AY 2017-2018 Assessment

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.

AY 2017-2018 Assessment

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 will be limited as less than ten majors are enrolled.

SLO 1. Students will demonstrate their knowledge of experimental design.

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

Measure 1.1. (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%.

AY 2017-2018 Assessment

Findings: Target not met.

Analysis: In AY2016-2017, 0% (0/1) (target not met) of applied microbiology majors earned ≥70% on the assessment. This performance was tremendously reduced (-100%) from the goal of 100% of students earning the target of ≥70% on this assessment meaning that the student was unable to demonstrate appropriate knowledge of proper experimental design. This poor performance was likely because the student had a cursory understanding of the topic but not a comprehensive enough understanding to be able to answer application-style questions. Based on an analysis of the data, a decision was made to change the way in which the relevant information was delivered in the course. Faculty were encouraged to increase the number and frequency of topic assessments to provide additional feedback to students on their understanding.

In AY2017-2018, 75.00% (3/4) of applied microbiology majors earned ≥70% on the assessment. This performance is far 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. This performance was improved (+75.00%) compared to the performance of students from the previous AY demonstrating that the informational delivery changes implemented were moderately successful in improving student learning/understanding.

To further analyze the data collected, we examined student performance on individual questions in the assessment. Based on this additional evaluation, it appears that students performed at the lowest level on question #2 of the quiz. This question pertains to the identification of scientific variables and their uses. Such concepts are generally more difficult for students to understand/apply. For the next academic year, the delivery of this type of material will include additional/various teaching methods such as active learning/flipped classroom activities and extended classroom/assessment time.

Decision: While implementing the decision/plan of action from AY2016-2017 did result in large (+75.00%) improvement, the analysis of the assessment results from this AY demonstrates that, for the topic of experimental design, repetition and increased frequency of assessment were not enough to achieve our goals for this student learning outcome. While the use of additional testing/feedback may have helped some students make the academic adjustments needed for better performance (hence the noted improvement), it wasn't enough to induce necessary improvement. For example, above average students may have been able to make the needed adjustments to improve but average/below average students may not have benefited from the additional assessment/feedback strategy used. Further data analysis indicated that the weakest areas of student performance were scientific variables and their usage. Based on this evidence, the faculty will work 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 will include implementing active learning techniques and providing students with additional

classroom and assessment time on these topics. The target of this SLO will be maintained until 100% of students to attain a final quiz grade of ≥70%.

Measure 1.2. (Direct – knowledge)

As part of the final examination for BIOL2090, students are asked to 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 these questions.

Findings: Target not met.

Analysis: In AY2016-2017, 100% (1/1) (target met) of applied microbiology majors earned ≥50% on the assessment. This performance satisfied the goal of 100% of students earning the target of ≥50% on this assessment meaning that the student demonstrated appropriate understanding of experimental design and its application. These results may be slightly misleading as only one student was assessed, and different results would likely be observed with additional students tested. A decision was made to have faculty increase the number and frequency of topic assessments to provide additional feedback to students on their understanding of experimental design.

In AY2017-2018, 50.00% (2/4) of applied microbiology majors earned ≥50% on the assessment. This performance is 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. This performance was reduced (-50.00%) compared to the performance of the one assessed student from the previous AY demonstrating that the informational delivery changes implemented were not successful in improving student learning/understanding. This result is likely due to a larger sample size (1 student as opposed to 4 students) in the assessment pool for this AY.

To further analyze the data collected, we examined student performance on individual questions in the assessment. Based on this additional evaluation, it appears that students performed at the lowest levels on question #2 of the constructive response assessment. This question pertains to microbiological techniques and how they can be used to answer microbiological questions. Such concepts are generally more difficult for students to understand/apply. For the next academic year, the delivery of this type of material will include additional/various teaching methods such as active learning/flipped classroom activities and extended classroom/assessment time.

Decision: While implementing the decision/plan of action from AY2016-2017 did result in a decrease (-50.00%) in performance, the analysis of the results of the assessment for this AY is probably more representative of student performance as it involved four-times the number of assessed students. The results demonstrate that, for the topic of experimental design, repetition and increased frequency of assessment were not

enough to achieve our student learning goals. While the use of additional testing/feedback may have helped some students make the academic corrections necessary for better performance, it wasn't enough to meet assessment goals. For example, above average students may have been impacted but average/below average students did not benefit from the additional assessment/feedback strategy used. Further data analysis indicates that the weakest areas of student performance were in identifying the appropriate use of microbiological experimental techniques. Based on this evidence, the faculty will work to change the delivery of course material to improve student comprehension and retention of all material in general but most specifically experimental techniques. This alteration will include implementing active learning techniques and providing students with additional classroom and assessment time on these topics. The target of this SLO will be maintained until 100% of students to attain a final average score of ≥50% on two different constructive response questions.

SLO 2. Students will demonstrate their ability to analyze scientific data.

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

Measure 2.1. (Direct – knowledge)

Throughout the course, students will read recently-published, peer-reviewed primary research articles and analyze scientific data regarding the human microbiome. Each student is required to develop a 15-minute presentation based on the concepts described in these articles. The target is to have 100% of students satisfy the grading rubric for the presentation.

Findings: Target met.

Analysis: In AY2016-2017, 100% (1/1) (target met) of applied microbiology majors met the presentation requirements on the grading rubric for this assessment. This performance satisfied the goal of 100% of students earning the target of meeting the requirements of this assessment meaning that the student demonstrated appropriate, professional presentation standards. These results may be slightly misleading as only one student was assessed, and different results would likely be observed with additional students tested. A decision was made to have faculty increase communication with students regarding presentation expectations.

In AY2017-2018, 100.00% (4/4) of applied microbiology majors met the presentation requirements of the assessment. This performance meets the target goal of 100% of students earning 100% on this assessment meaning that students could demonstrate an acceptable understanding of professional presentation requirements. This performance, like the performance of the one assessed student from the previous AY, demonstrates that the informational delivery changes implemented were successful in improving student learning/understanding. For the next academic year, the rubric for

the assessment of the student presentations will be altered to increase the expectations of the students.

Decision: While implementing the decision/plan of action from AY2016-2017 did result in maintaining our performance goals, the analysis of the assessment results for this AY is probably more meaningful and indicative of student performance as it involved four-times the number of assessed students. The results demonstrate that, for the preparation and execution of scientific presentations, repetition and increased frequency of assessment were enough to achieve our student learning goals. The use of additional testing/feedback may have helped some students make the academic corrections necessary for better performance. Based on this evidence, the faculty will work to enhance the delivery of course material to improve student knowledge and comprehension of appropriate, professional scientific presentation skills. This alteration will include implementing active learning techniques and providing students with additional classroom and assessment time on these topics. For the next academic year, the rubric for the assessment of the student presentations will be altered to increase the expectations of the students.

Measure 2.2. (Direct – knowledge)

As part of the final examination for BIOL2090, students must answer a constructive response question assessing their understanding of the “suprahuman”. The target is to have 100% of the students will earn at least 70% of the points on the question.

Findings: Target not met.

Analysis: In AY2016-2017, 100% (1/1) (target met) of applied microbiology majors met the constructive response requirements on the grading rubric for this assessment. This performance satisfied the goal of 100% of students earning at least 70% of the points on the question meaning that the student demonstrated appropriate, effective, and professional writing standards. These results may be slightly misleading as only one student was assessed, and different results would likely be observed with additional students tested. A decision was made to have faculty increase communication with students regarding scientific writing and constructive response expectations.

In AY2017-2018, 50.00% (2/4) of applied microbiology majors met the constructive response requirements on the grading rubric for this assessment. This performance does not meet the target goal of 100% of students earning at least 70% on this assessment meaning that students were not able to demonstrate appropriate, effective, and professional writing standards. This poor performance could be attributed to the students not having enough knowledge/understanding of the topic making the application of the concept in a scientific writing response difficult. Alternatively, the students may have a full understanding of the topic but simply have difficulty with effective writing. Based on the results of this assessment, faculty will work to change the delivery of course material to improve student comprehension and retention of microbiological material in general but most specifically on current concepts such as the

"suprahuman". This alteration will include implementing active learning techniques and providing students with additional classroom and assessment time on these topics. The target of this SLO will be maintained until 100% of students to attain a final score of ≥70% on this constructive response assessment.

Decision: While implementing the decision/plan of action from AY2016-2017 did result in a decrease (-50.00%) in performance, the analysis of this AY is probably more representative of student performance as it involved four-times the number of assessed students. The results demonstrate that, for the development of complex skills like effective scientific writing, repetition and increased frequency of assessment were not enough to achieve our student learning goals. While the use of additional testing/feedback may have helped some students make the academic corrections necessary for better performance, it wasn't enough to meet assessment goals. For example, above average students may have been impacted but average/below average students did not benefit from the additional assessment/feedback strategy used. Based on this evidence, the faculty will work to change the delivery of course material to improve student comprehension of the skills required for professional scientific writing. This alteration will include implementing active learning techniques and providing students with additional classroom and assessment time on these topics. The target of this SLO will be maintained until 100% of students to attain a final average score of ≥70% on the constructive response questions.

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

With the analysis of the AY2016-2017 assessment data:

- Curriculum changes were made to improve student achievement. The changes involved increasing the number and frequency of assessment to provide more feedback to students.

- Faculty were encouraged to increase communication with students regarding presentation, scientific writing, and constructive response expectations.

- Additionally, efforts were made to use concept-based educational techniques to identify links between topics discussed in courses and the general understanding of the microbiological world.

Unfortunately, the implementation of these changes did not improve student performance in most areas (the one exception was effective, professional, scientific presentations). It is likely that alterations in information delivery alone is not enough to ensure greater student success. The School of Biological and Physical Sciences is working to improve student understanding of complex topics (such as experimental design, appropriate usage of experimental variables and controls, and effective scientific writing) using an active learning/flipped classroom approach in our classes.

AY 2017-2018 Assessment

We have created two fluid classrooms that will allow for greater flexibility in student collaboration/peer learning. Such techniques have been shown to be successful in improving student learning.

Plan of action moving forward

For AY2018-2019, curriculum changes will be implemented to improve student understanding/knowledge complex topics (such as experimental design, appropriate usage of experimental variables and controls, and effective scientific writing). Using active learning strategies like flipped classroom instruction and group/peer learning, understanding and application of these concepts are expected to improve. Additionally, faculty will provide students with additional classroom and assessment time on these topics. With greater understanding of these concepts, it will be easier to develop critical evaluation of scientific literature and writing. The rubric for the assessment of the student presentations will be altered to increase the expectations of the students. For all assessments, the goals will remain as described.