Assessment Cycle
2018 – 2019

Program – 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.

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

Purpose (optional): The primary goal of the Applied Microbiology program is to prepare students to enter into the job market competitively at the bachelor level or to further their education in either graduate or professional school.

Methodology: The assessment process for the Applied Microbiology program is as follows:

(1) Data from assessment tools (both direct – indirect, quantitative and qualitative) are collected and returned to the program coordinator;

(2) The program coordinator will analyze the data to determine whether students have met measurable outcomes;

(3) Results from the assessment will be discussed with the program faculty;

(4) The program coordinator, in consultation with the director of the School of Biological and Physical Sciences as well as the faculty of the School, will propose changes to measurable outcomes and/or assessment tools for the next assessment period and, where needed, curricula and program changes.

Student Learning Outcomes:

NOTE: The AY2017-2018 was the first full academic year 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 ≥70%.

Findings: Target not met.

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Analysis: This is a new student learning outcome and was therefore not performed during the AY2017-2018. It was first implemented during the Fall semester of the AY2018-2019. During the AY2018-2019, 66.67% (2/3) students completed the assessment with a score of ≥70%. This performance is below (-33.33%) our goal of 100% of students earning ≥70% on this assessment.

Decision: Based on the analysis of the 2018-2019 results, the students in the BIOL2060 course do not have the appropriate knowledge to meet our target of 100% of students attaining a quiz grade of ≥70%. We will improve informational delivery in our BIOL2060 course. In 2019-2020, the Director of the School of Biological and Physical Sciences will 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: This is a new student learning outcome and was therefore not performed during the AY2017-2018. It was first implemented during the Fall semester of the AY2018-2019. During the AY2018-2019, 100% (3/3) students completed the assessment with a score of ≥70%. This performance exceeds (+30.00%) our goal of 70% of the students reporting above average or excellent knowledge of the indicated concepts.

Decision: Based on the analysis of the 2018-2019 results, our target of 70% of students reporting above-average to excellent knowledge of the scientific method parts and application has been met and exceeded. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL2060 during the AY2018-2019. If these results remain consistent in AY2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of the basic parts and application 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.

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Measure 2.1. (Direct – knowledge)

Throughout the BIOL2090 course, students will learn how to develop a hypothesis, identify experimental variables, and explain what types of experimental controls should be used to test the hypothesis from a dataset specific for microbiology. Each student is required to pass a quiz covering these concepts in experimental design. The target is to have 100% of students attain a quiz grade of ≥70%.

Findings: Target not met.

Analysis: The target for Measure 2.1 is that 100% of the students would attain a quiz grade of 70% or higher. In AY2017-2018, 75% (3/4) of applied microbiology majors earned ≥70% on the assessment. This performance was below (-25%) our goal of 100% of students earning the target of ≥70% on this assessment meaning that students were not able to demonstrate appropriate knowledge of experimental design. Further data analysis indicated that the weakest areas of student performance were scientific variables and their usage. Based on this evidence, the Director encouraged faculty to change the delivery of course material to improve student comprehension and retention of all material in general but most specifically on proper experimental variable and control identification and usage. This alteration was to include implementing active learning techniques and providing students with additional classroom and assessment time on these topics. As a result of those changes in AY 2018-2019, 0% (0/2) of students earned a quiz grade of 70% or higher.

Decision: Based on the analysis of the 2018-2019 results, we will improve informational delivery in our BIOL2090 course. In 2019-2020, the Director of the School of Biological and Physical Sciences will encourage faculty to employ active learning strategies in their classrooms with specific emphasis placed on concepts relating to experimental design.

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 met.

Analysis: The target for Measure 2.2 is that 100% of the students would earn at least 50% of the points on each of the two constructive response questions regarding experimental design. In AY2017-2018, 50.00% (2/4) of applied microbiology majors earned ≥50% on the assessment. This performance was far below (-50%) our goal of 100% of students earning the target of ≥50% on this assessment indicating that students were not able to demonstrate an acceptable understanding and application of experimental design as assessed by constructive response assessments. Based on

additional evaluation of the assessment results, it appeared that students performed at the lowest levels on question #2, which pertains to microbiological techniques and how they can be used to answer microbiological questions. To address this learning deficit, the Director encouraged the faculty to modify their delivery of this type of material to include additional/various teaching methods such as active learning/flipped classroom activities and extended classroom/assessment time. As a result of these changes, during the AY2018-2019, 100% (2/2) of the students earned at least 50% of the points on each of the two constructive response questions.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our BIOL2090 course provides students with appropriate knowledge to meet our target of 100% of students earning at least 50% credit of both constructive response questions regarding scientific design. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL2090 during the AY2018-2019. If these results remain consistent through the AY 2019-2020, the target of the assessment will be modified to increase the challenge in student understanding of experimental design.

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 met.

Analysis: The target for Measure 3.1 is that 100% of the students would meet the scientific data presentation requirements outlined in the course. In AY2017-2018, 100% (4/4) of applied microbiology majors met the requirements of the assessment's rubric. With the small number of students in the sampling size, the assessment target was not altered to determine its validity. During the AY2018-2019, 100% (2/2) of the students met the standards of the rubric used to assess their presentation.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our BIOL2090 course provides students with appropriate knowledge to meet our target of 100% of students meeting the standards of scientific data presentation outlined in the course. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL2090 during the AY2018-2019. If these results remain consistent through AY2019-2020, the target of the assessment will be modified to increase the challenge in student scientific data presentation.

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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.

Analysis: This is a new student learning outcome and was therefore not performed during the AY2017-2018. It was first implemented during the Spring semester of the AY2018-2019. During the AY2018-2019, 100% (1/1) students met the requirements of the grading rubric for the assessment.

Decision: Based on the analysis of the 2018-2019 results, informational delivery in our BIOL4990 course provides students with appropriate knowledge to meet our target of 100% of students meeting the requirements of the grading rubric for the assessment. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL4990 during the AY2018-2019. If these results remain consistent through AY2019-2020, the target of the assessment will be modified to increase the challenge in student performance during their oral presentation.

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 will earn a 70% or better on the quiz.

Findings: Target met.

Analysis: The target for Measure 4.1 is that 90% of the students would earn a 70% or better on the quiz relating to the construction of a biochemical pathway. This is a new student learning outcome and was therefore not performed during the AY2017-2018. It was first implemented during the Spring semester of the AY2018-2019. During the AY2018-2019, 100% (3/3) of the students earned 70% or better on the biochemical pathway quiz.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our BIOL4930 course provides students with appropriate knowledge to meet our target of 90% of students earning a score of 70% or better on a biochemical

pathway quiz. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL4930 during the AY2018-2019. If these results remain consistent through AY2019-2020, the target of the assessment will be modified to increase the challenge in student interpretation and construction of microbial 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: N/A

Analysis: This is a new assessment and it was not administered during the AY2018-2019.

Decision: This new assessment 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. As Measure 4.1 will be continued during AY2019-2020 and administered to a hopefully larger population of students, Measure 4.2 will be administered to gauge student perception of their knowledge/understanding of these mechanisms.

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: N/A

Analysis: This is a new assessment and it was not administered during the AY2018-2019.

Decision: This new assessment was not administered during the AY2018-2019. 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. A new

course, BIOL4995 (Scientific Communication), has been added to the Applied Microbiology curriculum. This course will 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 AY2019-2020.

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 met.

Analysis: This is a new student learning outcome and was therefore not performed during the AY2017-2018. It was first implemented during the Spring semester of the AY2018-2019. During the AY2018-2019, 100% (1/1) students met the requirements of the grading rubric for the assessment.

Decision: Based on the current analysis of the 2018-2019 results, informational delivery in our BIOL4990 course provides students with appropriate knowledge to meet our target of 100% of students meeting the requirements of the grading rubric for the assessment. However, this finding is likely an artifact of the small student population of Applied Microbiology majors in BIOL4990 during the AY2018-2019. If these results remain consistent through AY2019-2020, the target of the assessment will be modified to increase the challenge in student 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 AY2017-2018, some changes were implemented to improve student performance. Specifically, the Director encouraged faculty to use more active learning exercises/approaches to informational delivery. Such techniques can improve student comprehension and application of knowledge. Specific focus was placed on expanding students' understanding of the proper usage of experimental variables in scientific studies. Additionally, the Director worked to reduce class size to create an environment more conducive for flipped classroom/active learning. Furthermore, additional student learning outcomes were designed and implemented during the Fall 2018 and Spring 2019 semesters to improve program assessment. Many of the targets for the assessments were met indicating the successful implementation of strategies in the mapped courses.

Plan of action moving forward: In several areas (*e.g.*, the students' understanding of experimental design and their ability to analyze scientific data), student performance is already exceeding our target. However, these findings may be an artifact of the small student population of Applied Microbiology majors during the AY2018-2019. If these

results remain consistent through AY2019-2020, the target of the assessments with met targets will be modified to increase the challenge to student skills, specifically their understanding of the microbial world and their effective communication of that understanding. In those areas in which our assessment targets were not met, newly implemented strategies will drive student improvement and performance.