

AC 2019 – 2020 Assessment

Bachelor of Science in Applied Microbiology

College: Arts and Sciences

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Northwestern Mission. Northwestern State University is a responsive, Student-oriented institution that is committed to the creation, dissemination, and acquisition of knowledge through teaching, research, and service. The University maintains as its highest priority excellence in teaching in graduate and undergraduate programs. Northwestern State University prepares its Students to become productive members of society and promotes economic development and improvements in the quality of life of the citizens in its region.

College of Arts and Sciences' Mission. College of Arts and Sciences' Mission. The College of Arts & Sciences, the largest college at Northwestern State University, is a diverse community of scholars, teachers, and students, working collaboratively to acquire, create, and disseminate knowledge through transformational, high-impact experiential learning practices, research, and service. The College strives to produce graduates who are productive members of society equipped with the capability to promote economic and social development and improve the overall quality of life in the region. The College provides an unequaled undergraduate education in the social and behavioral sciences, English, communication, journalism, media arts, biological and physical sciences, and the creative and performing arts, and at the graduate level in the creative and performing arts, English, TESOL, and Homeland Security. Uniquely, the College houses the Louisiana Scholars' College (the State's designated Honors College), the Louisiana Folklife Center, and the Creole Center, demonstrating its commitment to community service, research, and preservation of Louisiana's precious resources.

School of Biological and Physical Sciences. The School of Biological and Physical Sciences will become a reputable leader in public higher education by providing a transformative science educational experience using innovative instructional methods and through the scholarly achievements of our faculty, staff, students, and alumni. The School serves and inspires the students of Northwestern State University and the public through the development of lifelong learners who are excited about science, are disciplined in analytical and critical thinking skills, and are socially, environmentally, and ethically responsible. The School delivers Associate degrees in Veterinary Technology, Bachelor of Science degrees in Biology (with concentrations in Biomedical, Clinical Laboratory Science, Forensic Science, Natural Science, and Veterinary Technology), Applied Microbiology (with concentrations in Environmental and Applied Microbiology and Medical and Health Profession), and Physical Sciences. The School also offers minors in Biology, Microbiology, Wildlife Management, and Chemistry.

Applied Microbiology Program Mission Statement. The mission of the Northwestern State University Applied Microbiology program is to provide a comprehensive education

AC 2019 – 2020 Assessment

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 AY2017-2018 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: BIOL2060 – Microbiology I. All majors are required to complete BIOL2060.

Measure 1.1. (Direct – knowledge)

Throughout the BIOL2060 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.

Analysis: In AC 2018-2019 the target was not met. During the AC 2019-2020, a new faculty member started teaching BIOL 2060 and the director encouraged the instructor to employ active learning strategies in their classroom. Upon completion of the scientific method quiz 75% (3/4) students completed the assessment with a score of $\geq 70\%$. This

AC 2019 – 2020 Assessment

performance is below (-25%) the goal of 100% of students earning $\geq 70\%$ on this assessment.

Decision: Based on the analysis of the 2019-2020 results, the students in the BIOL2060 course do not have the appropriate knowledge to meet the target of 100% of students attaining a quiz grade of $\geq 70\%$. The faculty will continue to improve informational delivery in the BIOL2060 course. In 2020-2021, the Director of the School of Biological and Physical Sciences will work with the new faculty member teaching this course to make sure there is sufficient coverage of the parts of the scientific method. The Director will also continue to work to reduce class sizes in these introductory-level courses and encourage faculty to employ active learning strategies in their classrooms to provide students with greater applicational understanding of the parts of the scientific method and its application to scientific problems/questions.

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 2018-2019 the target was met. Based on the analysis of the 2018-2019 results, a new faculty member started teaching BIOL 2060 and the director continued to encourage the instructor to teach the parts of scientific method throughout the semester. As a result, 100% (4/4) students completed the assessment with a score of $\geq 70\%$. 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 2019-2020 results, the target of 70% of students reporting above average to excellent knowledge of the scientific method parts and application has been met and exceeded. In 2020-2021, the Director of the School of Biological and Physical Sciences will continue to work with the new faculty member teaching this course to make sure there is sufficient coverage of the parts of the scientific method. The Director will also continue to work to reduce class sizes in these introductory-level courses and encourage faculty to employ active learning strategies in their classrooms to provide students with greater applicational understanding of the parts of the scientific method and its application to scientific problems/questions. In 2020-2021 we will increase the target to 90% of students report 'above average' or 'excellent' knowledge of the scientific method.

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

Course Map: BIOL2090 - Microbiology II. All majors are required to complete BIOL2090.

Measure 2.1. (Direct – knowledge)

AC 2019 – 2020 Assessment

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 $\geq 70\%$.

Findings: Target not met.

Analysis: The target was not met in AC 2018-2019. Based on the analysis of the 2018-2019 results, in AC 2019 – 2020, a new faculty member was assigned to teach BIOL 2090 and the director encouraged the instructor to employ active learning assignments specifically around experimental design. As a result, 66% (4/6) of applied microbiology majors earned $\geq 70\%$ on the assessment. This performance was below (-33%) the goal of 100% of students earning the target of $\geq 70\%$ on this assessment meaning that students were not able to demonstrate appropriate knowledge of experimental design.

Decision: Based on the analysis of the 2019-2020 results, the Director of the School of Biological and Physical Sciences will continue to work with the instructor of the BIOL 2090 course to employ active learning strategies to ensure there is sufficient coverage of experimental design and related topics.

Measure 2.2. (Direct – knowledge)

As part of the final examination for BIOL2090, 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 met for the AC 2018-2019. Based on the analysis of the 2018-2019 results, In AC 2019-2020, a new faculty member was assigned to teach BIOL 2090 and the director encouraged the instructor to employ active learning assignments specifically around experimental design. As a result, 83% (5/6) of the Applied Microbiology students earned at least 50% of the points on each of those questions. Upon further evaluation of the data, the reason the goal was not met this cycle was a student simply did not attempt the questions on the Final exam. This performance is (-17%) below the goal of 100%.

Decision: Based on the 2019-2020 results, informational delivery in the BIOL 2090 course still provides students with appropriate knowledge to meet the target of 100% of students earning at least 50% credit of both constructive response questions regarding experimental design. In AC 2020-2021 the Director of the School of Biological and Physical Sciences will continue to work with the instructor of the BIOL 2090 course to employ active learning strategies to ensure there is sufficient coverage of experimental

AC 2019 – 2020 Assessment

design and related topics. More specifically the instructor can emphasize the importance of answering these two questions on the final exam.

SLO 3. Students will demonstrate their ability to analyze scientific data.

Course Map: BIOL2090 - Microbiology II, BIOL4990 – Capstone for Microbiology. All majors are required to complete BIOL2090 and BIOL4990.

Measure 3.1. (Direct – knowledge)

In this course, students are required to find a recently-published peer-reviewed journal article on a current topic in microbiology and prepare a 15-minute oral presentation explaining this paper to their classmates. The target is to have 100% of the students meet the presentation requirements on the grading rubric.

Findings: Target not met.

Analysis: In AC 2018-2019 the target was met. Thus, informational delivery in the BIOL 2090 course provides students the appropriate knowledge to meet the target of 100% of students meeting the standards of scientific data presentation outlined in the course. Based on the analysis of the 2018-2019, in AC 2019-2020, a new faculty member was assigned to teach BIOL 2090 and the director encouraged the instructor to employ active learning strategies for increasing scientific communication. As a result, only 66% (4/6) of Applied Microbiology students met the goal for presentation requirements on the grading rubric.

Decision: Based on the current analysis of the 2019-2020 results, it seemed that the informational delivery in the BIOL 2090 course provided students with appropriate knowledge to meet the target of 100% of students meeting the standards of scientific data presentation outlined in the course. However, it was clear that two students simply did not meet this goal. The earlier findings from previous academic cycles were likely an artifact of the small student population of Applied Microbiology majors. As enrollment increases for the microbiology program we will see if the goals are consistently met or if we need to increase the amount of class time dedicated to learning how to present scientific information. The Director of the School of Biological and Physical Sciences will continue to work with the instructor of the BIOL 2090 course to employ active learning strategies to ensure that sufficient class time is being committed to scientific communication.

Measure 3.2. (Direct – knowledge)

As part of the final examination for BIOL4990, students must give an oral presentation to their classmates describing their project theory, data/results, and conclusions. The target is to have 100% of the students will earn at least 70% of the points on the presentation.

Findings: Target met.

AC 2019 – 2020 Assessment

Analysis: This target was met in AC 2018 - 2019. Based on the analysis of the 2018-2019, informational delivery in the BIOL4990 course provides students with appropriate knowledge to meet the target of 100% of students meeting the requirements of the grading rubric for the assessment. In AC 2019 – 2020, the director encouraged the instructor to continue employing active learning strategies for increasing scientific communication. As a result, 100% (5/5) students, earned at least 70% of the points on the presentation.

Decision: Based on the analysis of the 2019-2020 results, informational delivery in the BIOL4990 course provides students with appropriate knowledge to meet the target of 100% of students meeting the requirements of the grading rubric for the assessment. Based on the analysis of the 2019-2020 results, in 2020 – 2021 the Director will continue to encourage faculty to employ active learning strategies in their classrooms to provide students with greater understanding of scientific communication. The director will also meet with the faculty member prior to the academic cycle to discuss increasing the rigor of the grading rubric.

SLO 4. Students will demonstrate their ability to think critically.

Course Map: BIOL4930 – Microbial Physiology. All majors are required to complete BIOL4930.

Measure 4.1. (Direct – knowledge)

In this course, students are required to use critical thinking skills to analyze a dataset and use that analysis to construct a biochemical pathway. The students will be given an assessment based on this process. The target is to have 90% of the students earn a 70% or better on the grading rubric for the biochemistry project.

Findings: Target met.

Analysis: The target was met during AC 2018-2019. Based on the analysis of the 2018-2019, informational delivery in the BIOL 4930 course provides students with appropriate knowledge to meet the target of 90% of students meeting the requirements of the grading rubric for the assessment. In AC 2019 – 2020, the director encouraged the instructor to employ active learning strategies to help students understand biochemical pathways in microorganisms. As a result, in AC 2019 – 2020, 100% (3/3) 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 90%.

Decision: Based on the AC 2019-2020 results, informational delivery in the BIOL4930 course provides students with appropriate knowledge to meet the target of 90% of students earning a score of 70% or better on the grading rubric for the biochemistry project. In AC 2020-2021, The Director of the School of Biological and Physical Sciences will continue to work with the instructor of the BIOL 4930 course to employ active learning

AC 2019 – 2020 Assessment

strategies to ensure new assignments that will increase the students understanding of biochemical pathways.

Measure 4.2. (Indirect – survey)

At the end of the course, a survey is administered to students to gauge their appraisal of their knowledge of the regulation of biochemical pathways. 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: This is a new assessment and it was not administered during the AY2018-2019. Given the students' target-exceeding performance on Measure 4.1, it can be assumed that the students were confident in their understanding of the mechanisms regulating microbial biochemical pathways. In AC 2019-2020, 33% (1/3) of Applied Microbiology majors report an above average or excellent knowledge of the indicated concepts. Based on the analysis of the AC 2019-2020 results, the class being moved online due to the COVID19 pandemic impacted the student's confidence for understanding biochemical pathways.

Decision: Based on the AC 2019-2020, it is clear that students do not feel they have an 'above average' to 'excellent' understanding of biochemical pathways. In AC 2020 – 2021 the Director of the School of Biological and Physical Sciences will continue to encourage use of active learning activities that emphasize biochemical pathways.

SLO 5. Students will demonstrate their ability to recognize the impact of microbial issues on society.

Course Map: BIOL4990 – Capstone Course for Microbiology. All majors are required to complete BIOL4990.

Measure 5.1. (Direct – knowledge)

In this course, students are required to make use of their interdisciplinary education to design, execute, interpret, and explain data generated from a microbiology experiment. The students will write a final paper describing their experiment. The target is to have 100% of the students meet the requirements of the grading rubric.

Findings: Target was met.

Analysis: This new assessment was not administered during the AY2018-2019. In AC 2019-2020, 100% (5/5) students meet the requirements of the grading rubric. While the students in BIOL4990 did convey their understanding of the impact of microbial issues on society in an oral form, they did not submit a written description.

Decision: Based on this result, a new course, BIOL4995 (Scientific Communication) has been added to the Applied Microbiology curriculum for AC 2020 - 2021. This course will

AC 2019 – 2020 Assessment

require both oral and written presentations of the microbiological capstone projects performed in BIOL4990 (Capstone Course for Microbiology). Measure 5.1 will be mapped to this new course during AC 2020-2021.

Measure 5.2. (Direct – knowledge)

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: This target was met in AC 2018-2019. In AC 2019 – 2020, 100% (5/5) students meet the requirements of the grading rubric. This means that the senior-level applied microbiology students were all able to relate their capstone projects to the current state of the workforce and needs of society.

Decision: Based on the current analysis of the 2019-2020 results. The director and faculty will increase the challenge for students to understanding how their microbiological research project can meet the needs of the workforce and society.

Comprehensive summary of key evidence of improvements based on analysis of results:

As a result of the findings of AC 2018-2019, several changes were implemented to improve student performance. More specifically, the Director:

- Encouraged faculty to use more active learning exercises/approaches to informational delivery.
- Some targets were increased to further challenge the students' performance on some assessments.
- Encouraged faculty spent more instructional time on the concepts.
- Provide additional support for new faculty members that are teaching assessment classes for the first time.

Plan of action moving forward:

In order to improve the program for AC 2020 – 2021 the director and faculty will implement the following changes to the instruction and classes:

- The Director of the School of Biological and Physical Sciences will continue to encourage faculty to employ active learning strategies in their classrooms to provide students with greater applicational understanding of the scientific method and experimental design

AC 2019 – 2020 Assessment

- The Director will encourage faculty to spend additional time in BIOL 2090 discussing topics related to scientific communication.
- The Director and Faculty will develop new assignments that will continue to challenge applied microbiology students in relation to the biochemical pathways associated with microorganisms.
- The Director and Faculty will develop new assignments that will continue to challenge applied microbiology students to relate capstone research projects to the workforce and society.
- The Director will meet with the instructors prior to the Fall and Spring semesters and discuss delivery of the content and the timing of the assessment.