AC 2020 – 2021 Assessment

Bachelor of Science in Applied Microbiology

College: Arts and Sciences

Prepared by: Christopher N. Lyles **Date: 6-11-21**

Approved by: Francene J Lemoine **Date: 6-17-2021**

Northwestern Mission. Northwestern State University is a responsive, student-oriented institution committed to acquiring, creating, and disseminating knowledge through innovative teaching, research, and service. With its certificate, undergraduate, and graduate programs, Northwestern State University prepares its increasingly diverse student population to contribute to an inclusive global community with a steadfast dedication to improving our region, state, and nation.

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

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

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 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
(3) have met measurable outcomes;

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

(5) 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 ≥70%.

Findings: Target met.

Analysis: In AC 2019-2020 the target was not met. Based on the analysis of the AC 2019-2020 results, the Director of the School of Biological and Physical Sciences and

other faculty worked with a new faculty member teaching this course to make sure there was sufficient coverage of the parts of the scientific method.

As a result of these changes, in AC 2020-2021, the target was met. Upon completion of the scientific method quiz 100% (5/5) students completed the assessment with a score of ≥70%. This performance is below met the goal of 100% of students earning ≥70% on this assessment.

Decision: In AC 2020-2021, the target was met. Based on the analysis of the AC 2020-2021 results, in AC 2021-2022 faculty will emphasize the parts of the scientific method prior to assessment. Faculty will provide a scientific method quiz that will be taken and discussed prior to the SLO assessment.

Measure 1.2. (Indirect – survey)

At the end of the course, a survey is administered to students to gauge their appraisal of their understanding of the basic parts and application of the scientific method. The target is to have 70% of the students report an above average or excellent knowledge of the indicated concepts.

Findings: Target met.

Analysis: In AC 2019-2020 the target was met. Based on the analysis of AC 2019-2020 results, during the AC 2020-2021, the Director of the School of Biological and Physical Sciences and other faculty worked with a new faculty member teaching BIOL 2060 to make sure there was sufficient coverage of the parts of the scientific method.

As a result of these changes, in AC 2020-2021, the target was met. One hundred percent (100%) (5/5) students completed the assessment indicating they had excellent or above knowledge of the scientific method. This performance exceeds (+30.00%) the goal of 70% of the students reporting above average or excellent knowledge of the indicated concepts.

Decision: In AC 2020-2021, the target was met. Based on the analysis of the AC 2020-2021 results, in AC 2021-2022, the Director of the School of Biological and Physical Sciences will work with the faculty member teaching this course to ensure there is sufficient coverage of the parts of the scientific method. The Department 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 2020 – 2021 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 ≥70%.

Findings: Target not met.

Analysis: In AC 2019-2020, the target was not met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021, active learning strategies were applied to BIOL 2090 to improve student experimental design.

As a result of these changes, in AC 2020 - 2021, the target was met. Eighty-three percent (83%) (5/6) of applied microbiology majors earned ≥70% on the assessment. This performance was below (-17%) the goal of 100% of students earning the target of ≥70% on this assessment.

Decision: In AC 2020-2021, the target was not met. Based on the analysis of the AC 2020-2021 results, in AC 2021-2022, the Director of the School of Biological and Physical Sciences will work with the instructor of the BIOL 2090 course to ensure there is sufficient coverage of experimental design and related topics and to promote discussion of topics prior to the completion of the assessment.

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: In AC 2019-2020, the target was not met. Based on the analysis of the AC 2029-2020 results, in AC 2020-2021 active learning strategies were applied to BIOL 2090 to improve student experimental design. Class time was set aside to specifically address how to answer constructive response questions about experimental design.

As a result of these changes, in AC 2020-2021, the target was not met. In AC 2020-2021, 83% (5/6) of the Applied Microbiology students earned at least 50% of the points on each of those questions. This performance is (-17%) below the goal of 100%.

Decision: In AC 2020-2021, the target was not met. Based on the analysis of the AC 2020-2021 results, the instructor of the BIOL 2090 course will ensure there is sufficient coverage of experimental design and related topics.

AC 2020 – 2021 Assessment

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. Due to the university's implementation of the experiential learning quality enhancement plan, this SLO will be updated to represent the new experiential learning curriculum and will be tied to BIOL 4995, CHEM 4920, and PHYS 4940.

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: In AC 2019-2020 the target was not met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021, faculty placed an emphasis on scientific communication.

As a result of these changes, in AC 2020-2021 the target was met. In AC 2020-2021, 100% (6/6) of Applied Microbiology students met the goal for presentation requirements on the grading rubric.

Decision: In AC 2020-2021, the target was met. Based on the current analysis of the AC 2020-2021 results, in AC 2021-2022, the mapping of Measure 3.1 will be changed to be consistent with the new QEP curriculum – specifically, the scientific communication courses: BIOL 4995, CHEM 4920, and PHYS 4940.

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: In AC 2019-2020, the target was met. Based on the results of AC 2019-2020, in AC 2020-2021, active learning strategies were employed in the course to focus students on the importance and efficacy of scientific communication. The grading rubric was adjusted to be more rigorous and provide better feedback.

As a result of these changes, in AC 2020-2021, the target was met. One hundred percent (100%) (1/1) students, earned at least 70% of the points on the presentation.

Decision: In AC 2020-2021, the target was met. Based on the current analysis of the AC 2020-2021 results, in AC 2021-2022, the mapping of Measure 3.2 will be changed to be consistent with the new QEP curriculum - specifically the scientific communication courses: BIOL 4995, CHEM 4920, and PHYS 4940.

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

Course Map: BIOL4930 – Microbial Physiology. All majors are required to complete BIOL4930. Due to the implementation of the University's QEP, this SLO will be updated to represent the new experiential learning curriculum and will be tied to BIOL 4970, 4990, CHEM 4910, or PHYS 4930. The new SLO will read as follows: Students will employ critical thinking to interpret scientific literature.

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. In AC2021 – 2022, the new measure will be as follows: 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 met**.**

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021, new active learning strategies were employed in BIOL 4930 when biochemical pathways content was being taught.

As a result of these changes, in AC 2020-2021, the target was met. In AC 2020 – 2021, 100% (6/6) 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: In AC 2020-2021, the target was met. Based on the AC 2020-2021 results, in AC 2021-2022, and because of the University's QEP, Measure 4.1 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.

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. In AC202- 2022, this measure will change to the following: 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 final average written assignment grade of ≥90% based on a standard rubric.

Findings: Target met

Analysis: In AC 2019-2020, the target was met. Based on the analysis of the AC 2019-2020 results, in AC 2020-2021, new active learning strategies were employed in BIOL 4930 when biochemical pathways content was being taught.

Decision: In AC 2020-2021, the target was met. Based on the AC 2020-2021 results, in AC 2021-2022, and as a result of the University's QEP, Measure 4.2 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.

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. In AC 2021 – 2022 the SLO will be changed to reflect the new QEP curriculum and mapped to BIOL 4990, 4970, CHEM 4910, or PHYS 4930.

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. In AC2021 – 2022, students will be required to give a final presentation graded by a standard rubric across all sections of capstone classes. The target is to have 100% of students give a final presentation that meets ≥70% of the prescribed guidelines.

Findings: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the AC 2019-2020 results, in AC 2020-2021, faculty introduced the rubric earlier in the semester, so students were aware of expectations at the onset.

As a result of these changes, in AC 2020-2021, the target was met. In AC2021-2022, 100% (1/1) students meet the requirements of the grading rubric.

Decision: In AC 2020-2021, the target was met. Based on the AC 2020-2021 results, in AC 2021-2022, and because of the University's QEP, Measure 5.1 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.

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. In AC 2021 – 2022, this measure will stay the same as it will be adopted to standardize assessment across all capstone sections.

Findings: Target was met.

Analysis: In AC 2019-2020, the target was met. Based on the analysis of AC 2019-2020, in AC 2020-2021, faculty encouraged students to discuss how their experiments would impact the workplace and society as they designed and executed their experiments.

As a result of these changes, in AC 2020-2021, the target was met. In AC 2020-2021 100% (1/1) of students met the requirements of the grading rubric.

Decision: In AC 2020-2021, the target was met. Based on the AC 2020-2021 results, in AC 2021-2022, and as a result of the University's QEP, Measure 5.2 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.

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

As a result of the findings of AC 2019-2020, several changes were implemented to improve student performance.

- The Director of the School of Biological and Physical Sciences and other faculty worked with a new faculty member teaching this course to make sure there was sufficient coverage of the parts of the scientific method.
- Active learning strategies were applied to BIOL 2090 to improve student experimental design.
- Class time was set aside to specifically address how to answer constructive response questions about experimental design.
- Active learning strategies were employed in the course to focus students on the importance and efficacy of scientific communication.
- The grading rubric in BIOL 4990 was adjusted to be more rigorous and provide better feedback.
- The rubric in BIOL 4990 was disseminated earlier in the semester.
- New active learning strategies were employed in BIOL 4930 when biochemical pathways content was being taught.
- Faculty encouraged students to discuss how their experiments would impact the workplace and society as they designed and executed their experiments.

AC 2020 – 2021 Assessment

Plan of action moving forward:

To drive the process of improvement, in AC 2021 – 2022 the director and faculty will implement the following changes to the instruction and classes:

- Faculty will emphasize the parts of the scientific method prior to assessment.
- Faculty will provide a scientific method quiz that will be taken and discussed prior to the final assessment.
- The Director of the School of Biological and Physical Sciences will work with the faculty to ensure there is sufficient coverage of the parts of the scientific method.
- The Director of the School of Biological and Physical Sciences will work with the instructor of the BIOL 2090 course to ensure there is sufficient coverage of experimental design and related topics and to promote discussion of topics prior to the completion of the assessment.
- Measure 3.1 will change to be consistent with the new QEP curriculum; specifically, the scientific communication courses BIOL 4995, CHEM 4920, and PHYS 4940.
- Measure 3.2 will change to be consistent with the new QEP curriculum; specifically, the scientific communication courses BIOL 4995, CHEM 4920, and PHYS 4940.
- Measure 4.1 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.
- Measure 4.2 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.
- Measure 5.1 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.
- Measure 5.2 will be updated to be consistent with all BIOL, CHEM, and PHYS capstone classes and assessments.