AC 2022-2023 Assessment

Natural Sciences. To understand the universe through the study of life and physical sciences.

Prepared by: Christopher N. Lyles   **Date: 5/19/2023**

Approved by: Greg Handel, Provost   **Date: 5/31/2023**

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.

Northwestern Core Curriculum. Northwestern has a broadly-based core curriculum that is central to the University's mission and consistent with the Louisiana Board of Regents' requirements for general education survey courses applicable to all students regardless of their major. The core encompasses the knowledge and abilities that Northwestern believes are essential to college graduates. Its requirements are designed to improve students' writing and speaking, to expand students' aptitude in mathematics and its applications, to strengthen students' understanding of biological, physical, social, and behavioral sciences, and to develop an appreciation and knowledge of the arts and humanities.

The goal of the core curriculum is for undergraduate students, depending on their respective degree program, to obtain appropriate learning outcomes for this general education competency.

Methodology: The assessment process includes:

(1) Data from assessment tools (direct and quantitative) are collected and returned to the executive director:

(2) The executive director will analyze the data to determine whether the applicable outcomes are met.

(3) Results from the assessment will be discussed with the appropriate staff; Individual meetings will be held with staff as required.

(4) The executive director, in consultation with the staff and senior leadership, will determine proposed changes to measurable outcomes, assessment tools for the next assessment period and, where needed, service changes.

NOTE: Each student is required to complete 3 separate natural science courses (9 credit hours total):

- one introductory physical science course (either SCI1010, CHEM1030, CHEM1070, or PHYS2030)

- one introductory biological science course (either SCI1020, BIOL1010, or BIOL2250)
- either a second physical science course (either SCI2010 or CHEM1040) or a second biological science course (either SCI2020 or BIOL2260).

Students can be broadly categorized into three different groups: (1) non-science majors, (2) science majors, or (3) nursing/allied health majors. For each of these three groups of students, there is a typical series of natural science courses that are taken but the timing and order of these courses varies significantly among the groups. The course series taken by the different student groups is as follows:

- Non-science majors – SCI1010, SCI1020, and then either SCI2010 or SCI2020
- Science majors – BIOL1010, CHEM1030, and CHEM1040
- Nursing/allied health majors – BIOL2250, BIOL2260, and CHEM1070

If the natural science competencies were assessed in EACH of the natural science core courses, every student would be assessed a total of three times which would be redundant and skew the collected data. Therefore, a representative set of courses were selected to assess the natural sciences competencies. The courses selected for assessment are

- BIOL1010 – taken by all science majors
- BIOL2250 – taken by all nursing/allied health majors
- SCI1020 – taken by all non-science majors

By assessing students in EACH of these selected courses every Fall and Spring semesters, we are monitoring the learning outcomes of 75% of the students in university core natural science courses.
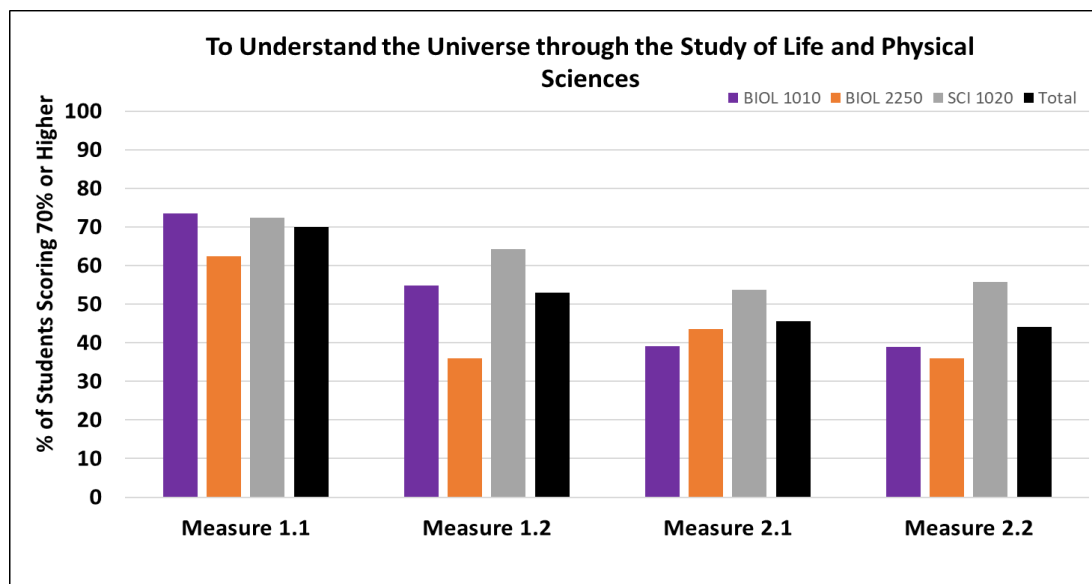
SLO 1 Students will identify the parts of the scientific method and design scientifically-sound experiments.

AC 2022-2023 Assessment

Measure 1.1 – Students will identify the parts of the scientific method.
Measure 1.2 – Students will demonstrate the ability to recognize scientifically – sound experiments.
SLO 2 Students will analyze scientific data to draw conclusions about the natural and physical world.
Measure 2.1 – Students will demonstrate their ability to make experimental predictions.
Measure 2.2 – students will analyze scientific data to draw conclusions about the natural and physical world.
The red line represents 80% target.

Service Learning Outcomes (SLO):

SLO 1. Students will identify the parts of the scientific method and design scientifically-sound experiments.
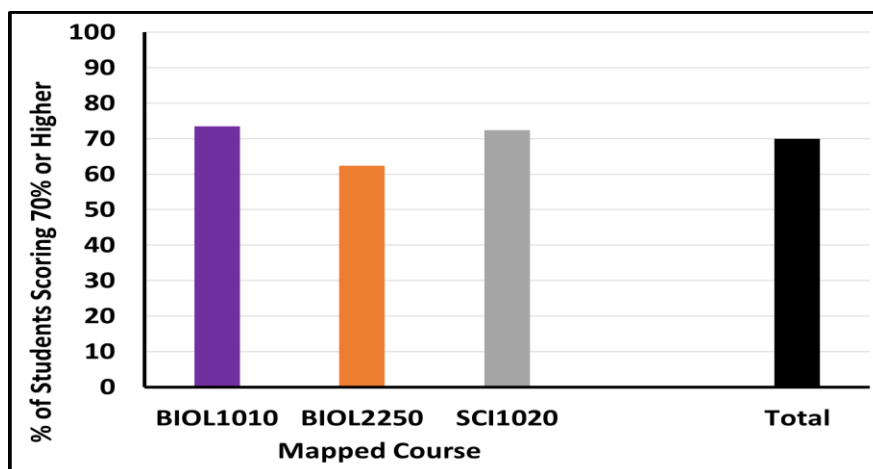
Measure 1.1. Students will identify the parts of the scientific method.

Throughout the indicated courses, students will learn about the parts of the scientific method including observations, hypotheses, and the various forms of experimental variables. Each student is required to pass a quiz covering these concepts. The target is to have 80% of students attain a quiz grade of ≥70%.

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	73.422% (221/301)	Fall and Spring
BIOL2250	Quiz	62.393% (146/234)	Fall and Spring
SCI1020	Quiz	72.333% (217/300)	Fall and Spring
Total		69.94% (584/835)	

Finding. Target Not Met. 835 Students assessed: 506 in Fall 2022 and 329 in Spring 2023; 100 dual enrollment students assessed: 26 in Fall 2022 and 74 in Spring 2023.

Graph.

Measure 1.1 – Students will identify the parts of the scientific method. Data from AC 2022 – 2023.

AC 2022-2023 Assessment

Analysis. In AC 2017-2018, the natural sciences core competency consisted of a single student learning outcome with a single measure. The University modified its General Education Core Curriculum ensuring that its six key competencies are central to the mission and are consistent with the Louisiana Board of Regents' requirements for general education. In response, the natural sciences core competency was changed to the following: To understand the universe through the study of life and physical sciences. This new core competency has two different student learning outcomes each with two different measures. New quiz-based assessments were designed and implemented for the first-time during AC 2018-2019. In AC 2022-2023, the target was not met with 69.94% (584/835) of students scoring 70% or higher on the quiz. This is below (-10.06%) our goal of 80% of students in BIOL 1010, BIOL 2250, and SCI 1020 scoring ≥70% on the quiz but higher (+8.06%) than the AC 2021-2022 assessment. Prior to the AC 2022 – 2023 academic year; the director met with the faculty and discussed a new plan to elucidate the scientific method and improve student performance. The instructors will provide a practice assessment and then discuss the results focusing on each aspect of the scientific method prior to the actual assessment. Based on the analysis of these results, we enhanced the instruction of the individual parts of the scientific method with emphasis on the different aspects of the scientific method.

Decision or action to drive future improvement. Based on the analysis of the results from AC 2022-2023, in AC 2023-2024, we will implement the following changes to drive the cycle of continuous improvement:

- Prior to the academic year, meet and discuss the timing and execution of the scientific method quiz with the faculty.

- Implement a practice scientific method exam and discuss and review the exam prior to the assessment.

- Focus more instructional time on the different types of experimental variables, which is a difficult concept for many students.

- The director, program coordinators, and course stewards will ensure that data is collected within the first five weeks of the respective semester.

Measure 1.2. Students will demonstrate the ability to recognize scientifically-sound experiments.

Throughout the indicated courses, students will learn how to use their knowledge of the parts of the scientific method to design scientifically-sound experiments. This will require the ability to identify relevant dependent and independent variables and understand how to use them to design appropriate experiments to test a given hypothesis. Each student is required to pass a quiz covering these concepts. The target is to have 80% of students attain a quiz grade of ≥70%.

AC 2022-2023 Assessment

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	54.81% (165/301)	Fall and Spring
BIOL2250	Quiz	35.90% (84/234)	Fall and Spring
SCI1020	Quiz	64.33% (193/300)	Fall and Spring
Total		52.93% (442/835)	

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Graph.
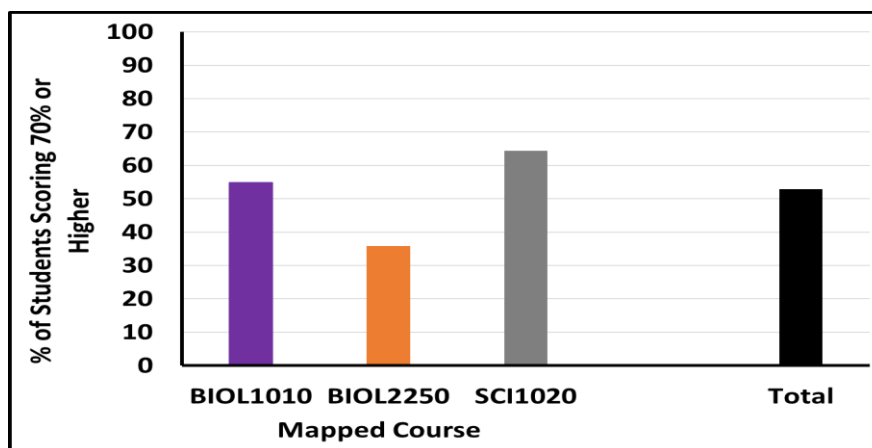
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SLO 2. Students will analyze scientific data to draw conclusions about the natural and physical world

Measure 2.1. Students will demonstrate their ability to make experimental predictions.

Throughout the indicated courses, students will learn how to use their knowledge of the scientific method and experimental design to make predictions of experimental results. This will require the ability to interpret experimental design to use those interpretations to predict the results of the executed experiments. Each student is required to pass a quiz covering these concepts. The target is to have 80% of students attain a quiz grade of ≥70%.

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	39.20% (118/301)	Fall and Spring
BIOL2250	Quiz	43.59% (102/234)	Fall and Spring
SCI1020	Quiz	53.67% (161/300)	Fall and Spring
Total		45.62% (381/835)	

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Graph.

AC 2022-2023 Assessment
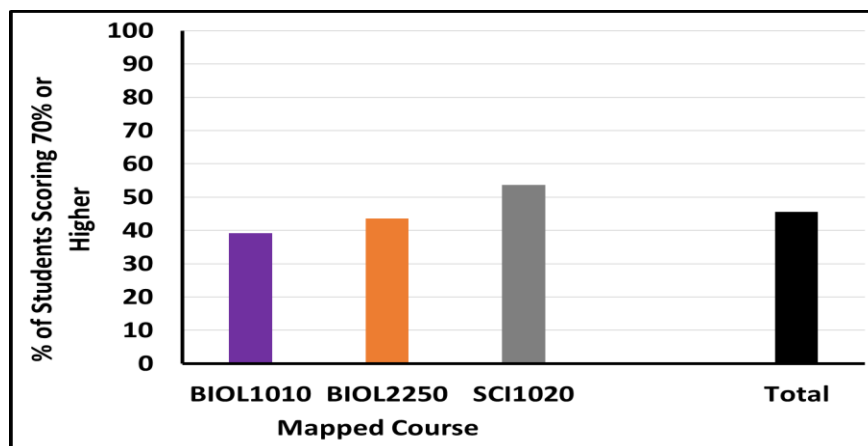
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- The director, program coordinators, and course stewards will ensure that data is

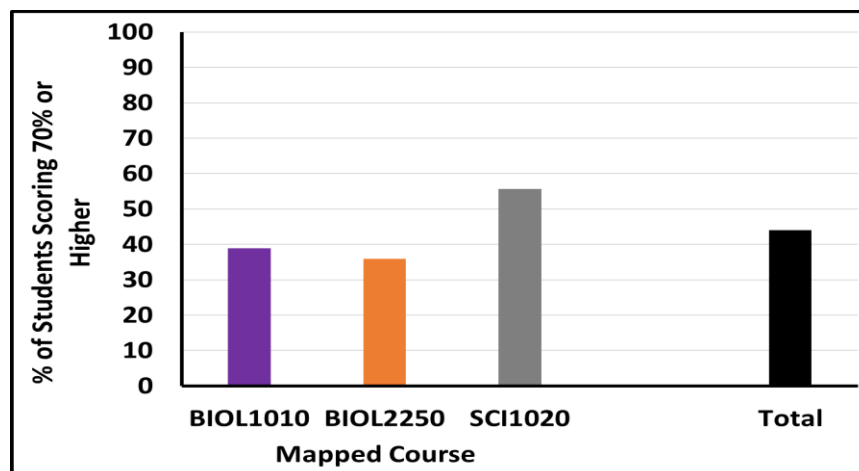collected within the first five weeks of the respective semester.

Measure 2.2. Students will analyze scientific data to draw conclusions about the natural and physical world.

Throughout the indicated courses, students will learn how to use their knowledge of the scientific method and experimental design to analyze scientific data and to make conclusions based on that data analysis. This will require the ability to interpret scientific data presented in verbal, tabular, or graphic form then use those interpretations to provide scientific explanations for those results. Each student is required to pass a quiz covering these concepts. The target is to have 70% of students attain a quiz grade of ≥70%.

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	38.87% (117/301)	Fall and Spring
BIOL2250	Quiz	35.89% (84/234)	Fall and Spring
SCI1020	Quiz	55.67% (167/300)	Fall and Spring
Total		44.072% (368/835)	

Finding. Target Not Met. 835 Students assessed: 506 in Fall 2022 and 329 in Spring 2023; 100 dual enrollment students assessed: 26 in Fall 2022 and 74 in Spring 2023.

Graph.

Measure 2.2 – Students will analyze scientific data to draw conclusions about the natural and physical world. Data collected from AC 2022 - 2023.

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Decision or action to drive future improvement. Based on the analysis of the results from AC 2022-2023, in AC 2023-2024, we will implement the following changes to drive the cycle of continuous improvement:

- Prior to the academic year, meet and discuss the timing and execution of the scientific method quiz with the faculty.

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- Focus more instructional time on the different types of experimental variables, which is a difficult concept for many students.

- The director, program coordinators, and course stewards will ensure that data is collected within the first five weeks of the respective semester.

Comprehensive Summary of Key Evidence of improvement based on the analysis of results. Based on the results of the assessment performed during AC 2022 – 2023 year, instructors of the indicated courses made the following adjustments to increase student performance:

- The timing of the assessment was discussed and delivered directly after discussion of the scientific method in class.

- Instructors implemented a practice scientific method exam and reviewed the practice test prior to taking the actual assessment.

The implementation of these changes resulted in improvements in student performance for measure 1.1 (+8.06%), 1.2 (+8.5%), 2.1 (+6.02%), and 2.2 (+7.62) from AC 2021 – 2022 to AC 2022 – 2023.

Plan of action moving forward. Based on the analysis of the results in AC 2022-2023, in AC 2023-2024, we will implement the following changes to drive the cycle of continuous improvement:

AC 2022-2023 Assessment

- The director, program coordinator, and course steward will meet prior to the AC 2023 – 2024 assessment cycle and stress the importance of the timing and execution of the scientific method exam.

- Instructors will provide a practice scientific method quiz that will be discussed and reviewed prior to the scientific method quiz assessment.

- Increase instructional time on the parts of the scientific method.

- Focus more instructional time on
    - the different types of experimental variables
    - how those variables are used in proper experimental design
    - the analysis of scientific data with focus on the understanding of tabular and graphical representations of data

- Provide more examples of applications of the scientific method with the parts identified and discussed, the use of specific variables and how they can be used to make predications of experimental results, and how those predictions can be used to draw conclusions of the scientific world.