

Assessment Cycle 2021-2022

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

College: Arts and Sciences

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Date: 06/01/2022

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Date: 06/22/2022

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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Applied Microbiology Program Mission Statement. The mission of Northwestern State University's 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 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 earn a quiz grade of $\geq 70\%$.

Findings: Target met.

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Analysis: In AC 2020-2021 the target was met. Based on the analysis of this assessment cycle, the faculty implemented a pre-scientific method quiz to be provided prior to the assessment. A presentation covering just the Scientific Method was created by the Coordinator to aid students in study of important topics. As a result of these changes, in AC 2021-2022, the target was met. One hundred percent (6/6) of students completed the scientific method assessment with a score of $\geq 70\%$. The performance of these students met the goal of 100% of students earning $\geq 70\%$ on this assessment. The students in the BIOL 2060 course do have the appropriate knowledge to understand and apply the scientific method to scientific questions.

Decision: Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The faculty will improve informational delivery in the BIOL 2060 course by emphasizing the parts of the scientific method in class prior to assessment. The Director will ensure that the pre-scientific method quiz is provided uniformly among all sections and then assessed and discussed prior to the SLO assessment.

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 met.

Analysis: In AC 2020-2021 the target was met. Based on the analysis of this assessment cycle, the faculty met with the Director to implement sufficient coverage in class on the various parts of the scientific method. As a result of these changes in AC 2021-2022, 100% (6/6) of students completed the assessment indicating they had above average or excellent knowledge of the scientific method. This performance exceeds (+30.00%) the goal of 70% of the students reporting above average or excellent knowledge of the indicated concepts.

Decision: Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The Director of the School of Biological and Physical Sciences will meet with the instructors of this course to make sure there is sufficient coverage of the parts of the scientific method. For the 3rd consecutive year, we have met the target and prior to the start of AC 2022-2023, the Director will discuss increasing the target goal with the faculty.

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

Course Map: Tied to the course syllabus objectives

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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 earn a quiz grade of $\geq 70\%$.

Findings: Target not met.

Analysis: The target was not met in AC 2020-2021. Based on the analysis of this assessment cycle, the Director met with the instructor of BIOL 2090 to ensure sufficient coverage of experimental design and related topics prior to the completion of the assessment. As a result of these changes in AC 2021 - 2022, 86% (6/7) of Applied Microbiology majors earned $\geq 70\%$ on the assessment which was 3% higher than in AC 2020-2021. One student still struggled with experimental variables and controls. This performance is below (-14%) the goal of 100% of students earning the target of $\geq 70\%$ on this assessment meaning that all students were not able to demonstrate appropriate knowledge of experimental design.

Decision: Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The Director of the School of Biological and Physical Sciences will meet with the instructor of the BIOL 2090 course to discuss the timing of this assessment and to ensure there is sufficient coverage of experimental variables and controls and related topics to promote discussion prior to the completion of the assessment.

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: The target was not met for the AC 2020-2021 because students were not confident in their understanding of experimental design which was reflected in the target not being met in measure 2.1 that year. Based on the analysis of this academic cycle, the Director met with the instructor of BIOL 2090 to ensure sufficient coverage of experimental design and related topics. As a result of these changes in AC 2021-2022, 71% (5/7) of the Applied Microbiology students earned at least 50% of the points on each of those questions. This performance is 12% below the score in AC 2020-2021 and is 29% below the goal of 100%. Students were not able to properly identify the experimental controls and variables within the provided experimental design.

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Decision: Based on the 2021-2022 results, in AC 2022-2023, the microbiology faculty will meet with the Director prior to the start of Fall 2022 to discuss the informational delivery on experimental controls and variables and discuss how to effectively emphasize these topics throughout the year and to provide additional resources on Moodle.

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 new SLO was created and 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 and will be assessed using a standard rubric. The target is to have 70% of students attain a final average grade of $\geq 70\%$.

Findings: Target met.

Analysis: In AC 2021-2022, 100% (2/2) of Applied Microbiology students met the goal for writing requirements on the grading rubric. This exceeded the targeted goal of 70% by +30% and means that microbiology majors can effectively communicate science by writing a scientific article. This was the first year that this was assessed.

Decision: In AC 2021-2022, the target was met. Based on the analysis of AC 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The faculty will provide rubrics to the students and adjust content delivery as needed and will meet with the Director to ensure that the appropriate amount of time is delivered 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 average grade of $\geq 70\%$.

Findings: Target met.

Analysis: The target was met in AC 2021– 2022, with 100% (2/2) of Applied Microbiology majors scoring $\geq 70\%$ on the assessment. This means that students can effectively communicate in a non-traditional manner such as a podcast, infographic for social media (*i.e.*, Instagram, *etc.*), or some other manner that targets the general public. This was the first year that this outcome was assessed.

Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement.

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The faculty will provide rubrics to the students and adjust content delivery as needed and will meet with the Director to ensure that the appropriate amount of time is delivered 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, or CHEM 4910, or PHYS 4930.

Measure 4.1. (Direct – skill): Throughout all sections of capstone courses, students will read the 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 met.

Analysis: In AC 2021 – 2022, 80% (4/5) of the Applied Microbiology majors earned a 70% or better on the grading rubric for the project. This is +10% above the target goal of 70% and means that students can effectively analyze scientific literature. The student who did not reach the goal was unable to answer questions about the statistical measure used to evaluate the data in the scientific article that was provided. This was the first year that this was assessed.

Decision: In AC 2021-2022, the target was met. Based on the AC 2021-2022 results, In AC 2022-2023, the faculty will emphasize statistical measurement earlier in the course particularly during the creation of a student research proposal (SLO 4.2), which occurs prior to this measure (SLO 4.1). The Director will meet with the instructor of Biology 4990 to ensure that the appropriate amount of time is used to discuss the importance of statistical measurements to analyze scientific data.

Measure 4.2. (Direct - ability)

Throughout all sections of capstone courses, students are required to write a proposal about their capstone project. The target is to have 70% of students earn a final average written assignment grade of $\geq 90\%$ 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 $\geq 90\%$ on the assessment. These results suggest that students can design their own project relating to Applied Microbiology and create a proposal to support their idea. This was the first year that this was assessed.

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Decision: In AC 2021-2022, the target was met. Based on the results of AC 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The faculty will provide rubrics to the students and adjust content delivery as needed. Prior to the AC 2022-2023, the Director will meet with the faculty to make sure that enough of the classroom time is focused on content delivery of this topic.

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, or CHEM 4910, or PHYS 4930.

Measure 5.1. (Direct – skill): Students are required to give a final presentation graded by 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% (5/5) students scoring $\geq 70\%$ on the final presentation. This was the first time that this was assessed.

Decision: In AC 2021–2022, the target was met. Based on the analysis of AC 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The Director will meet with the faculty prior to the start of AC 2022-2023, to ensure that the appropriate amount of time is spent on the necessary topics and that rubrics are provided to students prior to the assessment.

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 experiment. This will allow them to relate their “research” 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 was met.

Analysis: In AC 2021-2022, the target was met with 100% (5/5) students scoring $\geq 70\%$ on the final presentation. This was the first time that this was assessed. Meeting this target suggests that the Applied Microbiology students can relate their capstone projects to the current state of the workforce and needs of society.

Decision: In AC 2021-2022, the target was met. Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The Director and faculty will meet to discuss how to challenge students

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to understand how their microbiology project can meet the demands of the workforce and society.

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.

- Encouraged faculty to spend more instructional time on the concepts.
- The Director met with the instructors prior to the Fall and Spring semesters and discussed delivery of the content and the timing of the assessment.
- The Director and new Coordinator of Applied Microbiology along with the instructors created SLO 3, SLO 4, and SLO 5 to assess the new QEP curriculum. All targets of these new SLOs were met.
- BIOL 4995 (Scientific Communication) was offered in Spring 2022 for the first time as part of the new QEP curriculum and was mapped onto SLO 3.

Plan of action moving forward:

- Prior to the start of AC 2021-2022, the Director will meet with all Applied Microbiology faculty and the Applied Microbiology Coordinator to discuss the delivery of the content and the timing of the assessment processes, goals, and requirements for all SLOs.
- The Coordinator of Applied Microbiology has created a pre-scientific method quiz that will be delivered prior to the assessment of SLO 1.1.
- Prior to the start of AC 2022-2023, the Director and Coordinator will meet with faculty to discuss the delivery of experimental variable and controls as part of the experimental design in SLO 2.
- Faculty will provide rubrics for the design of a scientific paper and a non-traditional paper intended for the general public to effectively inform students of the criteria for the creation of successful papers in SLO 3.
- Enhanced time will be provided to discuss how statistical measurements are used to evaluate scientific data set in SLO 4.

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- The Director and Coordinator will discuss with instructors the use of descriptors to define the ranks that students choose on the survey to report their knowledge on topics in SLO 1.2.
- The Director will meet with faculty to discuss increasing target goals to further challenge the students' performance on SLO 1.2.