

## University Core Competency AC 2019-2020

**Natural Sciences – Core Competency #3.** To understand the universe through the study of life and physical 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.

**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)

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- 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).

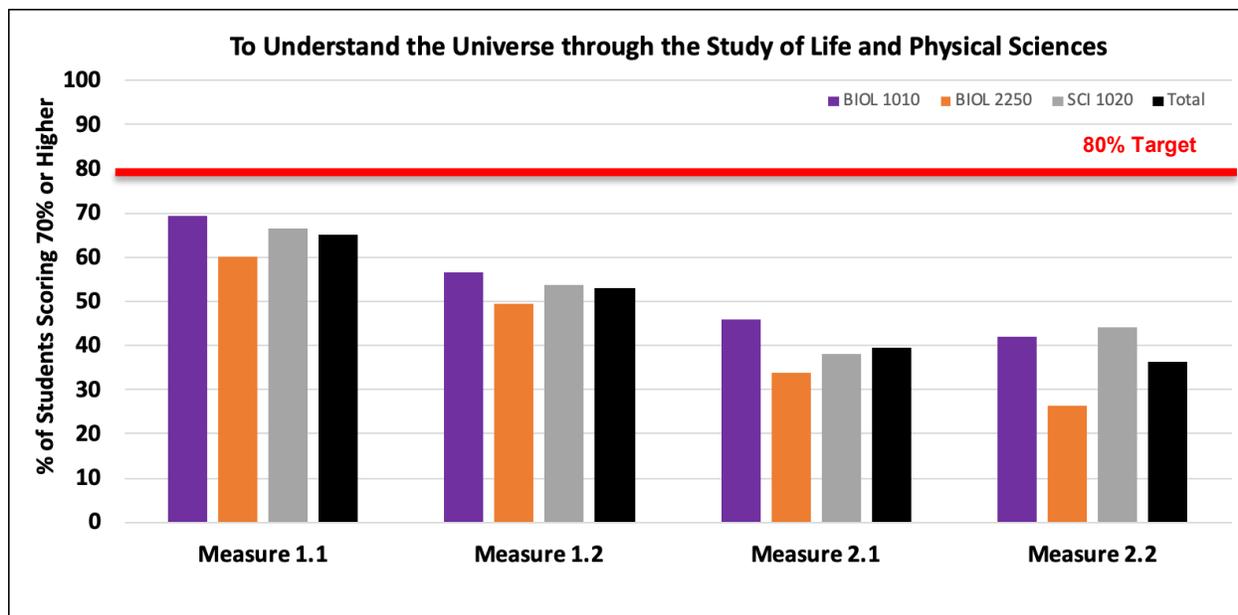
Students can be broadly categorized into three different groups: (1) non-science majors, (2) science majors, or (3) nursing/allied health majors. For each of these three groups of students, there is a typical series of natural science courses that are taken but the timing and order of these courses varies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

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.

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### Service Learning Outcomes (SLO):

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

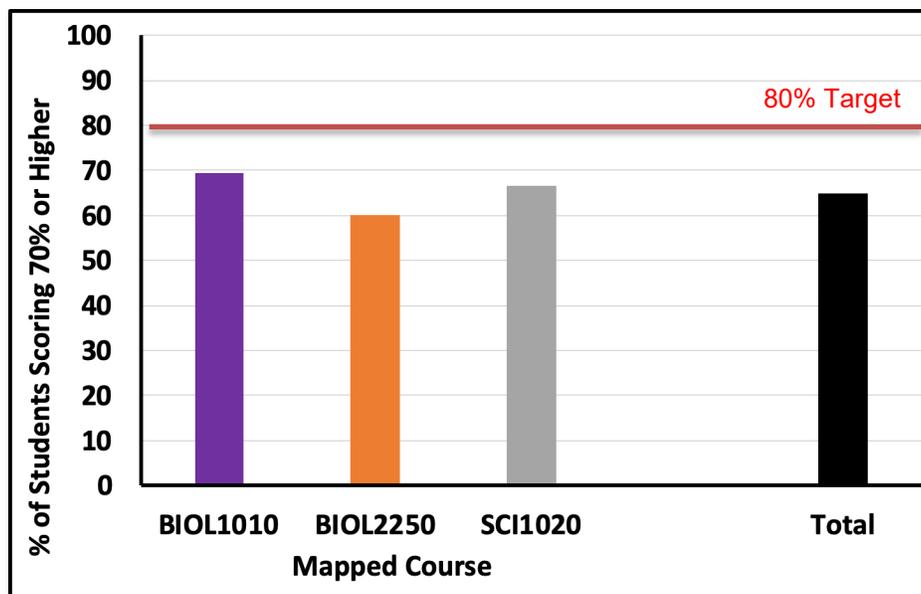
**Measure 1.1.** Students will identify the parts of the scientific method.

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  $\geq 70\%$ .

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	69.31% (201/290)	Fall and Spring
BIOL2250	Quiz	60.06% (182/303)	Fall and Spring
SCI1020	Quiz	66.46% (105/158)	Fall and Spring
Total		64.98% (488/751)	

**Finding.** 751 Students assessed (590 in Fall 2019 and 161 in Spring 2019). Target Not Met.

**Graph.**



*Measure 1.1 – Students will identify the parts of the scientific method. Data from AC 2019 – 2020.*

**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

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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 2018-2019, the target for this measure was met not met with 64.04% (983/1535) of students scoring 70% or higher on the quiz. Based on the analysis of the AC 2018-2019 results, in AC 2019-2020 instructors of the mapped courses decided to spend more instructional time describing the parts of the scientific method specifically focusing on the different types of experimental variables – an area of difficulty for many students. Following these adjustments, in AC 2019 – 2020, the target was not met with 64.98% (488/751) students scoring a 70% or higher on the quiz. This is below (-15.02%) our goal of 80% of students in BIOL 1010, BIOL 2250, and SCI 1020 scoring  $\geq 70\%$  on the quiz. However, we do see a slight increase (+0.94%) from the AC 2018 – 2019 suggesting that the adjusted instruction did slightly increase the students' performance. Based on the analysis of these results, we will enhance the instruction of the individual parts of the scientific method with emphasis on the different types of experimental variables.

**Decision or action to drive future improvement.** Based on the analysis of the results in AC 2019-2020, in AC 2020-2021, we will implement the following changes to drive the cycle of continuous improvement:

- Increase instructional time on the parts of the scientific method
- Focus more instructional time on the different types of experimental variables
- Provide more examples of applications of the scientific method with the parts identified and discussed

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

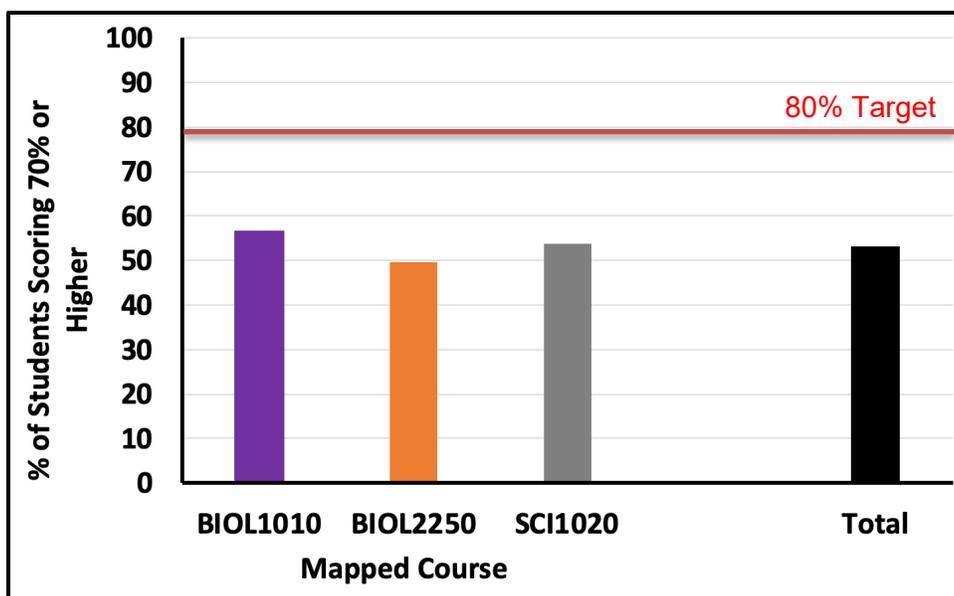
Throughout the indicated courses, students will learn how to use their knowledge of the parts of the scientific method to design scientifically-sound experiments. This will require the ability to identify relevant dependent and independent variables and understand how to use them to design appropriate 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  $\geq 70\%$ .

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	56.55% (164/290)	Fall and Spring
BIOL2250	Quiz	49.49% (148/299)	Fall and Spring
SCI1020	Quiz	53.80% (85/158)	Fall and Spring
Total		50.18% (397/747)	

**Finding.** 751 Students assessed (590 in Fall 2019 and 161 in Spring 2019). Target Not Met.

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Graph.



*Measure 1.2 - Students will demonstrate the ability to recognize scientifically - sound experiments. Data from AC 2019 – 2020.*

**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 2018-2019, the target for this measure was met not met with 50.18% (780/1535) of students scoring 70% or higher on the quiz. Based on the analysis of the AC 2018-2019 results, in AC 2019-2020 instructors of the mapped courses decided to spend more instructional time describing the parts of the scientific method specifically focusing on the different types of experimental variables and their use in proper experimental design. Following those adjustments, in AC 2019-2020 the target was not met with 53.14% (397/747) students scoring a 70% or higher on the scientific method quiz. This is below (-16.86%) our goal of 70% of students in BIOL 1010, BIOL 2250, and SCI 1020 scoring  $\geq 70\%$  on the quiz. However, in AC 2019-2020, there was a slight increase (+2.96%) when compared to AC 2018 – 2019 suggesting that the adjusted instruction did slightly increase the students' performance. Based on the analysis of these results, we will enhance the instruction of the individual parts of the scientific method with emphasis on the different types of experimental variables.

**Decision or action to drive future improvement.** Based on the analysis of the results in AC 2019-2020, in AC 2020-2021, we will implement the following changes to drive the cycle of continuous improvement:

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- Increase instructional time on the parts of the scientific method
- Focus more instructional time on the different types of experimental variables and their use in proper experimental design
- Provide more examples of applications of the scientific method with the parts identified and discussed with emphasis on why specific variables were used

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

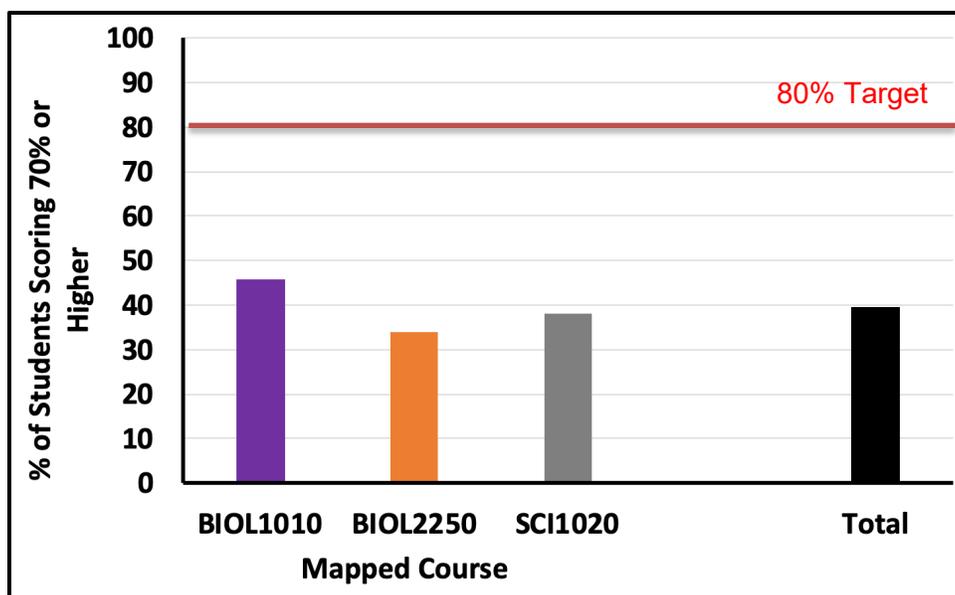
**Measure 2.1.** Students will demonstrate their ability to make experimental predictions.

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  $\geq 70\%$ .

Course Name	Methodology	Target	Term
BIOL 1010	Quiz	45.86% (133/290)	Fall and Spring
BIOL2250	Quiz	49.49% (148/299)	Fall and Spring
SCI1020	Quiz	37.97% (60/158)	Fall and Spring
Total		39.41% (296/751)	

**Finding.** 751 Students assessed (590 in Fall 2019 and 161 in Spring 2019). Target Not Met.

**Graph.**



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*Measure 2.1 - Students will demonstrate their ability to make experimental predictions. Data from AC 2019 - 2020*

**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 2018-2019, the target for this measure was met not met with 39.61% (608/1535) of students scoring 70% or higher on the quiz. Based on the analysis of the AC 2018-2019 results, in AC 2019-2020 instructors of the mapped courses decided to spend more instructional time describing the parts of the scientific method specifically focusing on experimental design and the prediction of experimental results. Following those adjustments, in AC 2019-2020 the target was not met with 39.41% (296/751) students scoring a 70% or higher on the scientific method quiz. This is below (-40.59%) our goal of 80% of students in BIOL 1010, BIOL 2250, and SCI 1020 scoring  $\geq 70\%$  on the quiz. The student performance from AC 2019-2020 slightly decreased (-0.28%) from the AC 2018 – 2019 suggesting that our altered instruction has not increased student performance for this measure. Based on the analysis of these results, we will continue to enhance the instruction of the different types of experimental variables, their use in proper experimental design, and their value in making experimental predictions.

**Decision or action to drive future improvement.** Based on the analysis of the results in AC 2019-2020, in AC 2020-2021, we will implement the following changes to drive the cycle of continuous improvement:

- Increase instructional time on the parts of the scientific method with focus on the different types of experimental variables and their use in proper experimental design
- Provide more examples of applications of the scientific method with the parts identified, discussion of why specific variables was used, and how you can use that understanding to make predications of experimental results

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

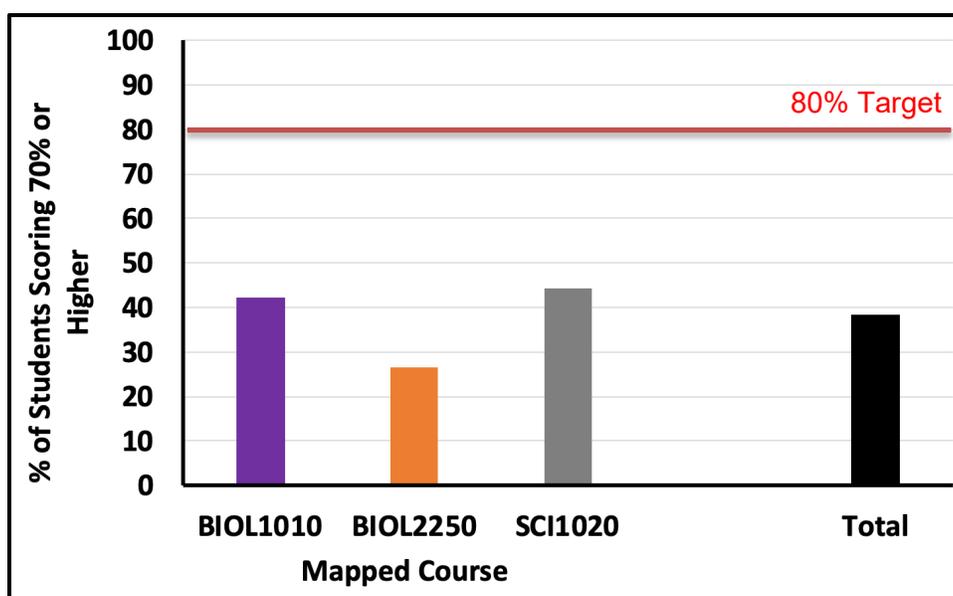
Throughout the indicated courses, students will learn how to use their knowledge of the scientific method and experimental design to analyze scientific data and to make conclusions based on that data analysis. This will require the ability to interpret scientific data presented in verbal, tabular, or 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 80% of students attain a quiz grade of  $\geq 70\%$ .

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Course Name	Methodology	Target	Term
BIOL 1010	Quiz	42.07% (122/290)	Fall and Spring
BIOL2250	Quiz	26.40% (80/303)	Fall and Spring
SCI1020	Quiz	44.30% (70/158)	Fall and Spring
Total		36.21% (272/751)	

**Finding.** 751 Students assessed (590 in Fall 2019 and 161 in Spring 2019). Target Not Met.

**Graph.**



*Measure 2.2 - Students will analyze scientific data to draw conclusions about the natural and physical world. Data collected from AC 2019 – 2020.*

**Analysis.** In 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 AY2018-2019. In AY 2018-2019, the target for this measure was met not met with 40.20% (617/1535) of students scoring 70% or higher on the quiz. Based on the analysis of the AC 2018-2019 results, in AC 2019-2020 instructors of the mapped courses decided to spend more instructional time describing the parts of the scientific method specifically focusing on analysis of experimental results to draw conclusions. Following those adjustments, in AC 2019-2020 the target

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was not met with 36.21% (272/751) students scoring below a 70% on the scientific method quiz. This is below (-43.79%) our goal of 80% of students in BIOL 1010, BIOL 2250, and SCI 1020 scoring  $\geq 70\%$  on the quiz. The overall performance of students from AC 2019-2020 decreased (-7.44%) from the previous AC 2018 – 2019 suggesting that our altered instruction has not increased student performance for this measure. Based on the analysis of these results, we will continue to enhance the instruction of the analysis of scientific results to draw conclusions.

**Decision or action to drive future improvement.** Based on the analysis of the results in AC 2019-2020, in AC 2020-2021, we will implement the following changes to drive the cycle of continuous improvement:

- Increase instructional time on 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, discussion of why specific variables was used, how you can use that understanding to make predications of experimental results and draw conclusions of the scientific world

**Comprehensive Summary of Key Evidence of improvement based on the analysis of results.** Based on the results of the assessment performed during the AC 2019 - 2020 semester, instructors of the indicated courses made the adjustments by spending more instructional time on:

- describing the parts of the scientific method specifically focusing on the different types of experimental variables – an area of difficulty for many students
- describing how the different types of experimental variables can be used in proper experimental design
- describing how a proper understanding of experimental design can aid in the prediction of experimental results
- describing how the analysis of experimental results can be used to draw scientific conclusions

The implementation of instructional changes from AC 2018 - 2019 resulted in +0.94% and +2.94% improvements in students' performance for measures 1.2 and 2.2, respectively in AC 2019-2021. This result could be an artifact of the difference in the total number of students assessed between the two academic cycles, but it also suggests small improvements in performance when students are asked to identify the parts of the scientific method and designing scientifically-sound experiments. However, we also see nominal decreases -0.28% and -7.44% in student performance for measures 2.1 and 2.2, respectively. Instructional changes from AC 2018 – 2019 does not seem to have impacted the student performance for SLO 2 more specifically the ability of the student to make experimental predictions and draw conclusions.

**Plan of action moving forward.** Based on the analysis of the results in AC 2019-2020, in AC 2020-2021, we will implement the following changes to drive the cycle of continuous improvement:

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- 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