

Academic Cycle 2021 – 2022

Bachelor of Science (BS) in Biology (618)

School of Biological and Physical Sciences

College: Arts and Sciences

Prepared by: Jerry Brunson

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Approved by: Francene Lemoine

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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 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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Biology Program Mission Statement. The mission of the Northwestern State University Biology program is to provide a comprehensive education in biology 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 Biology 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 Biology 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 explain the basic concepts of the molecular basis of life.

Course Map: Tied to the course syllabus objectives

BIOL1010: Biological Principles I. All majors are required to complete BIOL1010.

Measure 1.1. (Direct – knowledge): Throughout the course, students will learn about the molecular basis of life including macromolecules, cellular structure, enzyme function, gene expression, cellular respiration, photosynthesis, DNA structure and function, genetics, and cellular division. Each student is required to pass a quiz covering these concepts. The target is to have 70% of students earn a quiz grade of $\geq 70\%$.

Findings: Target met.

Analysis: In AC 2020-2021, the target was met with 86% (117/136) of students scoring $\geq 70\%$ on the assessment. This was due to the enhanced instructional time on concepts of the molecular basis of life and the timing of the assessment.

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The AC 2021-2022 target was also met with 74% (74/100) of students scoring $\geq 70\%$ on the assessment. Meeting this target implies that students were able to demonstrate appropriate knowledge of the molecular basis of life. This was a decrease of 12% from the previous AC 2020-2021. The content for the BIOL 1010 course was adjusted to be more intuitive for the students.

Decision: Based on the analysis of AC 2021-2022, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The Director will meet with the faculty to further drive the importance of spending adequate instructional time on the concepts of the molecular basis of life and the appropriate time and delivery of the assessment. The book for BIOL 1010 will change for AC 2022-2023 which also changes online platforms with which these students will engage.

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 concepts covered in the course. 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: Due to the target not being met in AC 2020-2021, the Director met with faculty prior to the start of AC 2021-2022 to discuss delivery of the content and the timing of the assessment and to focus more lecture time and provide external resources on the topics on which students felt they did not understand well.

The result for AC 2021-2022 was that 9% (4/44) of students reported that they had an above average or excellent understanding of basic cellular structure. Additionally, 27% (12/44) students reported that they had an above average or excellent understanding of basic cellular function. This performance is below (-61% and -43%, respectively), the goal of 70% of students reporting above average or excellent understanding of the basic principles of cellular structure and function. The Director worked with the instructors to qualify the survey responses and discuss what those responses mean to the students.

Decision: Based on the analysis of the AC 2021-2022 assessment results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The Director will meet with the instructors prior to the start of the AC 2022-2023 cycle to ensure an appropriate amount of lecture time is devoted to this in class and to determine which external resources are best suited to enhance understanding of the basic concepts covered in the course. The coordinator of Biology and Applied Microbiology will include a rubric for students to better define the ranking terms to ensure that they understand the question being asked. The book for BIO 1010 will change for AC 2022-2023 which also changes online platforms with which these students will engage.

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SLO 2. Students will describe the role of evolution and ecology in the diversity of life.

Course Map: Tied to the course syllabus objectives

BIOL 1020: Biological Principles II. All majors are required to complete BIOL 1020.

Measure 2.1. (Direct – knowledge): Throughout the course, students will learn about evolution and ecology. The topics covered include natural selection, evolution, ecology, population genetics, taxonomy, the diversity of prokaryotes, protists, fungi, plants, and animals. Each student is required to complete a quiz covering these concepts. The target is to have 70% of students earn a quiz grade of $\geq 70\%$.

Findings: Target not met.

Analysis: In AC 2020-2021 the target was not met. Due to this result, in AC 2021-2022, instructors restructured lecture content and order, provided external resource to aid students in understanding transpiration, plant tissues, flower structures, plant reproduction and water movement, the high level of diversity of organisms, evolution, populations, ecology, and how behavior can influence this diversity. Due to the restructuring of the course in AC 2021-2022, the topics covered also changed.

In AC 2021-2022, 44% (27/61) of students in BIOL 1020 earned a quiz grade of 70% or higher. This is a decrease of 21% from AC 2020-2021 and is 26% below the target of 70%. The students struggled with the topics of evolution and ecology. Due to the issues the students were having with these topics, the Director encouraged the instructors to stress concepts related to evolution and ecology.

Decision: In 2021-2022, the target was not met. Based on the analysis of the AC 2021-2022 results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The Director will meet with instructors about restructuring the lecture content and order as well as providing external resource to aid students in understanding natural selection, evolution, ecology, population genetics, taxonomy, the diversity of prokaryotes, protists, fungi, plants, and animals. The book for BIOL 1020 will change for AC 2022-2023 which also changes online platforms with which these students will engage.

Measure 2.2. (Indirect – survey)

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

Findings: Target not met.

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Analysis: In AC 2020-2021 the target was not met. Prior to the start of the AC 2021-2022, the Director met with the faculty and discussed restructuring lecture content and order and providing external resources to aid students in understanding transpiration, plant tissues, flower structures, plant reproduction and water movement, the high level of diversity of organisms, evolution, populations, ecology, and to explain how behavior can influence this diversity. Due to the restructuring of the course in AC 2021-2022, the topics covered also changed.

In AC 2021 -2022, 46% (28/61) of students in BIOL 1020 reported above average or excellent understanding of basic concepts in evolution. Additionally, 26% (16/61) of biology majors reported above average or excellent understanding of basic concepts of ecology. This performance is below (-24% and -44%, respectively), the goal of 70% of students reporting above average or excellent understanding of the basic concepts in evolution and ecology. Students do not feel confident of their knowledge in this content area which is supported by the fact that they did not demonstrate sufficient knowledge on these topics in measure 2.1, where the target was also not met.

Decision: In AC 2021-2022, the target was not met. Based on the analysis of the AC 2021-2022 assessment results, in AC 2022-2023, the faculty will implement the following changes to drive the cycle of improvement. The Director will meet with the instructors prior to the start of AC 2022-2023, to continue emphasizing the restructuring lecture content and order. Faculty will provide external resources to aid students in understanding natural selection, evolution, ecology, population genetics, taxonomy, the diversity of prokaryotes, protists, fungi, plants, and animals. The coordinator of Biology and Applied Microbiology will introduce a rubric for students to define the ranking terms to ensure that they understand the question being asked. The book for BIOL 1020 will change for AC 2022-2023 which also changes online platforms with which these students will engage.

SLO 3: Students will be able to communicate scientific information.

Course Map: Tied to the course syllabus objectives

BIOL 4995: Scientific Communication. All majors are required to complete BIOL 4995.

Measure 3.1. (Direct – ability): Throughout all sections of the Scientific Communication course, students will learn about the various aspects of communication in the sciences. Each student will write a scientific article to be assessed using a standard rubric. The target is to have 70% of students earn a final assignment grade of $\geq 70\%$.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (9/9) of biology majors scoring $\geq 70\%$ on the assessment. This demonstrates that students can create a scientific article targeted to other scientists. This was the first year this measure was assessed.

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Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. The faculty will provide to student the rubrics used to assess the assignment to enhance understanding of the expected outcomes on this project. In addition, faculty will adjust content delivery as needed and will meet with the Director to ensure that the appropriate amount of time is used to deliver the necessary information.

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 give a non-traditional communication to the public on 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 earn a final assignment grade of $\geq 70\%$.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (9/9) of biology majors scoring $\geq 70\%$ on the assessment, which means that students can effectively communicate science in a non-traditional manner such as a podcast, infographic for social media (*i.e.*, Instagram, *etc.*), or some other manner that targets the general public. This was the first year that this measure was assessed.

Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. Faculty will provide to students the rubrics used to assess the assignment so that they understand the expected outcomes on this project. In addition, the faculty will adjust content delivery as needed and will meet with the Director to ensure that the appropriate amount of time is spent delivering the information on these topics.

SLO 4: Students will employ critical thinking to interpret scientific literature.

Course Map: Tied to the course syllabus objectives

BIOL 4970: Capstone Course for Biology or BIOL 4990, CHEM 4910, or PHYS 4930. All majors are required to complete BIOL 4970.

Measure 4.1. (Direct - ability): Throughout all sections of the capstone course, students will read the scientific articles from the primary literature and be required to complete quizzes over the material. The target is to have 70% of students earn a final average quiz grade of $\geq 90\%$.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 84.6% (22/26) of biology majors scoring $\geq 90\%$ on the assessment. This outcome suggests that students can critically

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analyze a scientific article and effectively communicate this information when required. This was the first year that this measure was assessed.

Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. At the start of the course, faculty will provide to students the rubrics used to assess performance and adjust content delivery as needed. Faculty will also meet with the Director to ensure that the appropriate amount of time is used deliver the information on these topics.

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 earn a final average written assignment grade of $\geq 90\%$ using a standard rubric.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 77% (20/26) of biology majors scoring $\geq 90\%$ on the assessment. The students surpassed the targeted goal of 70% scoring 90% or better by +7% demonstrating that students can devise a research project and produce a research proposal on how to execute that project. This was the first year that this measure was assessed.

Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. Prior to the start of the assignment, faculty will provide the rubrics to the students and adjust content delivery as needed. Faculty also will meet with the Director to ensure that the appropriate amount of time is used to deliver information on this topic.

SLO 5: Students will demonstrate professional development.

Course Map: Tied to the course syllabus objectives

BIOL 4970: Capstone Course for Biology or BIOL 4990, CHEM 4910, or PHYS 4930. All majors are required to complete BIOL 4970.

Measure 5.1. (Direct – skill): 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 $\geq 70\%$ of the prescribed guidelines.

Findings: Target met.

Analysis: In AC 2021-2022, the target was met with 100% (26/26) of biology majors scoring $\geq 70\%$ on the assessment. This was the first year that this was assessed. The results of this measure suggest that students are able to complete a senior project and reflect on those experiences while relating the material to the general public.

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Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. Prior to the start of the assignment, faculty will provide rubrics to the students and adjust content delivery as needed. Faculty also will meet with the Director to ensure that the appropriate amount of time is used to deliver information on this topic.

Measure 5.2. (Direct – skill)

At the end of the Capstone course, students will find a current entry-level job in a field of biology 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: In AC 2021-2022, the target was met with 100% (26/26) of biology majors scoring $\geq 90\%$ on the assessment. This was the first year that this was assessed. Reaching the target goal means that biology students can relate their capstone projects to the current state of the workforce and needs of society.

Decision: In AC 2021-2022, the target was met. Based on the analysis of 2021-2022, in AC 2022-2023, the faculty will implement the following to drive the cycle of improvement. Prior to the start of the assignment, faculty will provide rubrics to the students and adjust content delivery as needed. Faculty also will meet with the Director to ensure that the appropriate amount of time is used to deliver information on this topic.

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 2021-2022. These changes are based on the knowledge gained through the analysis of AC 2020-2021 results.

- Faculty adjusted the content delivery and the order in which the content is delivered to be more intuitive for students in the BIOL1010 course.
- Faculty focused more lecture time and provided external resources on the topics on which students felt they did not understand well based on the survey results of AC 2020-2021.
- Faculty restructured lectures and provided external resources to aid students in understanding transpiration, plant tissues, flower structures, plant reproduction and water movement, the high level of diversity of organisms, evolution, populations, ecology, and how behavior can influence this diversity.

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- The Director encouraged instructors to stress concepts such as evolution and ecology to increase performance.
- The Director worked with instructors to qualify the survey responses i.e., what does excellent, above average, average, and below average mean to students.
- The Director and new Coordinator of Biology along with the instructors created SLO 3, SLO 4, and SLO 5 to assess the new QEP curriculum. All targets of these new SLOs were met.
- BIOL 4995 Scientific Communication was offered in Spring 2022 for the first time as part of the new QEP curriculum and was mapped onto SLO 3.

Plan of action moving forward.

- Prior to the start of AC 2022-2023, the Director will meet with the instructors and discuss the delivery of the content and the timing of the assessment processes, goals, and requirements.
- The book for BIOL 1010 and BIOL 1020 courses will change for AC 2022-2023 which also changes online platforms with which these students will engage.
- The Director and Coordinator will discuss with instructors the use of descriptors to define the ranks that students choose on the respective surveys to report their knowledge on topics.
- Faculty teaching BIOL 1020 will provide external resources to aid students in understanding natural selection, evolution, ecology, population genetics, taxonomy, the diversity of prokaryotes, protists, fungi, plants, and animals.