

OUTCOMES ASSESSMENT REPORT 2020-2021

Biology Undergraduate

(Instructional Degree Program)

B.S./B.A.

(Degree Level)

Program Mission:

The mission of the Biology program is to provide undergraduate and graduate students with a high quality science education that includes experience with research and field projects. The program provides a scientific and technical background that empowers students to successfully pursue science and technology careers, or proceed on to advanced graduate studies.

Student Learning Outcome 1:

Have a command of basic biological knowledge in the areas of ecology and evolution, cell and molecular biology, and organismal biology.

NMHU Traits Specifically Linked to Student Learning Outcome 1

- Mastery of Content Knowledge and Skills

First Means of Assessment for Outcome 1:

Successful students will master course content in representative upper level major courses, with an average grade of "C" or better on class tests and laboratory reports in representative courses across subdisciplines: Biol 3000, Biol 3020, Biol 3030, Biol 3130, Biol 3310, Biol 3320, Biol 4230, Biol 4350, Biol 4400, Biol 4550, Biol 4760, Biol 4890. 75% or more students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	66	Number of Students Not Meeting Criterion:	32 (27)
Total Number of Students Assessed:	98 (93)	Percent of Students Meeting Criterion:	67% (71%)

**Note that this tally included 5 students who did not turn the lab report portion of this assessment. Data in parenthesis are results excluding the 5 students from analysis.*

Second Means of Assessment for Outcome 1:

Successful students will master course content in representative lower level major courses, with an average grade of "C" or better on class tests and laboratory reports for introductory biology courses in the biology major (Biol 2110, Biol 2620) 75% or more will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	54	Number of Students Not Meeting Criterion:	29 (7)
Total Number of Students Assessed:	83 (61)	Percent of Students Meeting Criterion:	70% (89%)

**Note that this tally included 22 students who did not turn the lab report portion of this assessment. Data in parenthesis are results excluding the 22 students from analysis.*

Interpretation of Results for Outcome 1:

Our measure of student mastery of biology content knowledge using both upper level and lower level assessments did not meet our criteria for success (75% of students with a C or better on measured assignments) *when including students who did not turn in assignments*. Sixty seven percent of upper level students (first means of assessment) reached mastery, and 70% of lower level students (second means of assessment) reached mastery.

However, for the second means of assessment, we do meet the criteria for success (89%) at the introductory course level if only students who turned in assignments are included in the analysis. This re-analysis is focused on students who completed their course assessments and excluded the 22 students who did not turn in any lab reports which consequently led all 22 to not meet the C grade criterion for mastery. Therefore, perhaps a more accurate picture of student performance would not include cases where students did not turn in any assignment. Information about students who did not submit assignments should be addressed as another type of issue with our program since we cannot assess this SLO such with 'missing data.'

Similarly, for the first means of assessment, 5 students did not turn in any lab report and all 5 did not meet the criterion for mastery. If those cases were excluded from the data, 71% of students would meet the criterion for success.

In previous years, we only measured upper level student success and observed an upward trend in mastery (78% and then 84% from 2018 to 2020), suggesting that this year's data also reflects the first full academic year of the COVID-19 pandemic and subsequent student and faculty hardships. This year, our sample sizes also increased in both the breadth of courses sampled and number of students included in the data analysis.

Student Learning Outcome 2:

Have an understanding of and the ability to use scientific methodology and technology through which biological knowledge accumulates.

NMHU Traits Specifically Linked to Student Learning Outcome 2

- Effective Use of Technology

- Mastery of Content Knowledge and Skills

First Means of Assessment for Outcome 2:

Successful students will show mastery and apply knowledge of basic biological principles and effectively use current technology to a degree that is satisfactory to the faculty of the biology discipline as indicated by a grade of “C” or better in Applied Biological Research, Biol 4980. 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	5	Number of Students Not Meeting Criterion:	0
Total Number of Students Assessed:	5	Percent of Students Meeting Criterion:	100%

Second Means of Assessment for Outcome 2:

Mastery of laboratory skills and techniques demonstrated by an an average grade of “C” or better on laboratory reports for representative upper level courses across subdisciplines. Biol 3000, Biol 3020, Biol 3030, Biol 3310, Biol 3320, Biol 3890, Biol 4890, Biol 4350. 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	63	Number of Students Not Meeting Criterion:	21 (16)
Total Number of Students Assessed:	84 (79)	Percent of Students Meeting Criterion:	75% (80%)

**Note that this tally included 5 students who did not turn the lab reports. Data in parenthesis are results excluding the 5 students from analysis.*

Third Means of Assessment for Outcome 2:

Mastery of laboratory skills and techniques demonstrated by an an average grade of “C” or better on laboratory reports for introductory biology courses in the biology major (Biol 2110 SP, Biol 2620). 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	48	Number of Students Not Meeting Criterion:	34 (12)
Total Number of Students Assessed:	86 (60)	Percent of Students Meeting Criterion:	59% (80%)

**Note that this tally included 22 students who did not turn the lab reports. Data in parenthesis are results excluding the 22 students from analysis.*

Interpretation of Results for Outcome 2:

The first means of assessment for this outcome, the use of the scientific method and technology, indicate successful mastery among students in upper level courses (100% at mastery level).

The second means of assessment demonstrates we met the criterion for success with 75% mastery that is similar to the previous two years of reporting (79% for 2018-19 and 76% for 2017-18). However, if we excluded the 5 students who did not turn in assignments, we have a small increase in the percentage of students meeting the criterion (80%).

The third means of assessment, laboratory skills measured in the introductory biology courses, is a new means of assessment for this year's report. Only 59% of students met the criterion for success. However, we had 22 students not turn in lab reports at all, so that all 22 students did not meet the C grade criterion for mastery. If these cases were excluded from the analysis, we would have 80% of students meeting the criterion for the third means of assessment at the introductory biology level, a much better indicator, perhaps, of overall student preparation provided by these courses. Students failing to turn in assignments is a different issue to address by the department, and such data does not give us the ability to do an assessment. Nevertheless, this means of assessment demonstrates a need to further investigate why students struggled with this SLO. The included courses (Biol 2110 and Biol 2620) were delivered 100% distance education and during the COVID19 pandemic, and this may have contributed to the poor performance on lab reports that rely heavily on hands-on experiences.

Student Learning Outcome 3:

Be able to effectively communicate and critically analyze biological knowledge.

NMHU Traits Specifically Linked to Student Learning Outcome 3

- Effective Communication Skills
- Critical and Reflective Thinking Skills
- Effective Use of Technology

First Means of Assessment for Outcome 3:

Successful students will demonstrate mastery with scores of "C" or better for research papers and/or oral presentations in representative upper level courses across subdisciplines Biol 3000, Biol 3890, Biol 4230, Biol 4350, Biol 4400, Biol 4760, Biol 4890, Biol 4910, Biol 4980. 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	53	Number of Students Not Meeting Criterion:	3
Total Number of Students Assessed:	56	Percent of Students Meeting Criterion:	95%

Second Means of Assessment for Outcome 3:

Successful students will demonstrate mastery with scores of "C" or better for major lab report papers and/or oral presentations in introductory biology courses in the biology major (Biol 2110 SP, Biol 2620). 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	58	Number of Students Not Meeting Criterion:	25 (7)
Total Number of Students Assessed:	83 (65)	Percent of Students Meeting Criterion:	70% (89%)

**Note that this tally included 18 students who did not turn the assignments for this assessment. Data in parenthesis are results excluding the 18 students from analysis.*

Third Means of Assessment for Outcome 3:

Successful students will show mastery and apply knowledge of basic biological principles to a degree that is satisfactory to the faculty of the biology discipline as indicated by a grade of "C" or better on the Senior project I (Biol 4910). 75% or more of students will meet our criteria for success.

Summary of Data:

Number of Students Meeting Criterion:	5	Number of Students Not Meeting Criterion:	0
Total Number of Students Assessed:	5	Percent of Students Meeting Criterion:	100%

Interpretation of Results for Outcome 3:

We measured biology student ability to communicate and analyze biological knowledge through assessment of the representative upper level and lower level courses.

At the upper level (first and third means of assessment), students met the criteria for success with this SLO (95% and 100%) in line with past years. This year, we included a broader diversity of upper level courses in the first means of assessment and had a better sample size compared to past years.

The second means of assessment for this SLO is new to our outcomes plan this year and measured student mastery of this SLO at the introductory biology level. The data indicates that 70% of introductory biology students reached mastery, below our criterion threshold of 75% for success. However, a major issue with this second means of assessment is that some introductory students opt out of participating in some writing and oral presentation assignments at all, creating a bimodal pattern of grades (high and low). We had 18 students not turn in any assignments for this assessment. If these

cases were excluded from the analysis, we would have 89% of students meeting the criterion for mastery. Students failing to turn in assignments is a different issue to address by the department, and such data does not give us the ability to do an assessment. We also know that 100% distance education during the pandemic may impact student learning. An additional issue with oral presentation grades for introductory courses was that distance education environment impeded student professional development opportunities to collaborate with peers and practice communication skills.

Student Learning Outcome 4:

Receive a comprehensive background essential to advanced work and/or a career in biology or related fields.

NMHU Traits Specifically Linked to Student Learning Outcome 4

- Mastery of Content Knowledge and Skills
- Effective Communication Skills
- Critical and Reflective Thinking Skills

First Means of Assessment for Outcome 4:

A student satisfaction survey is administered to all graduating seniors by the Biology Department. Measures of success- 50% or more of respondents indicate that they are continuing their education or employment in biology or related area. 75% of the respondents will indicate that they are satisfied or very satisfied with their preparation for work or graduate school. Faculty knowledge will be used to collect information on career paths of students who graduated the previous year.

Summary of Data:

Number of Students Meeting Criterion:	na	Number of Students Not Meeting Criterion:	na
Total Number of Students Assessed:	na	Percent of Students Meeting Criterion:	na

Interpretation of Results for Outcome 4:

Due to changes in the Office of Institutional Research and Effectiveness and changes in the Biology Program, we do not currently have a student satisfaction survey that is administered in the senior year. We are developing a survey instrument to give to all upper level classes through our online learning platform.

Note about data: Data used for this report is treated in the following ways: 1) For students with multiple entries across different courses, they meet the criteria for mastery

if they meet the criteria for mastery in at least one of the courses, and 2) students who are registered for a course but never attended the class are omitted from this analysis.

Utilization of Results:

Outcomes assessment results differed from previous years regarding 1) use of a new assessment plan that now includes lower level biology courses, 2) increased breadth of courses included and number of students sampled, and 3) a year of 100% distance education and COVID-19 pandemic conditions for students and faculty.

Overall, among the three SLOs we could measure this year, upper level students met mastery criteria for two out of three SLOs. Upper level students did not meet the criterion for success for SLO 1, mastery of content knowledge and skills (67% mastery vs 75% threshold; or 71% mastery after removing cases where assignments were not turned in by students). Though many of our results should be carefully interpreted in light of the COVID-19 pandemic distance education environment, we believe that this year's data, that included a greater diversity of upper level courses and overall better sample sizes, is important to review and plan for further clarification of any underlying challenges for students or for the faculty.

Our new assessment plan now including lower level courses (Biol 2110 and 2620) indicates in its first year that perhaps we are not meeting criteria for success for SLOs 1, 2, and 3 (70%, 59%, 70% mastery vs 75% threshold). However, this new analysis brought up a particular challenge with the data, i.e. that at this level some students did not submit assignments at all, and as such, the data represents an *absence of information* about student knowledge (SLO1), thinking about the scientific method (SLO2), or ability to communicate science (SLO3). When this missing data is excluded from the analysis, students met criteria for success for all three SLOs (89%, 80%, 89%) giving us more information about how students who engage in the assessment are faring. The challenges of addressing student failure to submit assignments is discussed in the next section.

Changes to Program Based on Results:

While we cannot change many conditions surrounding the COVID-19 pandemic, our department will address aspects of our SLOs needing improvement by encouraging faculty members in our program to participate in distance education pedagogical trainings through the Center for Teaching Excellence, use department meeting times to discuss approaches to distance education and student challenges to learning as they occur, and support a mid-course feedback process from students to instructors. We will also revisit biology curriculum mapping to assess ways that introductory courses should include appropriate levels of sciences skills scaffolding to support student mastery, and ways that upper level laboratory skills could be better reinforced and scaffolded earlier

in the program. The department will continue to use the Partnership for Undergraduate Life Sciences Education (PULSE) community resources to review and map the curriculum. For example, more low stakes formative opportunities to practice oral presentation skills and writing skills could be incorporated into introductory and advanced courses.

To address the challenge of a bimodal distribution of performance and students failing to turn in assignments particularly at the introductory course level, we will 1) strive to connect students with resources on campus, 2) reiterate to instructors the importance of early reporting of student absences and engagement issues to student support services, and 3) further analyze course data to determine whether particular declared majors differ in preparedness and engagement in class. First, the department will increase efforts to connect introductory level students with on campus resources including ARMAS, the supplemental instruction program (embedded in Biol 2110 and 2620), and the Student Success Center. Second, protocols are in place where instructors identify students who do not come to class or fail to turn in assignments and those students receive support from the student success center advisors. Third, introductory biology courses serve a range of majors at the university including pre-professional health, forestry, natural resources management, and chemistry. Other programs may not be well aligned with the biology curriculum and therefore leave students underprepared, or, if student preparedness is lacking among biology majors, we can address this in our course mapping.

In alignment with our department strategic plan, we will pursue budget requests for technological resources necessary to build engaging applied experiences in laboratory courses that improve future employability. We will also seek out any remaining pandemic related university funding available to host more distance education pedagogy training for faculty.

Finally, we will be developing our own survey instrument for upper level courses to collect information on student plans for careers in biology.

Retention Strategies:

Overall, we will continue to utilize biology program curriculum mapping exercises to improve supporting the development of student skills, and coordinate biology student activities with other campus resources and extracurricular programs to support holistic student experiences and success.

This first full year of the pandemic, we also initiated the first year of a five year NSF Hispanic Serving Institution grant, SomosSTEM, with biology professors Sarah Corey-Rivas (PI) and Justine Garcia (Co-PI). The goal of SomosSTEM is to *increase underrepresented minoritized student persistence among NMHU Life Sciences majors*

at early freshman to sophomore critical transitions through a pathway of early, integrated, and culturally informed research experiences within the STEM community, shaped by near-peer and local partnership expertise. The program is providing high impact learning materials to all 1000 and 2000 level biology courses, along with in depth professional development and pedagogy training for biology faculty members. We believe that this program will address many of the early retention challenges we face, and can also provide a platform to further explore the particular challenges faced by introductory course students.