Assessment Cycle 2024-2025

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 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

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 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:

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 2023-2024, the target was not met. One-third (1/3 or 33%) of students scored ≥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. However, for the second year, a student did not show up to take the

assessment. The other student struggled with the concept and application of the scientific method.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head developed a PowerPoint presentation covering the parts of the scientific method independent of class material. This allowed students to focus on this topic and led to the faculty spending extra time on the topic in class. As a result of the changes in AC 2023-2024, the target was not met in AC 2024-2025 when 33% (1/3) students scored ≥70% on the scientific method assessment. This was the same score as the previous AC, and is 67% below the target. The faculty met with the department head and developed additional lecture material such as a PowerPoint presentation, independent of the current book material being used, to enhance focus on this target. At this meeting, the faculty expressed concern that this target was too high to meet.

Decision: In AC 2024-2025, the target was not met. Based on the analysis of AC 2024-2025, in AC 2025-2026, the faculty will implement the following changes to drive the cycle of improvement. The department head will meet with faculty to discuss implementing a project in the lab using the scientific method to identify unknown microbes provided to the students. This active learning assignment will further drive student understanding of the scientific method. The target for this measure will be reduced to 70% of students attaining a quiz grade of ≥70%. Even at this goal, the target would not have been met in the past 2 years, as the results of both cycles reporting -37% below the target.

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: The target was not met for AC 2023-2024, with 33% (1/3) of students indicating at least an above average understanding of the scientific method. This was an +8% increase 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 on controls in experiments but confusion still remained as students had difficulty teasing apart control groups and control variables.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. In the prior AC, qualifying statements were added to help the students understand their level of knowledge in this survey (i.e,. above average knowledge of the scientific method allows students to apply this method to new ideas). During the AC, the department head met with the faculty and made changes to these statements to improve clarity. The faculty also shared resources that challenged the

students to use the scientific method. As a result of the changes in AC 2023-2024, the target was not met for AC 2024-2025 with 67% (2/3) indicating at least above average understanding of the scientific method. This result is +34% higher than in AC 2023-2024. Students felt more confident this year of their knowledge although they still struggled with their content knowledge as measured in 1.1. The faculty had students match controls to various experiments for additional practice to shore up knowledge and confidence. It was not surprising this measure was not met as students were struggling on mastering the content.

Decision: In AC 2024-2025, the target was not met. Based on the analysis of AC 2024-2025, the faculty will implement the following changes in AC 2025-2026 to drive the cycle of improvement. The department head will meet with the faculty to review the additional work that was created and use the educational framework of Transparency in Learning and Teaching (TILT) to enhance assignments on these topics to enhance comprehension of content and their appraisal of their knowledge.

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 ≥70%.

Findings: Target met.

Analysis: In AC 2023-2024, 0% (0/3) of Applied Microbiology majors earned ≥70% on the assessment. This was a significant drop-off, although only three microbiology majors were in this class during the AC. The faculty spent additional time on experimental variables and controls in classroom discussions, but the students struggled to understand the topic.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head met with the faculty and created assignments to allow students to practice creating and testing hypotheses. The focus was to find common things that students were used to engaging in, such as Netflix not playing on an iPad. As a result of the changes in AC 2023-2024, the target was met for AC 2024-2025 with 100% (7/7) of students reaching the target. This result was significantly better (+100%) than in AC 2023-2024 and exceeded the target by +30%. Assignments were crafted to provide more experience identifying variables in the class.

Assessment Cycle 2024-2025

Decision: In AC 2024-2025, the target was met. Based on the analysis of AC 2024-2025, the faculty will implement the following changes, in AC 2025-2026, to drive the cycle of improvement. The department head will meet with the course instructor to incorporate discussions of controls into assignments as done in the previous cycle with experimental variables. This will enhance focus on this content area.

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 met.

Analysis: In AC 2023-2024, 33% (1/3) of Applied Microbiology majors earned ≥50% on the assessment. 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.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. In the prior cycle, some students missed this assignment. A policy was created to allow for make-up of missed assignments. It was decided what was the best time in the semester to provide this assessment. As a result of the changes in AC 2023-2024, the target was met in AC 2024-2025, with 100% (7/7) students earning at least 50% of the points on the constructive response questions assessing content knowledge of experimental design. This target had not been met the previous 3 cycles. The department head and faculty met to discuss why students continue to miss this measure. This led to a change in timing of this assessment that allowed a more intuitive engagement of this content and to developing a consistent policy for missed assignments.

Decision: In AC 2024-2025, the target was met. Based on the analysis of AC 2024-2025, the faculty will implement the following changes, in AC 2025-2026, to drive the cycle of improvement. The department head will meet with the microbiology instructors to discuss enhancing time spent on this content in lecture and lab as well as review all assessments for improvement.

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.

Assessment Cycle 2024-2025

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 quiz grade of ≥70%.

Findings: Target met.

Analysis: In AC 2023-2024, 100% (2/2) of Applied Microbiology students met the goal for presentation requirements on the grading rubric. This demonstrated that microbiology majors could effectively communicate science by writing a scientific article. The department head met with faculty prior to the start of AC 2023-2024 to ensure that all faculty had consistent rubrics that were being provided to Applied Microbiology majors and that enough time was spent in class on this topic.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head met with faculty and resources on writing a scientific article were shared. One faculty was new and had scant resources. Now all faculty have the best resources for this. With the additional resources, faculty spent extra time on the topic as well. As a result of the changes in AC 2023-2024, the target was met for AC 2024-2025 with students showing excellence with 100% (2/2) students attaining a final average quiz grade of ≥70% on their scientific article. This was above (+30%) the target matching last year's score. The department head met with faculty prior to the start of AC 2024-2025 and reinforced the focus of materials on scientific writing and promoted resource sharing with the additional instructor who was teaching this class. Microbiology majors at Northwestern State are excelling at communicating scientific findings to peers in the greater scientific community.

Commented [MH1]: What did the faculty do to improve the results for AC 2023-2024 in this class?

Decision: In AC 2024-2025, the target was met. Based on the analysis of AC 2024-2025, the faculty will implement the following changes, in AC 2025-2026, to drive the cycle of improvement. The department head will meet with the faculty prior to the start of AC 2025-2026 to scaffold the creation of this writing assignment by having it divided into parts driven by smaller assessments. Once completed, students will merge these parts of their paper and give a final review and submission of the complete scientific article for assessment.

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 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 average grade of ≥70%.

Findings: Target met.

Analysis: The target was met in AC 2023-2024, with 100% (2/2) of Applied Microbiology majors scoring ≥70% on the assessment. 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.

Assessment Cycle 2024-2025

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The faculty created a rubric with guidelines for the non-traditional communication including an approved list. As a result of the changes, the target was met in AC 2024-2025 with 100% (2/2) of students meeting the target exceeding the goal by +30%. The department head met with the faculty and discussed generating an approved list of different types of non-traditional communications that students could create. Students generated a diverse array of non-traditional communications, demonstrating their ability to effectively communicate scientific ideas in a manner that could have been readily consumed by the general public.

Decision: In AC 2024-2025, the target was met. Based on the analysis of 2024-2025, the faculty will implement the following changes, in AC 2025-2026, to drive the cycle of improvement. The department head will meet with the faculty to discuss clarification of the target audience for the non-traditional communication. This will provide better focus and outcomes for students and reinforce audience awareness. Peer review of produced content will also be introduced to help students revise their work and learn from actively helping other students.

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 ≥90%.

Findings: Target not met.

Analysis: In AC 2023-2024, the target was met with 100% (2/2) of the Applied Microbiology majors earning 90% or better on the grading rubric for the project. Thus, students could effectively analyze scientific literature, and the students provided meaningful answers to questions based on that literature. The department head ensured that rubrics were provided and that sufficient time was spent in the classroom on this topic.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. Faculty provided an additional assignment with a data set for which students were required to run the statistics, create a graphical representation, and analyze the results. Extra time was spent on this topic in class, and they practiced data analysis. As a result of the changes in AC 2023-2024, the target was not met in AC 2024-

2025 with 40% (2/5) students attaining a final average quiz grade of ≥90%. The AC 2024-2025 numbers exceeded the target goal by +30%. Faculty set aside time in class to focus specifically on analyzing scientific data for additional practice to drive success in this measure. This did not help. Faculty were also concerned that obtaining a final average quiz grade of ≥90% showed excellence but was too high of a mark for student success.

Decision: In AC 2024-2025, the target was not met. Based on the analysis of AC 2024-2025, the faculty will implement the following changes in AC 2025–2026 to drive the cycle of improvement: The department head will meet with faculty to review the scientific papers that were used last year for practice and find articles that better align with the class. The assessments for these will be reviewed as they may lack focus to facilitate critical thinking. It may help to review a case study to demonstrate critical thinking outside of a scientific article. Next year's target quiz grade will be reduced to 80%, which will demonstrate above average ability and is higher than the target of measures, 1, 2, and 3.

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 2023-2024, the target was met with 100% (2/2) of Applied Microbiology majors scoring ≥90% on the assessment. These results suggested that students were designing their own project relating to Applied Microbiology and created a proposal to support this idea. 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.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head and the faculty met and shared guides breaking down the individual parts of the proposal. Ideas were shared about how to create the proposal in class, and the students were given 5 weeks to create the proposal. As a result of the changes in AC 2023-2024, the target was met in AC 2024-2025 with 100% (5/5) of students meeting the target. This exceeded the goal by +30%. The faculty shared ideas and classroom resources with fellow faculty to facilitate mastery of content and spent ample time on this topic in the classroom. Students excelled at designing a project and generating a proposal.

Decision: In AC 2024-2025, the target was met. Based on the results of AC 2024-2025 the faculty will implement the following changes in AC 2025-2026 to drive the cycle of improvement. The department head will meet with the instructors to discuss scaffolding the proposal into smaller components with interim deadlines. This should provide additional support for students. They will submit a complete final proposal for their

assessment. The target will be changed to 70% of students attaining a final average written assignment grade of ≥80%, based on a standard rubric. At 80%, students are exhibiting an above average ability to write a project proposal, and the goal is better attainable and less stressful for students to achieve.

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 ≥70% of the prescribed guidelines.

Findings: Target not met.

Analysis: In AC 2023-2024, the target was met with 100% (2/2) of students scoring ≥70% on the final presentation of their Capstone project. These students effectively communicated their Capstone project findings in a setting open to the public. The faculty had students make in-class presentations, prior to the public presentation, to help students identify problem areas in their presentation or presentation skills.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head and the faculty met to provide resources on the parts of the presentation and delivery. These resources were covered in classes resulting in more time being spent in class on this topic, and all instructors have this resource now. As a result of the changes in AC 2023-2024, the target was not met in AC 2024-2025, with 80% (4/5) of students meeting the target. This was below (-20%) the target goal, and was below (-20%) the score in the prior AC. Instructors spent additional time discussing the elements of a successful presentation and shared resources with other faculty to drive change. Instructors also felt that requiring 100% of students to score ≥70% on the final presentation of their Capstone project was too rigorous.

Decision: In AC 2024-2025, the target was not met. Based on the results of AC 2024-2025, the faculty will implement the following changes in AC 2025-2026 to drive the cycle of improvement. The department head will meet with faculty to discuss recording student presentations and have students watch themselves to reflect on their own performances. The target will be reduced to 80% of students scoring ≥70% on their final presentation. This maintains rigor while also reducing stress on faculty and students to meet this target.

Assessment Cycle 2024-2025

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 the 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 2023-2024, the target was met with 100% (2/2) of students meeting this grade requirement. This demonstrated that students were able to relate their project to the workforce and the needs of society. The faculty provided information to students on how to locate jobs in the field of science.

Based on the analysis on the AC 2023-2024 results, in AC 2024-2025, the following changes were made. The department head met with faculty to guarantee that all faculty were aware of this requirement. This measure was also added to the rubric. Faculty also shared resources on how to find jobs in Biology. As a result of the changes in AC 2023-2024, the target was met in AC 2024-2025 with 100% (5/5) of students meeting the target. This matches the score in the prior AC and the target goal. Students were able to identify workforce needs based on their project and relayed this in the classroom. Rubrics were improved by faculty and distributed by the course steward. Resource sharing was also facilitated by the course steward to instructors. Additional time was spent in class on how to effectively search for jobs.

Decision: In AC 2024-2025, the target was met. Based on the results of AC 2024-2025 the faculty will implement the following changes, in AC 2025-2026, to drive the cycle of improvement. Prior to the start of AC 2025-2026, the department head will meet with faculty to discuss including student-generated mock resumes for the jobs they find. This extra assessment should allow students to reach the target goal with alacrity.

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 met with faculty to develop additional lecture material such as a PowerPoint presentation independent of the current book material being used and adjusted the timing of lecture material on the scientific method, the practice quiz, and the assessment.

- In Measure 1.2, the department head met with the faculty and improved the qualifying statements on the survey that describe each level of learning and spent extra time on content such as controls and variables.

- In Measure 2.1, faculty developed materials with examples of experimental design and hypothesis development formulated around common situations that students encounter in their normal routine.

- In Measure 2.2, the department head met with the faculty and discussed why students continue to miss this particular assessment resulting in the target not being met, and accordingly adjusted the timing of the assessment, and developed a path to allow students to make-up missed assessments.
- For SLOs 3, 4, and 5; therefore, the department head will ensured that all instructors had the materials that are driving excellence in these measures.
- A list of approved non-traditional communication types were provided to students to offer more guidelines and expressed the diverse array of choices that they have in Measure 3.2.
- A focus on data analysis was important in Measure 4.1, and faculty provided ample time on this in class.
- The instructors developed resources about best practices for doing job searches in their area for Measure 5.2.

Plan of action moving forward:

- In Measure 1.1, students will conduct an experiment to identify unknown microbes using the scientific method.
- In Measure 1.2, the assessment will change using the framework TiLT to promote student success.
- More time will be spent on content including an additional assessment focused on the topic of controls in Measure 2.1.
- Prior to the start of AC 2025-2026, the department head will meet with faculty to discuss enhancing time spent on this content in lecture and lab and review all assessments for improvement in Measure 2.2.
- The department head will meet with the faculty prior to the start of AC 2025-2026, to scaffold the creation of this writing assignment in Measure 3.1 by having it created in parts driven by smaller assessments.
- The department head will meet with the faculty to discuss clarification of the target audience for the non-traditional communication in Measure 3.2.

Assessment Cycle 2024-2025

- For Measure 4.1, the department head will meet with faculty to review the scientific papers that were used last year for practice and find articles that better align with the class.
- For Measure 4.2, the department head will meet with the instructors to discuss scaffolding the proposal into smaller components with interim deadlines.
- For Measure 5.1, the department head will meet with faculty to discuss record student presentations and have students watch themselves to reflect on their own performance.
- For Measure 5.2, the Department Head will meet with faculty to discuss including student generated mock resumes for the job they find.
- In SLOs 4 and 5, targets will be adjusted to more reasonable goals that are achievable by students and are more similar to targets of the other measures while maintaining rigor.