 4990: Capstone Course for Microbiology or BIOL 4970, CHEM 4910, or PHYS 4930. All majors are required to complete BIOL4990, 4970, CHEM 4910, or PHYS 4930.

Measure 5.1. (Direct – skill): Students will be required to give a public presentation of the results of their Capstone project graded by a standard rubric across all sections of Capstone classes. The target is to have 100% of students give a presentation that meets ≥70% of the prescribed guidelines.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (5/5) students scoring ≥70% on the final presentation. The Director met with the faculty to ensure that standard rubrics were provided to students.

In AC 2022-2023, the target was met with 100% (7/7) students scoring ≥70% on the final presentation matching the targeted goal and the results in AC 2021-2022. Based on these results, all students are able to effectively communicate their Capstone project findings in a setting open to the public.

Decision: The target was met for the second consecutive year. Based on the results of AC 2022-2023, the faculty will implement in AC 2023-2024 the following to drive the cycle of improvement. The Department Head will meet with faculty to discuss best practices to enhance student preparation and success on the public presentations. The faculty will provide rubrics that are standard among all sections and provide a schedule with a date for these presentations.

Measure 5.2. (Direct – skill): At the end of the course, students will find a current entry-level job in a field of microbiology related to their Capstone project. This will allow them to relate their project with the current state of the workforce and needs of society. The target is to have 100% of the students meet the requirements of the grading rubric.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (5/5) students reaching the targeted goal. Meeting this target demonstrates that the Applied Microbiology students can relate their capstone projects to the current state of the workforce and needs of society.

As a result of these findings, the Director and faculty met prior to the start of AC 2022-2023, to discuss ways to challenge students to understand how their microbiology project can meet the demands of the workforce and society. As a result of this implementation in AC 2022-2023, the target was met with 100% (7/7) meeting this grade requirement. This demonstrates that students were able to relate their project to the workforce and needs of society.

Decision: In AC 2022-2023 the target was met for the second consecutive year. Based on the results of AC 2022-2023, the faculty will implement in AC 2023-2024 the following to drive the cycle of improvement. Faculty will ensure that they are using standard rubrics which includes relating their project to workforce development. The Department Head will meet with faculty to discuss best practices for students to find this information based on a variety of projects.

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.

- Prior to the start of the AC 2022-2023, the Director met with the faculty and encouraged faculty to spend more instructional time on the concepts.

- The Director ensured that all faculty were providing the scientific method quiz for SLO 1.1 around the same time and reporting the outcome by week 5 of the semester.

- The Director met with faculty to discuss additional material that could be provided to reinforce concepts discussed in class.

- Faculty met with faculty to elucidate why students were not able to properly identify experimental controls and variables and came up with ideas to promote these concepts including a PowerPoint file on the topic created by the Coordinator.

- Prior to the start of the AC 2022-2023, the Director met with faculty to ensure that rubrics were being provided and followed to ensure that proper expectations were set for students and that faculty were assessing students consistently to meet requirements for SLO 3, 4, & 5.

- The use of statistics and teaching this to Capstone students was emphasized by the Director as well prior the start of AC 2022-2023.

Plan of action moving forward:

- The Department Head will meet with faculty to discuss emphasizing assessment topics in class and producing additional materials for these topics.

- Qualifying statements will be created for the surveys in measure 1.2 and 2.2.

- The Department Head will ensure that all classes in SLO 3, 4, & 5 are using a standard rubric across all sections to assess students.

- The faculty will spend more effort and time on the topic of analysis of scientific data in measure 4.1.

- The faculty will meet to discuss best practices for presentations of student capstone projects to ensure that students are as successful as possible.

- The Department Head will meet with faculty for measure 5.2 and ensure that they all faculty aware that students need to relate capstone projects to workforce development and that this should be part of a standard rubric.