

Assessment Cycle 2023-2024

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

Department of Biology and Microbiology

School of Science, Technology, Engineering, & Math

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 Science, Technology, Engineering and Math. The School of Science, Technology, Engineering and Math (STEM) at Northwestern State University serves to create a collaborative environment for natural and applied science education that inspires students and faculty to engage in an interdisciplinary approach to developing strong analytical skills in interpersonal communication, critical thinking, research, and data literacy as they become lifelong learners who are prepared for an ever-changing, global STEM community.

Department of Biology and Microbiology Mission Statement. The mission of the Northwestern State University Biology and Microbiology Department is to provide a comprehensive education in biology and microbiology for all of our majors and to create

Assessment Cycle 2023-2024

a unique training environment for students wishing to pursue graduate or professional education.

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 Department Head of Biology and Microbiology as well as the faculty of the Department, 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 $\geq 70\%$.

Findings: Target not met.

Assessment Cycle 2023-2024

Analysis: In AC 2022-2023, the target was not met, with 71% (5/7) of students completing the scientific method assessment with a score of $\geq 70\%$. This was 29% below the target goal of 100%, as were the results from the last cycle. Based on the AC 2022-2023 results analysis, the faculty implemented the following changes in AC 2023-2024. The program coordinator developed additional resources to reinforce these topics, and the Department Head met with faculty to discuss how to emphasize these topics and use the new resources. Despite these efforts, 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.

As a result of these changes in AC 2023-2024, the target was not met. One of three students, or 33%, scored $\geq 70\%$ on the scientific method assessment. After covering the pertinent information on this topic, a practice quiz was provided to students and reviewed in class by faculty. For the two students who did not meet the target, one student did not show up to take the assessment and the other student struggled with conveying their understanding of the concept and application of the scientific method.

Decision: In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following changes to drive the cycle of improvement. The Department Head will meet with faculty to discuss developing additional lecture materials such as a PowerPoint presentation independent of the current textbook material being used. The timing of the lecture material on the scientific method, the practice quiz, and the assessment will be discussed to enhance student success.

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 2022-2023, the percentage of students who indicated that they had excellent or above-average knowledge of the scientific method was 25%. Based on the AC 2022-2023 results analysis, the faculty implemented the following changes in AC 2023-2024. The Department Head met with faculty to discuss the qualifying statements that were added to the survey to describe each level of learning/understanding. This provided students with more guidelines to understand what excellent or above-average knowledge of the scientific method is.

As a result of the changes in AC 2022-2023, the target was not met for AC 2023-2024, with 33% (1/3) of students indicating greater than an average understanding of the scientific method. This was an 8% increase in AC 2023-2024 in comparison to the prior AC. Students struggled with this content as indicated in measure 1.1 where the target was not met. The faculty spent extra time describing controls in experiments, but

Assessment Cycle 2023-2024

confusion still remained as students had difficulty teasing apart control groups and control variables.

Decision: In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following changes to drive the cycle of improvement. The Department Head will meet with the faculty to review the qualifying statements on the survey that describe each level of learning. The faculty will also discuss how to more effectively cover challenging topics such as controls and variables, including the sharing of class materials.

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 to 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 $\geq 70\%$.

Findings: Target not met.

Analysis: In AC 2022-2023, 82% (9/11) of Applied Microbiology majors earned $\geq 70\%$ on the assessment. Two students had difficulty comprehending experimental variables and controls. Based on the AC 2022-2023 results analysis, the faculty implemented the following changes in AC 2023-2024. The Department Head met with faculty to discuss this topic and encouraged the use of additional time covering this before the start of AC 2023-2024. The faculty spent additional time on experimental variables and controls in classroom discussions; however, the students still struggled to understand the topic.

As a result of the changes, in AC 2023-2024, the target was not met for AC 2023-2024, with 0% (0/3) of the students reaching the target of earning a quiz grade of $\geq 70\%$. This is a significant drop-off, although only three microbiology majors were in BIOL2090 this cycle.

Decision: In AC 2023-2024, the target was not met. Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following changes to drive the cycle of improvement. The Department Head will meet with the course instructors to review the material being presented to the class. They will discuss things such as crafting simple examples to illustrate how to utilize experimental design to create and test a hypothesis. Incorporating more common question that they would naturally encounter in day-to-day

Assessment Cycle 2023-2024

life will hopefully enhance student understanding of the components of experimental design.

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 2022-2023, 82% (9/11) of Applied Microbiology majors earned $\geq 50\%$ on the assessment. One student struggled with experimental design, and the other student missed several assignments due to absences. Based on the results analysis of AC 2022-2023, the faculty implemented the following changes in AC 2023-2024. The faculty generated additional materials to explain and test the students' knowledge of experimental design. The Department Head met with the faculty prior to the start of AC 2023-2024 to discuss how to improve lecture material covering experimental design and to generate additional resources to practice engaging this material in a constructive manner.

As a result of the changes in AC 2022-2023, the target was not met in AC 2023-2024, with 33% (1/3) students earning at least 50% of the points on the constructive response questions assessing content knowledge of experimental design. For the third year, this target has not been met and resulted in a decrease (-49%) from AC 2022-2023.

Decision: Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. The Department Head will meet with the faculty prior to the start of AC 2024-2025 to discuss why students continue to fall short on the target for this assessment. We will discuss the timing of the assessment and ways to allow students to make-up missed assessments.

Commented [MH1]: What did the faculty do in this current AC to improve the quality of the class/learning?
What did the student do or not do well in?

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 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 assessment grade of $\geq 70\%$.

Findings: Target met.

Assessment Cycle 2023-2024

Analysis: In AC 2022-2023, 100% (4/4) of Applied Microbiology majors met the goal for the communication requirements on the grading rubric. This demonstrated that microbiology majors could effectively communicate science by writing a scientific article. Faculty met with the Department Head and discussed what worked in this class. Based on the results analysis of AC 2022-2023, the faculty implemented the following changes in AC 2023-2024. The Department Head met with faculty prior to the start of AC 2023-2024 to ensure that consistent rubrics were being used and provided to Applied Microbiology majors and that enough time was spent in class on this topic.

As a result of the changes in AC 2022-2023, the target was met for AC 2023-2024, with an outstanding 100% (2/2) students attaining an assignment score of $\geq 70\%$ on their scientific communication assessment demonstrating that microbiology majors at Northwestern State are excelling at communicating scientific findings to peers in the greater scientific community.

Decision: In AC 2023-2024, the target was met. Based on the analysis of AC 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. The Department Head will meet with faculty prior to the start of AC 2024-2025 to reinforce the focus of materials on scientific writing and to promote resource sharing with the new instructor who will be teaching this class. This will help drive the standard of excellence being promoted in the classroom.

Measure 3.2. (Direct – ability): Throughout all sections of Scientific Communication course, students learn about the various aspects of communication in the sciences. Each student will provide 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 assessment score of $\geq 70\%$.

Findings: Target met.

Analysis: The target was met in AC 2022–2023, with 100% (4/4) of Applied Microbiology majors scoring $\geq 70\%$ on the assessment. Based on the AC 2022-2023 analysis results, the faculty implemented the following changes in AC 2023-2024. The faculty who taught this course ensured that the appropriate rubrics were provided to all instructors, and the instructors spent additional class time covering the requirements for this project. The Department Head met with the faculty to discuss different ideas for the types of non-traditional communications that could be utilized and what a minimum standard would be.

As a result of the changes in AC 2022-2023, the target was met in AC 2023-2024 with 100% (2/2) of students meeting the target, exceeding the goal by +30%. Students generated a diverse array of non-traditional communications, demonstrating their ability to effectively communicate scientific ideas in a manner that could be readily consumed by the general public.

Commented [MH2]: What did the faculty do to improve the results for AC 2023-2024 in this class?

Assessment Cycle 2023-2024

Decision: In AC 2023-2024, the target was met. Based on the analysis of 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. The Department Head will meet with the faculty to discuss generating an approved list of the various types of non-traditional communications that students can create. This will further provide easy to follow guidelines for students. Guidelines will be provided to allow new communication ideas not previously considered and allow students the opportunity to express their creativity fully while communicating scientific ideas to the public.

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 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 $\geq 90\%$.

Findings: Target met.

Analysis: In AC 2022–2023, the target was met, with 100% (4/4) of the Applied Microbiology majors earning 70% or better as a final quiz average. Thus, students could effectively analyze scientific literature, and the students provided meaningful answers to questions based on that literature. Based on the AC 2022-2023 analysis results, the faculty implemented the following changes in AC 2023-2024. The Department Head encouraged faculty to increase the time spent on statistical measurements to analyze scientific data since a student struggled the previous cycle. The Department Head ensured that rubrics were being provided and that sufficient time was spent in the classroom on this topic.

As a result of the changes in AC 2022-2023, the target was met in AC 2023-2024, with 100% (2/2) students attaining a final average quiz grade of $\geq 90\%$. This exceeded the target goal by +30%. Students demonstrated excellence in critical thinking skills as assessed by this measure.

Commented [MH3]: What did the faculty do to assist the students in reaching the target during AC 2023-2024?

Decision: In AC 2023-2024, the target was met. Based on the analysis of AC 2023-2024, in AC 2024–2025, the faculty will implement the following to drive the cycle of improvement. Faculty will set aside time in class to specifically focus on analyzing scientific data as this appears to be best practice for driving success in this measure.

Assessment Cycle 2023-2024

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 $\geq 90\%$ on the written assignment based on a standard rubric.

Findings: Target met.

Analysis: In AC 2022–2023, the target was met with 100% (4/4) of Applied Microbiology majors scoring $\geq 90\%$ on the assessment. These results suggested that students were capable of designing their own project relating to Applied Microbiology and creating a proposal to support this idea. Based on the AC 2022-2023 analysis results, the faculty implemented the following in AC 2023-2024. The Department Head met with faculty to make sure that enough of the classroom time was focused on content delivery of this topic. The faculty spent a significant amount of time in the first five weeks of the course working with students on creating an idea for a student project and designing a proposal.

As a result of the changes in AC 2022-2023, the target was met in AC 2023-2024, with 100% (2/2) of students meeting the target, which exceeded the goal by +10%.

Decision: In AC 2023-2024, the target was met. Based on the results of AC 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. The Department Head will meet with the instructors teaching this course. The faculty will share ideas and classroom resources with fellow faculty to help drive the mastery of content that these students have shown in this measure. In addition, the Department Head and instructors will discuss spending ample time on this topic in the classroom.

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

Findings: Target met.

Analysis: In AC 2022-2023, the target was met with 100% (7/7) of students scoring $\geq 70\%$ on the final presentation of their Capstone project. These students effectively

Assessment Cycle 2023-2024

communicated their Capstone project findings in a setting open to the public. Based on the AC 2022-2023 results analysis, the faculty implemented the following in AC 2023-2024. The Department Head ensured that faculty were using a standard rubric consistently among all sections and named a course steward who also helped to maintain this standard. The course steward also ensured that the rubric effectively covered all the expectations for a scientific presentation. The faculty provided an in-class presentation prior to the public presentation to help students identify any problem areas in their presentation skills.

As a result of the changes in AC 2022-2023, the target was met in AC 2023-2024, with 100% (2/2) of students meeting the target goal and demonstrating mastery of this skill.

Decision: In AC 2023-2024, the target was met. Based on the results of AC 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. The Department Head will meet with the instructors to discuss time spent on the elements of a successful Capstone presentation and to share resources with another instructor who will be new to teaching this course. The timing of in-class presentations prior to the public presentation will be discussed, and the Department Head will ask all instructors to follow this model.

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 2022-2023, the target was met with 100% (7/7) of students meeting this grade requirement. This demonstrated that students were able to relate their project to the workforce and the needs of society. Based on the AC 2022-2023 analysis results, the faculty implemented the following changes in AC 2023-2024. The Department Head and faculty met at the start of AC 2023-2024, to discuss ways to challenge students to understand how their microbiology project can meet these demands. The faculty provided information to students on how to locate jobs in the field of science.

As a result of the changes in AC 2022-2023, in AC 2023-2024, the target was met with 100% (2/2) of students meeting the target. Students were able to identify workforce needs based on their project and relayed this in the classroom.

Decision: In AC 2023-2024, the target was met. Based on the results of AC 2023-2024, in AC 2024-2025, the faculty will implement the following to drive the cycle of improvement. Prior to the start of AC 2024-2025, the Department Head will meet with faculty to evaluate rubrics for this measure and to ensure that instructors teaching this for the first time have effective resources to drive content mastery by students. Further discussion will include the best practices for finding jobs related to microbiology and that ample time is spent on this topic in the classroom.

Assessment Cycle 2023-2024

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 2024-2025. These changes are based on the knowledge gained through the analysis of AC 2023-2024 results.

- In Measure 1.1, The Department Head made additional resources to reinforce these topics, and the Department Head met with faculty to discuss again how to emphasize these topics, which used the new resources. One student failed to show up and 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.
- In Measure 1.2, The Department Head met with faculty to discuss the qualifying statements that were added to the survey to describe each level of learning. This provided students with more guidelines to understand what excellent or above-average knowledge of the scientific method is.
- In Measure 2.1, The Department Head met with faculty to discuss this topic and encouraged additional time to be spent covering this before the start of class in AC 2023-2024. The faculty spent additional time on experimental variables and controls in classroom discussions, but the students struggled to understand the topic.
- In Measure 2.2, knowledge of experimental design. The Department Head met with the faculty prior to the start of AC 2023-2024 to discuss how to improve lecture material for experimental design and to generate additional resources to practice engaging this material in a constructive manner.
- In Measure 3.1, The Department Head met 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.
- In Measure 3.2, The faculty who taught this course ensured that the appropriate rubrics were provided to all the instructors now teaching it as well, and the instructors spent additional time covering the requirements for this project. The Department Head met with the faculty to discuss different ideas for the types of non-traditional communications that could be utilized and what a minimum standard would be.
- In Measure 4.1, The Department Head encouraged faculty to increase time spent on statistical measurements to analyze scientific data since a student struggled

Assessment Cycle 2023-2024

the previous cycle. The department head ensured that rubrics were being provided and that sufficient time was spent in the classroom on this topic.

- In Measure 4.2, The Department Head met with faculty to make sure that enough of the classroom time was focused on content delivery of this topic. The faculty spent a significant amount of time in the first five weeks of the course working with students on creating an idea for a student project and designing a proposal.
- In Measure 5.1, The Department Head ensured that faculty were using a standard rubric consistently among all sections and named a course steward who also maintained this standard. The course steward also ensured that the rubric effectively covered all the expectations for a scientific presentation. The faculty provided an in-class presentation prior to the public presentation to help students identify any problem areas in their presentation skills
- In Measure 5.2, The Department Head and faculty met at the start of AC 2023-2024, to discuss ways to challenge students to understand how their microbiology project can meet these demands. The faculty provided information to students on how to locate jobs in the field of science.

Plan of action moving forward:

- The Department Head will meet with faculty to develop additional lecture material such as a PowerPoint presentation independent of the current book material being used, and the timing of lecture material on the scientific method, the practice quiz, and the assessment.
- The Department Head will meet with the faculty to review the qualifying statements on the survey that describe each level of learning and discuss how to more effectively cover challenging topics such as controls and variables, including the sharing of class materials.
- Faculty will develop materials with examples of experimental design and hypothesis development formulated around common situations that students encounter in their normal routine.
- The Department Head will meet with the faculty to discuss why students continue to miss this assessment resulting in the target not being met, and to discuss the timing of the assessment, and ways to allow students to make-up missed assessments.
- The classes are expanding to include additional faculty; therefore, the Department Head will promote resource sharing to ensure that all instructors

Assessment Cycle 2023-2024

have the materials that are driving excellence in these measures.

- A list of approved non-traditional communication types will be provided to students to offer more guidelines and express the diverse array of choices that they have.
- A focus on data analysis is important and the faculty will provide ample time on this in class.
- The Department Head and the instructors will discuss having in-class practice for student presentations in all sections of this class prior to the public presentation.
- The instructors will develop resources about best practices for doing job searches in their area.