

Weber State University  
Biennial Report on Assessment of Student Learning

Cover Page

Department/Program: Botany and Plant Ecology  
Academic Year of Report: 2020/21 (covering Summer 2019 through Spring 2021)  
Date Submitted: 15 November 2021  
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We have updated the Institutional Effectiveness website, which includes an update for each program page. All Biennial Assessment and Program Review reports will now be available on a single page. Please review your page for completeness and accuracy, and indicate on the list below the changes that need to be made. Access your program page from the top-level [results](#) page. Select the appropriate college and then your program from the subsequent page.

**A. Mission Statement**

**Information is current; no changes required.**

Update if not current:

**B. Student Learning Outcomes**

(please note the addition of certificate and associate credential learning outcomes)

**Information is current; no changes required.**

**C. Curriculum** (please note, we are using Google Sheets for this section so that updates are easier to make)

**Information is current; no changes required.**

Updates made on Google Sheet

**D. Program and Contact Information**

**Information is current; no changes required.**

Update: Sue Harley's office is TY 416, not TY 417.

**E. Assessment Plan**

We have traditionally asked programs to report on outcome achievement by students at the course level. We are encouraging programs to consider alternative assessment approaches and plans that are outcome-based as opposed to course-based, though course-based assessment

can continue to be used. A complete assessment plan will include a timeline (which courses or which outcomes will be assessed each year), an overall assessment strategy (course-based, outcome-based, reviewed juries, ePortfolio, field tests, etc.), information about how you will collect and review data, and information about how the department/program faculty are engaged in the assessment review.

     **Information is current; no changes required.**

Update if not current:

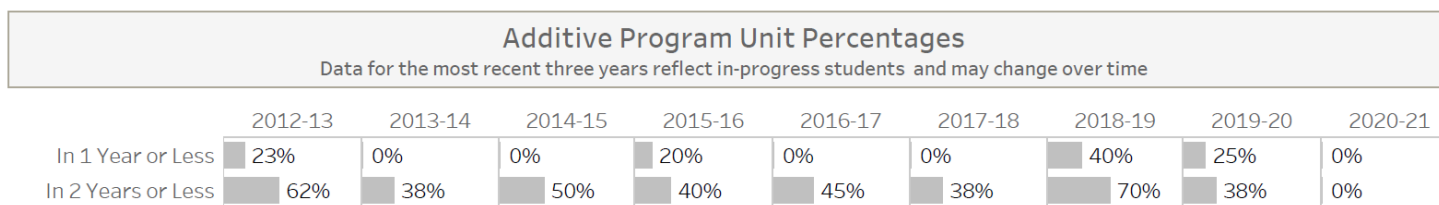
**Courses within the Major Assessment Schedule:**

At a minimum, the following courses will be evaluated within the next three years:

<b>BTNY Course</b>	<b>2021-2022</b>	<b>2022-2023</b>	<b>2023-2024</b>
2104 (Plant Form & Function)	X	X	X
2114 (Evolutionary Survey of Plants)	X	X	X
2121 (Career Planning)	X	X	X
2203 (Home & Garden)	X		
2303 (Ethnobotany)		X	
2413 (Natural Resource Management)	X		
2600 (Lab Safety)	X		
2750 (Topics in Science and Society)	X		
3105 (Anatomy of Vascular Plants)	when taught		
3153 (Biology of the Plant Cell)		X	
3204 (Plant Physiology)		X	
3214 (Soils)	X		
3303 (Plant Genetics)		X	
3454 (Plant Ecology)		X	
3473 (Plant Geography)	when taught		
3504 (Mycology)			X
3583 (Medicinal Plants)	X		X
3624 (Taxonomy of Vascular Plants)	X		X
3643 (Intermountain Flora)		X	
4113 (Plant Evolution)	when taught		
4750 (Topics in Botany)	when taught		
4950 (Advanced Field Botany)	X		X
4990 (Botany Capstone Seminar)		X	

## F. Student Achievement

- i. Percent of students completing degrees after 90 credit hours within 2 years and a reflection on that metric (this information can be accessed on the Program Review Undergraduate dashboard – tab labeled, ‘Time to Grad from 90CH – please reach out to [oe@weber.edu](mailto:oe@weber.edu) if you need help with this metric). What department initiatives are in place to address this?



From 2014-15 through 2018-19, the botany major program averaged a 48.6% completion within 2 years of 90CH. Because we are a small department, there is a lot of year to year fluctuation. An increase or decrease of a few students can have a large effect on the percentage. This recent time block includes a year at 70%. The prior five year average from 2013-14 to 2017-18 missed the 70% year and was 40.6%, while the average from 2012-13 to 2016-18 included a 62% year and was 47.0%. Changes in the requirements for the major, effective with the 2020-2021 catalog, should reduce time to graduation. Several majors in the pipeline have switched to more recent catalog years in order to take advantage of the changes. We will continue monitoring the rolling 5 yr average.

## Evidence of Learning

There are varieties of ways in which departments can choose to show evidence of learning.

- 1) Course-based assessment
  - a. This is the format we have traditionally suggested programs use for assessment. The familiar ‘evidence of learning worksheets’ are included in the template and can also be accessed from the IE website. The critical pieces to include are:
    - i. learning outcomes addressed in the course,
    - ii. method(s) of measurement used,
    - iii. threshold for ‘acceptable – that is, the target performance,
    - iv. actual results of the assessment,
    - v. interpretation/reflection on findings,
    - vi. the course of action to be taken based upon the interpretation,
    - vii. how that action will be evaluated.

2) Outcome-based assessment

- a. Moving from course-based to outcome-based assessment has the potential for programs to gather and reflect upon data that are more meaningful, and to connect assessment findings from throughout the program. The approach may be much easier for associates and certificate programs where only select students in classes are earning the credential. For more information email ([gniklason@weber.edu](mailto:gniklason@weber.edu))
- b. Reporting options include:
  - i. A traditional evidence-of-learning [worksheet](#) with an outcome (across multiple courses) as the focus (instead of a course with multiple outcomes).
  - ii. A report that is more [narrative-based](#).
  - iii. Other tools such as an ePortfolio in which key or signature assignments have been identified by the faculty, and uploaded by the student with their reflection. The key or signature assignments are aligned to student learning outcomes. (ePortfolio is an excellent assessment tool for certificates and associate degrees.)
  - iv. There are other approaches such as juried reviews, physical portfolios, field tests, etc.

- 3) General Education course assessment needs to continue to be reported at the course level using either the [traditional template](#) or a more [narrative-based format](#). See the [Checklist and Template](#) page for area-specific worksheets as well.

**Note: if you cannot download templates directly from this document, please visit our [template page](#) for downloads.**

## A. Evidence of Learning: Courses within the Major

### Botany Learning Thresholds:

**2000-Level Courses:** 80% of students achieve at least 70%

These courses serve as introductory courses for the botany major, botany minor, field botany certificate, and AS Biology as well as support courses for various College of Science majors

**Upper Division Botany courses:** 90% of students achieve at least 80

These courses serve the botany major, botany minor, and field botany certificate. Some also attract students from other College of Science majors.

### Evidence of Learning Worksheet: Courses within the Botany Major

Course: **BTNY 2104 Plant Form and Function** Semester taught: Spring 2020 Sections

Evidence of Learning Worksheet: **Courses within the Major – Copy as needed (see appendix for alternative format)**

Course: **BTNY 2104 (Plant Form and Function)** Semester taught: Fall 2019, N = 15 Sections included: CRN 22333

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Cellular, Developmental, Genetics, &amp; Molecular.</b> Students are able to describe and explain fundamental topics about the chemical and molecular machinations operating within all biological processes.	Measure 1: Two exams that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 64% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Six lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 85% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 1:	Measure 1:	Measure 1:	Measure 1:	Measure 1:	Measure 1:

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Cellular, Developmental, Genetics, &amp; Molecular.</b> Students are able to describe and explain fundamental topics about the centrality of genetic systems' governance of life's actions from the cellular to the phyletic.	One exam that included questions on this LO.	80% of students achieving 70 % or higher on the exam that included this LO	73% of students scored a 70% or higher on the exam	Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Five lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 100% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Measure 1: Three exams that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 67% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Eleven lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 92% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: One exam that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on the exam that included this LO	Measure 1: 64% of students scored a 70% or higher on the exam	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Two lab activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 77% of students scored a 70% or higher on the activities	Measure 2: The threshold was not met.	Measure 2: These labs include data analysis (including basic statistics) which was introduced earlier in the term. Review that material as students start this activity.	Measure 2: Monitor if review of data analysis improves the ability of students to do that well with these activities later in the semester.
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: One exam that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 64% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Seven lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 87% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	Measure 1: Two exams that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 69% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Five lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 83% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Microscopy Techniques</b>	Measure 1: Two exams that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 69% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Seven lab and other class activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 97% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Lab Safety</b>	Measure 1: One exam that included questions on this LO.	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 64% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.

\*Direct and indirect: at least one measure per objective must be a direct measure.

**Course: BTNY 2104 (Plant Form and Function)**

**Semester taught: Fall 2020, Spring 2021 (virtual hybrid), N = 44**

**Sections included: CRNS 22736 (F20), 32472 (Sp21)**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Cellular, Developmental, Genetics, &amp; Molecular.</b> Students are able to describe and explain fundamental topics about the chemical and molecular machinations operating within all biological processes.	Measure 1: Multiple choice questions on 2 exams given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 46% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: One activity on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 97% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Cellular, Developmental, Genetics, &amp; Molecular.</b> Students are able to describe and explain fundamental topics about the centrality of genetic systems' governance of life's actions from the cellular to the phyletic.	Measure 1: Multiple choice questions on 1 exam given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 60% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Five activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 95% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Measure 1: Multiple choice questions on 4 exams given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 48% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Twelve activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 91% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: Multiple choice questions on 1 exam given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 40% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Two activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 91% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: Multiple choice questions on 1 exam given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 63% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Two activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 89% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 1:	Measure 1:	Measure 1:	Measure 1:	Measure 2:	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	Multiple choice questions on 1 exam given in ChiTester	80% of students achieving 70 % or higher on exams that included this LO	79% of students scored a 70% or higher on the exams	Threshold was met.	No curricular or pedagogical changes needed at this time	
	Measure 2: Five activities on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 92% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Microscopy Techniques</b>	Measure 1: Multiple choice questions on 1 exam given in ChiTester	Measure 1: 80% of students achieving 70 % or higher on exams that included this LO	Measure 1: 67% of students scored a 70% or higher on the exams	Measure 1: Threshold was not met, but matching and essay questions were not included in the analysis as ChiTester does not recognize partial credit.	Measure 1: Paper exams will be used when the class returns to in person instruction. Reorganize exams so that questions are blocked by learning outcome and record data on those specific questions prior to returning exams.	Measure 1: Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: One activity on this LO	Measure 2: 80% of students achieving 70 % or higher activities	Measure 2: 94% of students scored a 70% or higher on the activities	Measure 2: The threshold was met.	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Lab Safety</b>	Measure 1: One activity on this LO	Measure 1: 80% of students	Measure 1: 100% of students scored	Measure 1: The threshold was met.	Measure 1:	In the future, include exam questions on lab safety.

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		achieving 70 % or higher activities	a 70% or higher on the activities		No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This is the first assessment using the new botany learning objectives. What we are discovering is that we need to collect data that are more granular compared to what we did with the old learning objectives. This is particular true for data from exams as these data need to be collected before paper exams are returned to students.

#### Evidence of Learning Worksheet: **Courses within the Botany Major**

Course: **BTNY 2114, Evolutionary Survey of the Plant Kingdom** Semester taught: **Spring 2020** Sections included: **CRN 31667**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated	Measure 1: A set of 4 multiple choice questions and two essay questions from Exam 1	Measure 1: 80% of students achieving 70 % or higher on 4 multiple choice and two essay questions	Measure 1: 100% of students scored a 70% or higher on Exam 1.	Measure 1: Threshold was met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Measure 2: A set of 16 multiple choice questions and one essay questions from Exam 4	Measure 2: 80% of students achieving 70 % or higher on 16 multiple choice and one essay questions	Measure 2: 100% of students scored a 70% or higher on Exam 4	Measure 2: Threshold was met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 2: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: A set of 9 multiple choice questions and one short answer questions from Quiz 7	Measure 1: 80% of students achieving 70 % or higher on 9 multiple choice questions and one short answer	Measure 1: 91% of students scored a 70% or higher on Quiz 7.	Measure 1: Threshold was met. Students demonstrated an understating of the dynamic interactions of living systems with each other and their environments	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: A set of 5 multiple choice questions and one essay questions from Final Exam	Measure 2: 100% of students scored a 70% or higher on 5 multiple choice questions from Exam 1	Measure 2: 83% of students scored a 70% or higher on the final exam.	Measure 2: Threshold was met. Students demonstrated an understating of the dynamic interactions of living systems with each other and their environments	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution	Measure 1: A set of 19 multiple choice questions from Exam 1	Measure 1: 100% of students scored a 70% or higher on 19 multiple choice questions	Measure 1: 100% of students scored a 70% or higher on Exam 1	Measure 1: Exam 1 had materials on the process of science, photosynthesis, and evolution. All students perform higher than a 70% on this exam. Assessment of particular materials within the exam are needed.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: Two lab practical	Measure 2: 100% of students	Measure 2: 100% of	Measure 2: Exam 1 had materials on the process	Measure 2: Include a separate lab practical	Analyze the specific questions from separate lab

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
explains both the unity and diversity of life.	assignments on building cladograms on Exam 1	scored a 70% or higher on two lab practical assignments	students scored a 70% or higher on Exam 1	of science, photosynthesis, and evolution. All students perform higher than a 70% on this exam. Assessment of particular materials within the exam are needed.	score with questions labeled for assessing student understanding of the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life	practical independently from overall scores. Keep a record of student performance
	Measure 3: A set of 6 multiple choice questions and 2 essay questions from Exam 3	Measure 3: % of students scored a 70% or higher on 6 multiple choice questions and 2 essay questions	Measure 3: 100% of students scored a 70% or higher on Exam 3	Measure 3: Threshold was met, but scores are from a compilation of many questions including some outside of this learning objective	Measure 3: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores
	Measure 4: A set of 3 multiple choice questions and 5 matching questions from Exam 4	Measure 4: 80% of students achieving 70 % or higher on 3 multiple choice questions and 5 matching questions	Measure 4: 100% of students scored a 70% or higher on Exam 4	Measure 4: Threshold was met, but it is unclear which questions on the exams were missed as exams were returned.	Measure 4: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance
	Measure 5: Oral presentation on a derived trait in plants	Measure 5: 80% of students achieving 70 % or higher on oral presentation	Measure 5: 91% of students scored a 70% or higher on the oral presentation	Measure 5: Students successfully demonstrated an understanding of the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life	Measure 5: No curricular or pedagogical changes needed at this time	



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: A set of 1 multiple choice, 1 matching, and 3 short answer questions on the Scientific process post lab quiz	Measure 1: 80% of students achieving 70 % or higher 1 multiple choice, 1 matching, and 3 short answer questions	Measure 1: 100% of students scored a 70% or higher on Post lab Quiz 1	Measure 1: Students successfully demonstrated an understanding of the process of science	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: A set of 3 multiple choice questions and 4 short answer questions from Exam 1	Measure 2: 80% of students achieving 70 % or higher on 3 multiple choice and two essay questions	Measure 2: 100% of students scored a 70% or higher on Exam 1.	Measure 2: Students successfully demonstrated an understanding of the process of science	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: An oral presentation on a derived trait in plants	Measure 1: 80% of students achieving 70 % or higher on oral presentation	Measure 1: 91% of students scored a 70% or higher on the oral presentation	Measure 1: Students successfully demonstrated oral communication skills	Measure 1: No curricular or pedagogical changes needed at this time  Include a measure of written communication skills such as a paper on the oral presentation topic	Analyze additional assessment of a variety of presentation formats
<b>Laboratory Skills</b> Students will demonstrate mastery of course appropriate laboratory skills, such as basic lab	Measure 1: A set of 8 lab practical questions on Exam 2	Measure 1: 80% of students achieving 70 % or higher on oral presentation	Measure 1: 77% of students scored a 70% or higher on Exam 2	Measure 1: Students successfully demonstrated basic light microscopy skills	Measure 1: Separate the exam score and lab practical score to get better assessment data on microscopy skills	
	Measure 2: A set of 5 lab practical questions on	Measure 2: 80% of students achieving 70 % or	Measure 2: 67% of students	Measure 2: Students did not successfully demonstrated basic light	Measure 2: Allow students more time to observe specimen with light	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
skills, molecular techniques, microscopy, and safety.	Microscopy post lab quiz	higher on oral presentation	scored a 70% or higher on the 5 questions on the post lab quiz	microscopy skills. It is unclear where the issue is	microscope and include more assessment of those skills with	
<b>Data Management Skills</b> Students will demonstrate the ability to maintain accurate and complete records of their work in formats such as lab notebooks and the ability to use various software applications such as ARCGIS and spreadsheets.	Measure 1: A set of 8 laboratory assignment in Lab Notebook Collection 1	Measure 1: 80% of students achieving 70 % or higher on 8 laboratory notebook assignments	Measure 1: 100% of students scored a 70% or higher on 8 laboratory notebook assignments	Measure 1: Students successfully demonstrated the ability to maintain accurate and complete records of their work	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: : A set of 7 laboratory assignment in Lab Notebook Collection 2	Measure 2: 80% of students achieving 70 % or higher on 7 laboratory notebook assignments	Measure 2: 100% of students scored a 70% or higher on 7 laboratory notebook assignments	Measure 2: Students successfully demonstrated the ability to maintain accurate and complete records of their work	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3 : A set of 6 laboratory assignment in Lab Notebook Collection 3	Measure 3: 80% of students achieving 70 % or higher on 7 laboratory notebook assignments	Measure 3: 91% of students scored a 70% or higher on 6 laboratory notebook assignments	Measure 3: Students successfully demonstrated the ability to maintain accurate and complete records of their work	Measure 3: No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

**Course: BTNY2121 Career Planning for Botanists Semester taught: Spring 2020**

**Sections included: 31703, n = 5**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Communicatio</b> n. Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	9 written assignments including a cover letter and resume, one oral presentation about career possibilities.	80% of the students achieving 70% or higher.	100% of the students met this threshold	The students met this LO well.	No changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This one-credit course focuses on communication with potential employers and development of their career trajectories. As such, focus is more on the communication of students' skills and experience than interpreting specific scientific experiments. All students performed well at meeting this LO.

**Course: BTNY2303 Ethnobotany VTRL**

**Semester taught: Spring 2021**

**Sections included: CRN 32557**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
Learning Outcome 1: Ecology & Evolution- Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: answering three essay quiz questions on ecology and human impact	Measure 1: 80% of students achieving 70% or higher	Measure 1: 88.2% of students achieved 70% or more	Measure 1: target goal was hit, students demonstrated good understanding of LO	no action needed	as in previous years, students demonstrated fair understanding of this LO
	Measure 2: Case study question on the effects of over-harvesting	Measure 2: 80% of students achieving 70% or higher	Measure 2: 50% of students achieved 70% or more	Measure 2: students did not meet the target- although their replies demonstrated understanding the issue, they didn't elaborate enough to get full credit	emphasize the need for detailed answers in essay questions	assess if that emphasis does the job- if not, consider different form of assessment.

<b>Learning Outcome 2: The Process of Science:</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	<b>Measure 1:</b> students designed an experiment	<b>Measure 1:</b> 80% of students achieving 70% or higher	<b>Measure 1:</b> 100% of students achieved 70% or more	<b>Measure 1:</b> target goal was hit, students demonstrated good understanding of LO	no action needed	as in previous years, students demonstrated fair understanding of this LO
	<b>Measure 2:</b> students analyzed scientific paper following questions from a work sheet in 2 person groups	<b>Measure 2:</b> 80% of students achieving 70% or higher	<b>Measure 2:</b> 94.1% of students achieved 70% or more	<b>Measure 2:</b> target goal was hit, students demonstrated good understanding of LO	no action needed	as in the previous year, students did well on this assessment

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

**Course: BTNY2413 Introduction to Natural Resource Management Semester taught: Fall 2019 Sections included: 22364, n = 17**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	2 case study reports (Grizzly bears and caribou)	80% of the students achieving 70% or higher.	82% of students met this threshold	Students met this LO well.	No changes needed.	This is consistent with past years’ performance despite changes in the programmatic outcomes.
<b>Quantitative Reasoning.</b> Students will represent	one case study report (invasive species management)	80% of the students achieving 70% or higher.	88% of students met this threshold	Students met this LO well.	No changes needed.	This is consistent with past years’ performance despite changes in the programmatic outcomes.

diverse experimental data sets graphically and apply statistical methods to them.						
<b>Communicatio</b> n. Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	7 case study reports; all required written communication incorporating the results of scientific studies.	80% of the students achieving 70% or higher.	94% of students met this threshold	Students met this LO well.	No changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Sustainability.</b> Students will use their knowledge of biology to address environmental issues and solutions.	4 case study reports (water, energy, sage grouse, forestry)  Method 2: 11 book journal reflections	80% of the students achieving 70% or higher.	91% of students met this threshold  Method 2: 100% of students met this threshold	Students met this LO well.	No changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This is a class that many students take early in their time at WSU, and it has a fairly high UW and I rate as students navigate finding their interests and balancing school work with their other responsibilities. The three students excluded from the data turned in very few assignments and frequently missed class; I suspect that pedagogical changes could not have affected that outcome. The students who were present and submitted work performed very well on all the learning objectives.

Evidence of Learning Worksheet: **Courses within the Botany Major**

**Course: BTNY 2600 (Laboratory Safety) Semester taught: F2019, SP2020, F2020, & SP2021 Sections included: 22017, 32059, 22739, & 31623,N=82**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Laboratory Skills</b> Students will demonstrate mastery of course appropriate laboratory skills, related to <b>laboratory safety</b> .	<b>Overall Laboratory and Field Safety</b> Measure 1: Two exams include the following Laboratory Safety topics covered in this course	80% of students will score 70% or above	Measure 1: <u>Exam 1</u> : 91.5% of students scored 70% or better <u>Exam 2</u> : 100% of students scored 70% or better	Measure 1: Students successfully demonstrated an overall understanding of Laboratory and Field Safety	Measure 1: No curricular or pedagogical changes needed at this time	Measure 1: Continue current practices of posting PowerPoints and videos on Canvas and have some hands-on activities and lectures for this hybrid course
	Measure 2: Hands-on safety audit of a Botany lab	80% of students will score 70% or above	Measure 2: 100% of students scored 70% or better	Measure 2: Students successfully conducted a laboratory audit for general lab safety related to topics covered in the course	Measure 2: No curricular or pedagogical changes needed at this time	Measure 2: Continue current lab audit exercise (much better in person), perhaps expanding to discipline-specific labs for this cross-listed course
	<b>Chemical Safety:</b> Measure 1: 15 question Quiz on OSHA and Chemical Safety	80% of students will score 70% or above	Measure 1: 97.4% of students scored 70% or better	Measure 1: Students successfully demonstrated an understanding of chemical safety skills	Measure 1: No curricular or pedagogical changes needed at this time	Measure 1: Continue current practice of posting all PowerPoints and videos on Canvas.
	Measure 2: Homework assignment in which students must determine how to store 20 chemicals by reading Safety Data Sheets (SDS). Understanding of	80% of students will score 70% or above	Measure 2: 68.1% of students scored 70% or better	Measure 2: In Fall 2019 (F2F), students successfully demonstrated an understanding of chemical storage skills. In Spring 2020 & Fall 2021 students almost reached the threshold. In Spring 2021 students performed	Measure 2: This assignment needs to be explained better to students, which happened in the face-to-face portion of this hybrid course, but not as effectively on-line.	Measure 2: More clarification is needed in explaining the assignment and more guidance will be offered in SDS interpretation henceforth.

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	<p>basic PPE &amp; earthquake precautions for chemical storage are also assessed.</p> <p><b>Biological Hazards Safety:</b> Measure 1: 16 question Quiz on Biohazards Safety</p> <p><b>General Laboratory Safety:</b> (PPE, lab equipment, fume hoods, biological safety cabinets, occupational safety, &amp; hazardous waste disposal)</p> <p>Measure 1: 10 question Quiz on General Lab Safety covering equipment, hazardous waste and hoods</p> <p>Measure 2: 10 question Quiz on General Lab Safety covering PPE and basic Occupational Safety</p> <p>Measure 3: Homework in</p>	<p>80% of students will score 70% or above</p> <p>80% of students will score 70% or above</p> <p>80% of students will score 70% or above</p> <p>80% of students will score 70% or above</p>	<p>Measure 1: 96.4% of students scored 70% or better</p> <p>Measure 1: 94.8% of students scored 70% or better</p> <p>Measure 2: 96.7% of students scored 70% or better</p> <p>Measure 3: 93.4% of students scored 70% or better</p>	<p>poorly in regards to chemical storage. During the pandemic, on-line students did not perform as well.</p> <p>Measure 1: Students successfully demonstrated an understanding of biohazard safety skills</p> <p>Measure 1: Students successfully demonstrated an understanding of equipment, hazardous waste and hoods safety skills</p> <p>Measure 2: Students successfully demonstrated an understanding of PPE and basic Occupational Safety skills</p> <p>Measure 3: Students successfully demonstrated an understanding of the</p>	<p>Measure 1: No curricular or pedagogical changes needed at this time</p> <p>Measure 1: No curricular or pedagogical changes needed at this time</p> <p>Measure 2: No curricular or pedagogical changes needed at this time</p> <p>Measure 3: No curricular or pedagogical changes needed at this time</p>	<p>Measure 1: Continue current practice of posting all PowerPoints and videos on Canvas.</p> <p>Measure 1: Continue current practice of posting all PowerPoints and videos on Canvas. Training videos on the use of specific lab equipment have been useful.</p> <p>Measure 2: With turnover in the Environmental Safety office on campus, new instructors will be brought in for this section and updates will be made for Spring 2022.</p> <p>Measure 3: Continue to have students think about risk minimization in their chosen career path.</p>

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	<p>which students discuss 5 hazards that they will encounter in their chosen career and how they will minimize the risks associated with them.</p> <p><b>Fire Safety:</b> (Types of fires &amp; extinguishers as well as a hands-on exercise where students use a fire extinguisher)</p> <p>Measure 1: 16 question Quiz on Fire safety</p>	80% of students will score 70% or above	Measure 1: 100% of students scored 70% or better	<p>hazards they will face in their career of choice and how to minimize the risk posed by each</p> <p>Measure 1: Students successfully demonstrated an understanding of Fire Safety skills</p>	Measure 1: No curricular or pedagogical changes needed at this time	Measure 1: Continue to have hands-on experience of students using a fire extinguisher. A joint grant to purchase a practice kit using a laser-equipped extinguisher pointed at a screen is being discussed as CO2 extinguishers are wasteful.
<p><b>Field Skills</b> Students will demonstrate mastery of course appropriate skills related to <b>field safety.</b></p>	<p><b>Field Safety:</b> Two weeks are devoted to field safety issues (driving, weather, animal encounters, mosquito &amp; tick-borne diseases, basic first aid measures, etc.)</p> <p>Measure 1: 10 question Quiz on Field Safety</p>	80% of students will	Measure 1: 97.5% of	Measure 1: Students successfully demonstrated	Measure 1: No curricular or pedagogical changes needed at this time	Measure 1: Continue offering this as a two-week topic. This is one of the



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		score 70% or above	students scored 70% or better	an understanding of Field Safety		students' favorite topics in the course. Dr. John Sohl, an emergency rescue responder, imparts first-hand knowledge and experiences that engages students.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This is a hybrid course cross-listed in five departments and required for several majors in the COS, including the new Environmental Sciences major. It is team-taught by instructors in Botany, Microbiology, Zoology, Physics as well as the Environmental/Safety office on campus. It is designed to cover a variety of laboratory, fire, and field safety topics to expose all students to areas of safety that they may not encounter in their field of study but they may need to know later in their careers. **The data presented in the assessment table above is only for students registered in BTNY 2600 (not CHEM 2600, GEO 2600, MICR 2600 or PHYS 2600).**

Topics not listed in the assessment report above also include Radiation Safety, Laser Safety, Ethical Treatment of Animals in Research, Toxicology, and Risk Analysis. Students have quizzes on each of these topics as well, on which they perform equally well as the topics listed in the above assessment table. These were not included in the assessment data because they are either extremely specific to certain fields (Radiation, Lasers, and Ethical Treatment of Animals in Research) or very general (Toxicology and Risk Analysis). The latter provide a general framework in which to approach safety and risk, but do not fit into Laboratory or Field Safety specifically, but rather span all aspects of laboratory and field safety.

There has been a turnover in personnel in the Environmental/Safety office and in some departments. Once the person who developed and has coordinated the course retires, as well as some other instructors, the course will have to be re-staffed and will most likely be restructured. A new coordinator (who also teaches 1/3 of the class topics) will also be needed within two years.

NOTE: Many quizzes and exams include essay questions. Hence, although there may not be many questions, students must demonstrate a clear understanding of topics and be able to communicate this in coherent sentences.

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Cellular, Developmental, Genetics, and Molecular 1.</b> Students are able to describe and explain fundamental topics about the chemical and molecular machinations operating within all biological processes.	Measure 1: Six essay exam questions over two exams	Measure 1: 90% of students scoring 80% or higher	Measure 1: 88.9% (8/9) of students scored 80% or higher	Measure 1: Target threshold was met. (With 9 students, if just 1 does not meet the target, the class will be under 90% for meeting the target.)	Measure 1: No curricular or pedagogical changes needed at this time	
<b>Cellular, Developmental, Genetics, and Molecular 2.</b> Students are able to describe and explain fundamental topics about the centrality of genetic systems' governance of life's actions from the cellular to the phyletic.	Measure 1: Eight essay exam questions over two exams	Measure 1: 90% of students scoring 80% or higher	Measure 1: 66.7% (6/9) of students scored 80% or higher	Measure 1: Target threshold was not met.	Measure 1: Homework assignments and quizzes were optional. Lower performing students tended to not do them. Make scores on low stakes homework assignments and quizzes a small percentage (10%) of the final grade to encourage students to do them in preparation for exams.	Will see if the addition of low stakes practice assignments/quizzes makes a difference the next time the course is taught.

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 2: Oral report on a specific type of plant cell based on information in the primary research literature.	Measure 2: 90% of students scoring 80% or higher	Measure 2: All students met the target.	Measure 2: All students successfully communicated the hypothesis, methodology, results, and conclusions of published research on a specialized plant cell.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Three essays directed toward for a general audience that were based on information in the primary research literature on model organisms, plant movements, and symbiosis.	Measure 3: 90% of students scoring 80% or higher	Measure 3: All students met the target for all three essay topics.	Measure 3: All students successfully interpreted and communicated the scientific literature for a general audience.	Measure 3: No curricular or pedagogical changes needed at this time	
<b>Anatomy, Physiology, &amp; Organismal</b> Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Measure 1: Eighteen essay exam questions over three exams	Measure 1: 90% of students scoring 80% or higher	Measure 1: 55.6% (5/9) of students scored 80% or higher	Measure 1: Target threshold was not met.	Measure 1: Homework assignments and quizzes were optional. Lower performing students tended to not do them. Make scores on low stakes homework assignments and quizzes a small percentage (10%) of the final grade to encourage students to do them in preparation for exams.	Will see if the addition of low stakes practice assignments/quizzes makes a difference the next time the course is taught..

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 2: Oral report on a specific type of plant cell based on information in the primary research literature.	Measure 2: 90% of students scoring 80% or higher	Measure 2: All students met the target.	Measure 2: All students successfully communicated the hypothesis, methodology, results, and conclusions of published research on a specialized plant cell.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Three essays directed toward for a general audience that were based on information in the primary research literature on model organisms, plant movements, and symbiosis.	Measure 3: 90% of students scoring 80% or higher	Measure 3: All students met the target for all three essay topics.	Measure 3: All students successfully interpreted and communicated the scientific literature for a general audience.	Measure 3: No curricular or pedagogical changes needed at this time	
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: Oral report on a specific type of plant cell based on information in the primary research literature.	Measure 1: 90% of students scoring 80% or higher	Measure 1: All students met the target.	Measure 1: All students demonstrated understanding of the scientific process used the study of their selected cell type.	Measure 1: No curricular or pedagogical changes needed at this time	
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: Oral report on a specific type of plant cell based on information in the primary research literature.	Measure 1: 90% of students scoring 80% or higher	Measure 1: All students met the target.	Measure 1: All students successfully communicated the hypothesis, methodology, results, and conclusions of published research on a specialized plant cell.	Measure 1: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 2: Three essays directed toward for a general audience that were based on information in the primary research literature on model organisms, plant movements, and symbiosis.	Measure 2: 90% of students scoring 80% or higher	Measure 2: All students met the target for all three essay topics.	Measure 2: All students successfully interpreted and communicated the scientific literature for a general audience.	Measure 2: No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This course is taught alternate years, which means the opportunities to implement course revisions are infrequent as well as delayed from when the class was last taught.

**Evidence of Learning Worksheet: Courses within the Major**

**Course: BTNY3204 (Plant Physiology)**

**Semester taught: Fall 2019**

**Sections included: 22369**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
Learning Outcome 1: The chemical and molecular machinations operating within all biological processes	Measure 1: at least two essay questions in exams	Measure 1: 90% of students scoring 80% or higher	Measure 1: 66.67% of students scored 80% or higher	Measure 1: Two out of three students scored between 80 and 100% on these questions while one always scored below. With such a small class, all students would need to score at least in the 80% range to achieve this goal	get a larger class for a better assessment of learning	
	Measure 2: lab report on respiration	Measure 2: 90% of students scoring 80% or higher	Measure 1: 66.67% of students scored 80% or higher	Measure 2: Two out of three students scored 80 and 100% on this lab report while one always didn't turn it in.	Make sure students are motivated and	This was a new experiment, needs repetition to close loop

					have time to turn lab reports in	
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Measurable Learning Outcome	Method of Measurement	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Close the Loop”
Students will...						
Learning Outcome 2: The coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Measure 1: three essay questions on exam	Measure 1 90% of students scoring 80% or higher	Measure 1: 66.67% of students scored 80% or higher	Measure 1: Two out of three students scored between 80 and 100% on these questions while one always scored below. With such a small class, all students would need to score at least in the 80% range to achieve this goal	get a larger class for a better assessment of learning	
	Measure 2: lap reports on respiration and photosynthesis	Measure 2: 90% of students scoring 80% or higher	Measure 2: 33.3% of students scored 80% or higher	Measure 2: one out of three students scored 80% or higher. The other two did not invest enough care into their reports	Measure 2: use a clear rubric for assessment	
Learning Outcome 3: The dynamic interaction of living systems with each other and their environments	Measure 1: three exam essay questions	Measure 1: 90% of students scoring 80% or higher	Measure 1: 100% of students achieved the goal for two of the questions, for the third question, two students (66%) achieved it	Measure 1: students did OK on this goal, but performance should be improved	Measure 1: spend more time explaining connections and consequences	
	Measure 2: student presentation on plant defence chemicals	Measure 2: 90% of students scoring 80% or higher	Measure 2: 100% of students achieved the goal	Measure 2: students understood the implications of plant defence compounds on the ecology of plants	Measure 2: no action needed	
Learning Outcome 4: The transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	three essay questions in two exams	Measure 1: 90% of students scoring 80% or higher	students achieved the goal for two out of three questions	despite this not having a 100% success rate, I would conclude that students meet the LO	no action needed	
	discussion of lecture materials in class	Measure 2: 90% of students	no student achieved the goal.	Class was using flipped classroom approach to encourage participation and students were	do not use flipped classroom and/or find other ways off assessment	

		scoring 80% or higher		often poorly prepared, esp towards end of semester		
Learning Outcome 6: <b>The Process of Science:</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	measure 1: five essay exam questions	Measure 1: 90% of students scoring 80% or higher	in two questions 100% of students achieved the goal, in two only one (33%) achieved the goal, and in one question two (66%) achieved it	Overall, students demonstrated understanding of LO, a larger class might help make this more obvious	integrate more data analysis in theoretical part	
	lab reports	Measure 2: 90% of students scoring 80% or higher	one student (33%) achieved the goal, although the other two were just under the threshold	Students need a better understanding of critical data evaluation and discussion	fewer lab reports and a clearer rubric that allows students to succeed	
Learning Outcome 7: <b>Quantitative Reasoning:</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	lab reports	Measure 1: 90% of students scoring 80% or higher	one student (33%) achieved the goal, although the other two were just under the threshold	Students need a better understanding of critical data evaluation and discussion	fewer lab reports and a clearer rubric that allows students to succeed	
	two essay exam questions	Measure 2: 90% of students scoring 80% or higher	66% of students achieved the goal	two out of three students scored between 80 and 100% on these questions while one always scored below. With such a small class, all students would need to score at least in the 80% range to achieve this goal		
Learning Outcome 8: <b>Communication:</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: lab reports	Measure 1: 90% of students scoring 80% or higher	one student (33%) achieved the goal, although the other two were just under the threshold	Students need a better understanding of critical data evaluation and discussion	fewer lab reports and a clearer rubric that allows students to succeed	
	Measure 2: lap report on independent project (free report format)	Measure 2: 90% of students scoring 80% or higher	Measure 2: 100% of students achieved the goal	Measure 2: students presented their independent projects in an acceptable to excellent manner	Measure 2: no action needed	

\*At least one measure per objective must be a direct measure; indirect measures may be used to supplement direct measure(s).

Additional narrative (optional – use as much space as needed):

the course was very small and this evaluation of whether or not learning outcomes were achieved is difficult: whenever one student stays below the threshold, the goal cannot be achieved. Active participation and quality of contributions was recorded and made up 20% of the final grade. This, however, did not inspire students to come

to class prepared (despite signing a “flipped classroom contract” at the beginning of the semester). Most topics had to be discussed from the basics up, so that more advanced literature and discussions could not be implemented. Overall, lab reports were poorly done, despite lots of continuous feedback. I think a more rigorous rubric and fewer lab reports to write overall (i.e. not for every lab) will improve this. I want to also put even more emphasis on the active science aspect, so possibly reduce the number of labs overall.

Evidence of Learning Worksheet: **Courses within the Major**

Course: **BTNY 3214 (Soils)**

Semester taught: **Spring 2021**

Sections included: **CRN 32752**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: An essay question on homework 1	Measure 1: 90% of students scored a 80% or higher on homework 1	Measure 1: 70% of students scored a 80% or higher on homework 1.	Measure 1: Threshold was not met. Meeting this threshold in a class of 10 students is very hard. Students that did not meet this threshold did not allocate enough time to their homework assignments and didn't answer everything completely. Excluding those students, students were able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: A set of 2 multiple choice questions, 3 drawing questions, 3 short answer, and 2 essay questions on midterm 1	Measure 2: 90% of students scored a 80% or higher on 2 multiple choice questions, 3 drawing questions, 3 short answer,	Measure 2: 70% of students scored a 80% or higher on the midterm exam	Measure 2: Threshold was not met. Meeting this threshold in a class of 10 students is very hard. 80% of the students had over a 75% on Exam 1. The exam did include mathematical calculations. I do not have data for individual questions within the	Measure 2: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		and 2 essay questions		exam, but excluding that section would improve the performance of students.		
	Measure 3: A set of 5 multiple choice questions, 2 drawing questions, 8 short answer, and 2 essay questions on Final Exam	Measure 3: 90% of students scored a 80% or higher on 5 multiple choice questions, 2 drawing questions, 8 short answer, and 2 essay questions	Measure 3: 70% of students scored a 80% or higher on the midterm exam	Measure 3: Threshold was not met. 90% of students were above a 73%. For a year still disrupted by Covid19, the overwhelming majority of students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments. Excluding one student that had overall poor participation results in the threshold being met.	Measure 3: No curricular or pedagogical changes needed at this time	
	Measure 4: A set of 6 short answer questions and one essay question on homework 4	Measure 1: 90% of students scored a 80% or higher on homework 4	Measure 1: 80% of students scored a 80% or higher on homework 4.	Measure 4: When you remove the student with poor participation the threshold is met. Students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments. Excluding the one student that had overall poor participation makes obtaining the feasible	Measure 4: No curricular or pedagogical changes needed at this time	
	Measure 5: Soil Biota Lab written Assignment.	Measure 5: 90% of students scored a 80%	Measure 1: 100% of students scored	Measure 5: Students demonstrated an understanding of the dynamic interaction of	Measure 5: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		or higher on Soil Biota Lab work	a 80% or higher on homework 4.	living systems with each other and their environments.		
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: A final draft of a research paper that represents the culmination of course-based research	Measure 1: 90% of students scored a 80% or higher on final research paper	Measure 1: 67% of students scored a 80% or higher on annotated bibliography	Measure 1: Threshold was not met. It is unclear why, as students were provided feedback on their rough drafts of their research paper. Several students changed nothing and turned in the same paper with the same issues that were highlighted by me in the first draft. These students were also not engaged in the course-based research project.	Measure 1: Assign smaller assignments related to the CUR to help assess the process of science course objective.	
<b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	Measure 1: A set of 2 short answer questions, and 3 calculation questions on midterm 1	Measure 1: 90% of students scored a 80% or higher on 2 multiple choice questions, 3 drawing questions, 3 short answer, and 2 essay questions	Measure 1: 70% of students scored a 80% or higher on the midterm exam	Measure 1: Threshold was not met. 80% of the students had over a 75% on Exam 1. However, the mathematical calculations and interpretations are where many struggled. I do not have data for individual questions within the exam, and need to include so in future sections.	Measure 1: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 2: A final draft of a research paper	Measure 2: 90% of students scored a 80% or higher on	Measure 2: 67% of students scored a 80% or higher on	Measure 2: Threshold was not met. Several students did not attempt to fix their statistical methods sections or graphs despite	Measure 2: Spend more time on introducing students to diverse experimental data sets, how to represent them	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		final research paper	annotated bibliography	feedback from me on their rough drafts.	graphically, and how to apply statistical methods to them	
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: An annotated bibliography of peer reviewed literature	Measure 1: 90% of students scored a 80% or higher on annotated bibliography	Measure 1: 67% of students scored a 80% or higher on annotated bibliography	Measure 1: Threshold was not met. Several students did not complete the assignment as they procrastinated starting and then realized how much work it was.	Measure 1: Assign weekly annotations rather than one annotation assignment that students can procrastinate. This will also give them more feedback as they are working to annotate primary literature	Measure 1: Analyze each assignment independently.
	Measure 2: A final draft of a research paper	Measure 2: 90% of students scored a 80% or higher on final research paper	Measure 2: 67% of students scored a 80% or higher on annotated bibliography	Measure 2: Threshold was not met. It is unclear why, as students were provided feedback on their rough drafts of their research paper. Several students changed nothing and turned in the same paper with the same issues that were highlighted by me in the first draft.	Measure 2: Assign peer reviews in addition to my comments and edits on the rough draft. Make the due date earlier in the semester if possible.	
<b>Sustainability.</b> Students will use their knowledge of biology to address environmental issues and solutions.	Measure 1: A set of 4 short answer questions on homework 1	Measure 1: 90% of students scored a 80% or higher on homework 1	Measure 1: 70% of students scored a 80% or higher on homework 1.	Measure 1: Threshold was not met. Meeting this threshold in a class of 10 students is very hard. Students that did not meet this threshold did not allocate enough time to their homework assignments and didn't answer everything completely. Excluding those students, students	Measure 1: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
				were able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments		
	Measure 2: A set of 3 short answer, 2 calculation problems and 2 essay questions on the midterm exam	Measure 2: 90% of students scored a 80% or higher on 3 short answer, 2 calculation problems and 2 essay questions	Measure 2: 70% of students scored a 80% or higher on the midterm exam	Measure 2: Threshold was not met. Meeting this threshold in a class of 10 students is very hard. 80% of the students had over a 75% on Exam 1. The exam did include mathematical calculations. I do not have data for individual questions within the exam, but excluding that section would improve the performance of students.	Measure 2: Reorganize exams so that questions are blocked by learning outcome and better record data on those specific questions	Analyze the specific questions from exams independently from overall scores. Keep a record of student performance.
	Measure 3: A set of 5 short answer questions on homework 4	Measure 3: 90% of students scored a 80% or higher on homework 4	Measure 3: 80% of students scored a 80% or higher on homework 4.	Measure 3: When you remove the student with poor participation the threshold is met. Students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments. Excluding the one student that had overall poor participation makes obtaining the feasible	Measure 3: No curricular or pedagogical changes needed at this time	
	Measure 4: A set of 2 multiple choice questions, 4 short	Measure 4: 90% of students	Measure 4: 70% of students scored a 80% or	Measure 4: Threshold was not met. 90% of students were above a 73%. For a	Measure 4: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	answer, and 2 True/False questions on Final Exam	scored a 80% or higher 2 multiple choice questions, 4 short answer, and 2 True/False questions	higher on the midterm exam	year still disrupted by Covid19, the overwhelming majority of students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments. Excluding the one student that had overall poor participation makes obtaining the feasible		
<b>Laboratory Skills</b> Students will demonstrate mastery of course appropriate laboratory skills, such as basic lab skills, molecular techniques, microscopy, and safety.	Measure 1: Formal Lab report on Soil Moisture Measurements	Measure 1: 90% of students scored a 80% or higher on lab work	Measure 1: 89% of students scored a 80% or higher on lab work	Measure 1: Threshold was not met. Meeting this threshold in a class of 10 students is very hard. Of the 9 students that completed the lab write-up, one student was below the threshold.	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Formal Lab report on Soil pH and Organic Matter	Measure 2: 90% of students scored a 80% or higher on lab work	Measure 2: 100% of students scored a 80% or higher on lab work	Measure 2: Students demonstrated mastery of course appropriate laboratory skills	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Formal Lab report on Soil Water movement	Measure 3: 90% of students scored a 80% or higher on lab work	Measure 3: 100% of students scored a 80% or higher on lab work	Measure 3: Students demonstrated mastery of course appropriate laboratory skills	Measure 3: No curricular or pedagogical changes needed at this time	
<b>Data Management Skills</b> Students will demonstrate the	Measure 1: A final draft of a research paper	Measure 1: 90% of students scored a 80% or higher on	Measure 1: 67% of students scored a 80% or higher on	Measure 1: Threshold was not met. It is unclear why. as students were provided feedback on their rough drafts of their	Measure 1: Include more assessment of their progress in the CUR	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
ability to maintain accurate and complete records of their work in formats such as lab notebooks and the ability to use various software applications such as ARCGIS and spreadsheets.		final research paper	annotated bibliography	research paper as well as throughout the project.		
	Measure 2: Formal Lab report on Soil pH and Organic Matter	Measure 2: 90% of students scored a 80% or higher on lab work	Measure 2: 100% of students scored a 80% or higher on lab work	Measure 2: Students demonstrated mastery of course appropriate laboratory skills	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Formal Lab report on Soil Water movement	Measure 3: 90% of students scored a 80% or higher on lab work	Measure 3: 100% of students scored a 80% or higher on lab work	Measure 3: Students demonstrated mastery of course appropriate laboratory skills	Measure 3: No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

**Course: BTNY3454 Plant Ecology**

**Semester taught: Fall 2019**

**Sections included: CRN 22365 n = 14**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated regulation of	Measure 1: A written homework assignment focused on organismal ecology of plants.  Measure 2: Three exams included short-answer questions about the	90% of the students achieving 80% or higher.	Measure 1: 100% of students met this objective.  Measure 2: 100% of students met this objective.	Measure 1: Students met this LO well.  Measure 2: Exam questions were not aligned to assess the three sub-disciplines of biology that we covered and so the students' mastery of	Measure 1: No pedagogical changes needed.  Measure 2: Though students were successful at meeting all three breadth LOs, exam questions need to be aligned in future years to	This is consistent with past years' performance despite changes in the programmatic outcomes.

integrated cellular systems and their effect on the physiological functioning of organisms	organismal ecology of plants.			each could not be adequately assessed.	assess these LOs separately.	
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: 12 written homework assignments focused on plant ecology.  Measure 2: Three exams included short-answer questions about the ecology of plants.	90% of the students achieving 80% or higher.	Measure 1: 100% of students met this objective.  Measure 2: 100% of students met this objective.	Measure 1: Students met this LO well.  Measure 2: Exam questions were not aligned to assess the three sub-disciplines of biology that we covered and so the students' mastery of each could not be adequately assessed.	Measure 1: No pedagogical changes needed.  Measure 2: Though students were successful at meeting all three breadth LOs, exam questions need to be aligned in future years to assess these LOs separately.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	Measure 1: A written homework assignment focused on plant evolution.  Measure 2: Three exams included short-answer questions about the evolutionary ecology of plants.	90% of the students achieving 80% or higher.	Measure 1: 100% of students met this objective.  Measure 2: 100% of students met this objective.	Measure 1: Students met this LO well.  Measure 2: Exam questions were not aligned to assess the three sub-disciplines of biology that we covered and so the students' mastery of each could not be adequately assessed.	Measure 1: No pedagogical changes needed.  Measure 2: Though students were successful at meeting all three breadth LOs, exam questions need to be aligned in future years to assess these LOs separately.	This is consistent with past years' performance despite changes in the programmatic outcomes.

<p><b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.</p>	<p>Measure 1: Students completed a group research project and developed individual written reports.</p> <p>Measure 2: Students completed independent projects and developed written reports.</p>	<p>90% of the students achieving 80% or higher.</p>	<p>Measure 1: 31% of students met this objective.</p> <p>Measure 2: 69% of students met this objective.</p>	<p>Method 1: Students did not meet this LO in the first assessment of the semester. This assessment is a scaffolding exercise to support the more intensive individual projects.</p> <p>Method 2: Students did not meet this learning outcome even in the final version.</p>	<p>This was very challenging for students - for many it was their first experience developing and completing a scientific research project. In the future I will develop more scaffolding assignments to support their work in this area.</p>	<p>This was not an outcome I assessed in past years.</p>
<p><b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.</p>	<p>Measure 1: Students analyzed the results from a remote sensing study.</p> <p>Measure 2: Students analyzed the results of independent projects and submitted these analyses prior to the full report.</p>	<p>90% of the students achieving 80% or higher.</p>	<p>Measure 1: 93% of students met this objective.</p> <p>Measure 2: 100% of students who submitted results prior to the full report met objectives. 4 students did not submit preliminary results. Two of these met this objective in the final report stage.</p>	<p>Method 1: Students met this LO well.</p> <p>Method 2: Students met this LO well with the exception that some students put off their project and were unable to turn in their analyses prior to the full written report.</p>	<p>No pedagogical changes needed.</p>	<p>This is consistent with past years' performance despite changes in the programmatic outcomes.</p>
<p><b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences</p>	<p>Measure 1: Students communicated the results of independent projects orally.</p> <p>Measure 2: Students communicated the</p>	<p>90% of the students achieving 80% or higher.</p>	<p>Measure 1: 100% of students met this objective.</p> <p>Measure 2: 69% of students met this objective.</p>	<p>Students met this LO well for the oral component and struggled more with the written component.</p>	<p>No pedagogical changes needed for oral communication. The written report reflects both written communication skills and the quality of their study and analysis. I suspect that the written communication was</p>	<p>This is consistent with past years' performance despite changes in the programmatic outcomes.</p>



	results of independent projects as written reports.				successful and that the lack of meeting LO was reflective of the struggles with quantitative reasoning. Next year I will assess these components separately.	
<b>Sustainability.</b> Students will use their knowledge of biology to address environmental issues and solutions.	Measure 1: Students had a written homework assignment addressing this topic.	90% of the students achieving 80% or higher.	100% of students met this objective.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Field Skills.</b> Students will demonstrate an ability to use field skills such as navigation, plant identification, plant measurement, and safety.	Three labs required fieldwork skills to be successful. Two labs focused on plant identification, and one on methods of field measurements.	90% of the students achieving 80% or higher.	100% of students met this objective.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Data Management Skills.</b> Students will demonstrate the ability to keep accurate records of their work and/or analyze their data using spreadsheets and statistical software.	Measure 1: Students will maintain a field notebook with their observations, which was assessed throughout the semester.	90% of the students achieving 80% or higher.	Measure 1: 100% of students met this objective.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed): This course covers quite a lot of the LOs within the major, with a focus on organismal and ecological scales, development of three of the four core competencies and two of the three skillsets. This means that many LOS are assessed within the course. As we move forward with the new programmatic outcomes, I would like to be more intentional about assessing each of the LOs separately. Despite these changes, minimal adjustment seems to be needed to the pedagogy to meet the desired LOs.

**Course: BTNY 3473, Plant Geography Semester taught: Fall 2020 Sections included: 22785, n=14**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	Exam question (Exam 1, question 6) on adaptations of plants to particular ecosystems	80% of the students achieving 70% or higher.	74% of students met this threshold	Many other students were just below the threshold (69%, not 70%)	I will emphasize this topic more and provide more examples and time for discussion in future classes	In future exams, determine if the additional emphasis supports student understanding of the topic
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Exam question (Exam 1, question 6) on adaptations of plant-environment interactions	80% of the students achieving 70% or higher.	79% of students met this threshold	Students were just below the threshold.	I will emphasize this topic more and provide more examples and time for discussion in future classes	In future exams, determine if the additional emphasis supports student understanding of the topic
<b>Ecology and Evolution.</b> Students are able to describe and	Exam question (Exam 2, question 4) on adaptations of	80% of the students achieving 70% or higher.	85% of students met this threshold	Students met this LO well.	No changes needed.	No changes needed.

explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	plants to particular ecosystems					
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1:  Class project on distribution of plant taxa	80% of the students achieving 70% or higher.	100% of students met this threshold	Students met this LO well.	No changes needed.	No changes needed.
<b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	Class activity on the relationships of floras	80% of the students achieving 70% or higher.	100% of students met this threshold based on indirect assessment	Students met this LO well.	No changes needed.	No changes needed.
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Figure presentation and lightning talks on peer-reviewed scientific literature	80% of the students achieving 70% or higher.	100% of students met this threshold	Students met this LO well.	No changes needed.	No changes needed.
<b>Navigation</b> Students will demonstrate knowledge and application of navigation skills, such as GPS, Mapping, and Remote Sensing.	Floristic boundaries virtual transect	80% of the students achieving 70% or higher.	100% of students met this threshold based on indirect assessment	Students met this LO well.	No changes needed.	No changes needed.

<b>Plant Identification</b> Students will demonstrate knowledge and application of plant identification skills such as dichotomous keying, common Utah flora, and curating specimens.	Floristic boundaries virtual transect	80% of the students achieving 70% or higher.	100% of students met this threshold based on indirect assessment	Students met this LO well.	No changes needed.	No changes needed.
<b>Data Management</b> Students will demonstrate the ability to use various software applications such as ARCGIS, R, spreadsheets, and databases.	Class activity on the relationships of floras that involves the use of R	80% of the students achieving 70% or higher.	100% of students met this threshold based on indirect assessment	Students met this LO well.	No changes needed.	No changes needed.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This was my first time teaching this class, and I taught it virtually given the situation with COVID. Therefore, some of the activities that I would have liked to have undertaken with the students were not possible. I would expect that in future (in-person) semesters we will be able to get a better sense of the Utah flora.

**Course: BTNY 3504 (Mycology)**

**Semester taught: Fall 2020**

**Sections included: CRN 22787**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental	Measure 1: A series of 4 multiple response questions on the midterm	Measure 1: 90% of students scored a 80% or higher on a series of 4 multiple	Measure 1: 91% of students scored a 80% or higher on case study work	Measure 1: Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect	Measure 1: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms		response questions		on the physiological functioning of organisms		
	Measure 2: A series of 4 multiple response questions on the midterm					
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 1: A total of 14 multiple choice, matching, fill in the blank, and shot answer questions on quiz 9	Measure 1: 90% of students scored a 80% or higher 14 multiple choice, matching, fill in the blank, and shot answer questions	Measure 1: 70% of students scored a 80% or higher on case study work	Measure 1: Students did not meet the threshold. It was an online asynchronous course during a global pandemic	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: A series of 3 assignments as part of a case study on mycorrhizas	Measure 2: 90% of students scored a 80% or higher on case study	Measure 2: 100% of students scored a 80% or higher on case study work	Measure 2: Students successfully described and explained fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: A series of 3 assignments as part of a case study on plant pathogens	Measure 3: 90% of students scored a 80% or higher on case study	Measure 3: 100% of students scored a 80% or higher on case study work	Measure 3: Students successfully described and explained fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 3: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 4: A series of 4 assignments as part of a case study on bat fungal interactions	Measure 4: 90% of students scored a 80% or higher on case study	Measure 4: 100% of students scored a 80% or higher on case study work	Measure 4: Students successfully described and explained fundamental topics about the dynamic interaction of living systems with each other and their environments	Measure 4: No curricular or pedagogical changes needed at this time	
	Measure 5: A series of 2 matching, 2 true/false, 3 short answer, and 1 essay question on the final exam	Measure 5: 90% of students scored a 80% or higher on 2 matching, 2 true/false, 3 short answer, and 1 essay questions	Measure 5: 90% of students scored a 80% or higher on final exam materials	Measure 5: Students successfully described and explained fundamental topics about the dynamic interaction of living systems with each other and their environments		
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	Measure 1: A series of 5 short answer and two essay questions on the midterm	Measure 1: 90% of students scored a 80% or higher on a series of 5 short answer and two essay questions	Measure 1: 60% of students scored a 80% or higher on midterm	Measure 1: Students did not meet the threshold. It was an online asynchronous course during a global pandemic	Measure 1: Teach the course face to face.	
	Measure 2: A series of 2 short answer questions on the final exam	Measure 2: 90% of students scored a 80% or higher on 2 short answer questions	Measure 2: 100% of students scored a 80% or higher on final exam questions	Measure 2: Students successfully described and explained fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: Experimental Design Assignment of the Design Your Own Experiment (DYOE) CURE	Measure 1: 90% of students scored a 80% or higher on Experimental Design Assignment	Measure 1: 100% of students scored a 80% or higher on Experimental Design Assignment	Measure 1: Students successfully used observational strategies to test hypotheses and critically evaluate experimental evidence	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Research Data Collection Assignment	Measure 2: 90% of students scored a 80% or higher on Research Data Collection	Measure 2: 82% of students scored a 80% or higher on Data Collection	Measure 2: Threshold was not met. Two students failed to complete their final project. This was an online asynchronous course during Covid19.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Final draft of the research paper on the DYOE CURE	Measure 3: 90% of students scored a 80% or higher on Experimental Design Assignment Final Paper	Measure 3: 90% of students scored a 80% or higher on final paper	Measure 3: Students successfully used observational strategies to test hypotheses and critically evaluate experimental evidence	Measure 3: No curricular or pedagogical changes needed at this time	
<b>Quantitative Reasoning.</b> Students will represent diverse experimental						

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
data sets graphically and apply statistical methods to them.						
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: An annotated bibliography of peer reviewed literature	Measure 1: 90% of students scored a 80% or higher on annotated bibliography	Measure 1: 90% of students scored a 80% or higher on annotated bibliography	Measure 1: Students successfully disseminated results of their secondary research of primary literature	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Final draft of the research paper on the DYOE CURE	Measure 2: 90% of students scored a 80% or higher on Experimental Design Assignment Final Paper	Measure 2: 90% of students scored a 80% or higher on final paper	Measure 2: Students successfully disseminated results of DYOE in a written paper	Measure 2: No curricular or pedagogical changes needed at this time	
<b>Laboratory Skills</b> Students will demonstrate mastery of course appropriate laboratory skills, such as basic lab skills, molecular techniques, microscopy, and safety.	Measure 1: A set of 3 lab assignments on Plasmodial Slime molds	Measure 1: 90% of students scored a 80% or higher on plasmodial slime mold lab work	Measure 1: 90% of students scored a 80% or higher on plasmodial slime mold lab work assignments	Measure 1: Students demonstrated mastery of course appropriate laboratory skills	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Formal Lab report on Pilobolus Lab Assignments	Measure 2: 90% of students scored a 80% or higher on formal lab report	Measure 2: 90% of students scored a 80% or higher on formal lab report	Measure 2: Students demonstrated mastery of course appropriate laboratory skills	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Formal Lab report on Isolating Fungi	Measure 3: 90% of students	Measure 3: 90% of students scored a 80% or	Measure 3: Students demonstrated mastery of	Measure 3: No curricular or pedagogical changes needed at this time	



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		scored a 80% or higher on formal lab report	higher on lab work	course appropriate laboratory skills		
<b>Data Management Skills</b> Students will demonstrate the ability to maintain accurate and complete records of their work in formats such as lab notebooks and the ability to use various software applications such as ARCGIS and spreadsheets.						
	Measure 2: Formal Lab report on Pilobolus Lab Assignments	Measure 2: 90% of students scored a 80% or higher on formal lab report	Measure 2: 90% of students scored a 80% or higher on formal lab report	Measure 2: Students demonstrated mastery of course appropriate laboratory skills	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Formal Lab report on Isolating Fungi	Measure 3: 90% of students scored a 80% or higher on formal lab report	Measure 3: 90% of students scored a 80% or higher on lab work	Measure 3: Students demonstrated mastery of course appropriate laboratory skills	Measure 3: No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

**Course: BTNY 4113, Plant Evolution**

**Semester taught: Spring 2021**

**Sections included:33268, n=11**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Anatomy, Physiology, &amp; Organismal.</b>	Leading and participating in	80% of the students	100% of students met this threshold	Students met this LO well.	No changes needed.	

Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their effect on the physiological functioning of organisms	discussion on green plant innovations	achieving 70% or higher.	based on indirect assessment			
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Final exam question on plants interacting with the environment (question 2)	80% of the students achieving 70% or higher.	100% of students met this threshold	Students met this LO well.	No changes needed.	
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	Final exam question on plants interacting with the environment (questions 3 and )	80% of the students achieving 70% or higher.	100% of students met this threshold	Students met this LO well.	No changes needed.	

<p><b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.</p>	<p>Measure 1:  Class project on plant phylogenetics</p>	<p>80% of the students achieving 70% or higher.</p>	<p>100% of students met this threshold</p>	<p>Students met this LO well.</p>	<p>No changes needed.</p>	
<p><b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.</p>	<p>Measure 1:  Class project on plant phylogenetics</p>	<p>80% of the students achieving 70% or higher.</p>	<p>100% of students met this threshold</p>	<p>Students met this LO well.</p>	<p>No changes needed.</p>	
<p><b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences</p>	<p>Lightning talks on peer-reviewed scientific literature</p>	<p>80% of the students achieving 70% or higher.</p>	<p>100% of students met this threshold</p>	<p>Students met this LO well.</p>	<p>No changes needed.</p>	
<p><b>Plant Identification</b> Students will demonstrate knowledge and application of plant identification skills such as dichotomous keying, common</p>	<p>Final exam question on plants interacting with the environment (question 6)</p>	<p>80% of the students achieving 70% or higher.</p>	<p>100% of students met this threshold</p>	<p>Students met this LO well.</p>	<p>No changes needed.</p>	

Utah flora, and curating specimens.						
<b>Data Management</b> Students will demonstrate the ability to use various software applications such as ARCGIS, R, spreadsheets, and databases.	Class project on plant phylogenetics	80% of the students achieving 70% or higher.	100% of students met this threshold	Students met this LO well.	No changes needed.	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

This was my first time teaching this class, and I taught it virtually given the situation with COVID. Students worked on a semester-long project related to plant phylogenetics, which included using multiple software programs to explore multiple sequence alignment and phylogeny reconstruction. Given the virtual nature of the class, this assignment was more challenging than it otherwise might have been; however, the students were able to meet the learning objectives. At the same time, I would plan on the students being able to accomplish more when we are able to meet in person.

**Course: BTNY4750 Lichen Ecology**

**Semester taught: Spring 2020**

**Sections included: 31702, n = 15**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Anatomy, Physiology, &amp; Organismal.</b> Students are able to describe and explain fundamental topics about the coordinated regulation of integrated cellular systems and their	Method 1: Students completed two short-answer quizzes including questions about lichen organismal biology.  Method 2: Students completed 2 written homework assignments	90% of the students achieving 80% or higher.	Method 1: 100% of the students met this threshold.  Method 2: 100% of the students met this threshold.	The students met this LO well.	No changes needed.	This course had never been previously taught.

effect on the physiological functioning of organisms	including questions about lichen organismal ecology.					
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	Method 1: Students completed two short-answer quizzes including questions about lichen ecology.  Method 2: Students completed 8 written homework assignments about lichen organismal ecology.	90% of the students achieving 80% or higher.	Method 1: 100% of the students met this threshold.  Method 2: 100% of the students met this threshold.	The students met this LO well.	No changes needed.	
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	Method 1: Students completed two short-answer quizzes about lichen evolution.	90% of the students achieving 80% or higher.	Method 1: 100% of the students met this threshold	The students met this LO well.	No changes needed.	
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Students completed 9 written reflections interpreting scientific papers.	90% of the students achieving 80% or higher.	93% of the students met this threshold	The students met this LO well.	No changes needed.	
<b>Sustainability.</b> Students will use their knowledge of	Students completed two written homework	90% of the students achieving	100% of the students met this threshold	The students met this LO well.	No changes needed.	

biology to address environmental issues and solutions.	assignments about conservation.	80% or higher.				
<b>Basic Lab Techniques</b> Students will demonstrate mastery of basic lab skills such as pipetting, light microscopy, chromatography, and aseptic technique.	Students completed a lab requiring microscopy techniques.	90% of the students achieving 80% or higher.	100% of the students met this threshold	The students met this LO well.	No changes needed.	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Quiz questions were not aligned to distinguish the three breath LO outcomes; next time I would like to align those questions. During the move online due to COVID-19, several students were missing homework assignments related to some of the LOs. I did not include those missing assignments in the assessment. I intended to spend more time on lab and field skills, but this aspect of the course was cut short by the move online. As a three-credit course without a scheduled lab, I simply dropped that aspect of the curriculum when the course moved online.

**Course: BTNY 4750 Special Topics - Plant Soil Feedback  
CRN 11996**

**Semester taught: Summer 2020**

**Sections included:**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental	Measure 1: Discussion 2 “Secondary Compounds and PSF”	Measure 1: 90% of students scored a 80% or higher on Discussion 2	Measure 1: 100% of students scored a 80% or higher on discussion 2	Measure 1: Students demonstrated an understanding of the dynamic interaction of living systems with each	Measure 1: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
topics about the dynamic interaction of living systems with each other and their environments		as determined by the rubric		other and their environments.		
	Measure 2: Homework Assignment 4 "Passenger or Drivers"	Measure 2: 90% of students scored a 80% or higher on Homework Assignment 4	Measure 2: 100% of students scored a 80% or higher on Homework Assignment 4	Measure 2: Students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Homework Assignment 5 "Functional Groups or Biological Species"	Measure 3: 90% of students scored a 80% or higher on Homework Assignment 5	Measure 3: 100% of students scored a 80% or higher on the Homework Assignment	Measure 3: Students demonstrated an understanding of the dynamic interaction of living systems with each other and their environments.	Measure 3: No curricular or pedagogical changes needed at this time	
	Measure 4: Discussion 5 "Functional Groups or Biological Species"	Measure 1: 90% of students scored a 80% or higher on the class discussion 5 as determined by the rubric	Measure 1: 88% of students scored a 80% or higher on discussion 5.	Measure 4: Threshold was not met. One student out of 8 scored below the 80%. This student's engagement in course materials was inconsistent throughout the semester. It was an online discussion course during the summer of Covid19.	Measure 4: Only teach the course in a face to face environment to help facilitate discussion	
	Measure 5: Discussion 7 "Scales? : Temporal and Spatial Scales"	Measure 5: 90% of students scored a 80%	Measure 1: 75% of students scored a 80% or	Measure 5: This was the last discussion of the course and 2 students out of eight failed to meet the	Measure 5: Only teach the course in a face to face environment to help facilitate discussion and	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
		or higher on the class discussion 7 as determined by the rubric	higher on discussion 7	threshold. The remaining demonstrated an understanding of the dynamic interaction of living systems with each other and their environments.	teach it full semester instead of a block to prevent burnout.	
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life.	Measure 1: Homework Assignment 6 "PSF as an eco-evolutionary mechanism"	Measure 1: 90% of students scored a 80% or higher on Homework Assignment 6	Measure 1: 100% of students scored a 80% or higher on Homework 6.	Measure 1: Students are able to describe and explain fundamental topics about the transforming role of evolution in changing life forms and how evolution explains both the unity and diversity of life	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Discussion 6 "PSF as an eco-evolutionary mechanism"	Measure 2: 90% of students scored a 80% or higher on the class discussion 6 as determined by the rubric	Measure 2: 88% of students scored a 80% or higher on Discussion 6	Measure 2: Threshold was not met. One student out of 8 scored below the 80%. This student's engagement in course materials was inconsistent throughout the semester. It was an online discussion course during the summer of Covid19.	Measure 2: Do not teach a discussion course based on reading primary literature in an online asynchronous format	
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and critically evaluate experimental evidence.	Measure 1: A reflection paper on the process of science and student's ability to communicate science	Measure 1: 90% of students scored a 80% or higher on Experimental Design Assignment	Measure 1: 100% of students scored a 80% or higher on Experimental Design Assignment	Measure 1: Students successfully used observational strategies to test hypotheses and critically evaluate experimental evidence	Measure 1: No curricular or pedagogical changes needed at this time	



Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 2: Homework Assignment 4 "Passenger or Drivers	Measure 2: 90% of students scored a 80% or higher on Homework 4	Measure 2: 100% of students scored a 80% or higher on Homework 4	Measure 2: Students critically evaluate experimental evidence and communicated results of science.	Measure 2: No curricular or pedagogical changes needed at this time	
	Measure 3: Final reflection paper on the process of science and student's ability to communicate science	Measure 3: 90% of students scored a 80% or higher on final reflection paper	Measure 3: 100% of students scored a 80% or higher on final reflection paper	Measure 3: Students successfully observed the scientific process and their role in the scientific process	Measure 3: No curricular or pedagogical changes needed at this time	
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	Measure 1: A reflection paper on the process of science and student's ability to communicate science	Measure 1: 90% of students scored a 80% or higher on reflection paper 1	Measure 1: 88% of students scored a 80% or higher on reflection paper 1	Measure 1: Threshold was not met. One student out of 8 scored below the 80%. This student's engagement in course materials was inconsistent throughout the semester. It was an online discussion course during the summer of Covid19.	Measure 1: No curricular or pedagogical changes needed at this time	
	Measure 2: Final reflection paper on the process of science and student's ability to communicate science	Measure 2: 90% of students scored a 80% or higher on final reflection paper	Measure 2: 100% of students scored a 80% or higher on final reflection paper	Measure 2: Students successfully communicated results of science and their process in understanding primary literature	Measure 2: No curricular or pedagogical changes needed at this time	

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	Measure 3: Discussion 2 "Secondary Compounds and PSF"	Measure 3: 90% of students scored a 80% or higher on Discussion 2 as determined by the rubric	Measure 3: 100% of students scored a 80% or higher on discussion 2	Measure 3: Students successfully communicated results of science to their peers	Measure 3: No curricular or pedagogical changes needed at this time	

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

**Course: BTNY4950 Advanced Field Botany**  
**n = 6**

**Semester taught: Fall 2019**

**Sections included: 22366,**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<b>Ecology and Evolution.</b> Students are able to describe and explain fundamental topics about the dynamic interaction of living systems with each other and their environments	The students read and responded to ecological papers about the field study and interpretations.	90% of the students achieving 80% or higher.	100% of the students met this LO.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>The Process of Science.</b> Students will use observational strategies to test hypotheses and	The students wrote a scientific report about an individual research project based on the class field trip data that	90% of the students achieving 80% or higher.	100% of the students met this LO.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.

critically evaluate experimental evidence.	required the full scientific process.					
<b>Quantitative Reasoning.</b> Students will represent diverse experimental data sets graphically and apply statistical methods to them.	The students wrote a scientific report about an individual research project based on the class field trip data that required quantitative analysis.	90% of the students achieving 80% or higher.	100% of the students met this LO.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Communication.</b> Students will disseminate results of experiments in a variety of presentation formats to a wide variety of audiences	The students wrote a scientific report about an individual research project based on the class field trip data.	90% of the students achieving 80% or higher.	100% of the students met this LO.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Field Skills.</b> Students will demonstrate an ability to use field skills such as navigation, plant identification, plant measurement, and safety.	Students were quizzed in the field on protocols and plant identification.	90% of the students achieving 80% or higher.	100% of students met this objective.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.
<b>Data Management Skills.</b> Students will demonstrate the ability to keep accurate records of their work and/or analyze their data using spreadsheets and statistical software.	Measure 1: Students will maintain a field notebook with their observations, which was assessed throughout the semester.  Measure 2: Student independent projects	90% of the students achieving 80% or higher.	Measure 1: 100% of students met this objective.  Measure 2: 100% of students met this objective.	Students met this LO well.	No pedagogical changes needed.	This is consistent with past years' performance despite changes in the programmatic outcomes.

	required record-keeping and data analysis to be successful.  Measure 3: Students were required to enter their data from the class field trip into a database and report summary statistics.		Measure 3: 100% of students met this objective.			
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\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed): Several of the LOs were wrapped up in a single assessment tool. The independent project reports required mastery of scientific process, quantitative reasoning, communication, field skills, and data management to be successful. I will likely separate assessment components in future years, but I also feel that it has value to pull all these skills and competencies together into a holistic product and the fact that all students were successful suggested mastery of the components in 2019.

**Course: BTNY 4990**  
**N=2**

**(Botany Capstone Seminar)**

**Semester taught: Fall 2020**

**Section: 22790**

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
<b>Seminar: Communication (Core Skills)</b> Students will demonstrate mastery of presenting a seminar based on a scientific article or a research project that they have conducted.	Measure 1: Final seminar presentation	90% of students will score 80% or above	Measure 1: 100% of students scored 80% or better	Measure 1: Students successfully demonstrated an ability to present a formal seminar	Measure1: No curricular or pedagogical changes needed at this time	Measure 1: Continue current practices to keep students on track with deadlines and practice sessions
	Measure 2: Final abstract of seminar presentation	90% of students will score 80% or above	Measure 2: 100% of students scored 80% or better	Measure 2: Students successfully demonstrated the ability to write an abstract for a seminar	Measure 2: No curricular or pedagogical changes needed at this time	Measure 2: Continue current Practice of having students submit a draft and a final version of abstract
	Measure 3:	90% of students will	Measure 3:	Measure 3: Students successfully demonstrated		

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
<p><b>Portfolio: Communication (Core Skills)</b> Students will demonstrate an ability to communicate via an e-portfolio the knowledge and skills they have acquired throughout their undergraduate major in Botany. The portfolio contains 6 folders (see measures).</p>	Final flyer to advertise seminar	score 80% or above	100% of students scored 80% or better	the ability to produce a flyer to advertise their seminar	Measure 3: No curricular or pedagogical changes needed at this time	Measure 3: Continue current practice of having students submit a draft and a final version of their flyer
	Measure 4: Final annotated bibliography	90% of students will score 80% or above	Measure 4: 100% of students scored 80% or better	Measure 4: Students successfully demonstrated the ability to write an annotated bibliography of their seminar information sources	Measure 4: No curricular or pedagogical changes needed at this time	Measure 4: Continue current practice of having students submit a draft and a final version of their annotated bibliography
	Measure 1: Final grade on portfolio	90% of students will score 80% or above	Measure 1: 100% of students scored 80% or better	Measure 1: Students successfully created a portfolio	Measure 1: No curricular or pedagogical changes needed at this time	Measure 1: Continue current practices to keep students on track by having deadlines for drafts and final versions of each folder
	Measure 2: Final grade on Folder 1 (Evidence of content knowledge) Includes current transcript, CatTracks & syllabi from courses taken for the Botany major	90% of students will score 80% or above	Measure 2: 100% of students scored 80% or better	Measure 2: Students successfully compiled required documents for Folder 1	Measure 2: No curricular or pedagogical changes needed at this time	Measure 2: Continue current practice of requiring students to compile documents for Folder 1
	Measure 3: Final grade on Folder 2 (Skills: Lab, Field, Data management, & Soft skills).	90% of students will score 80% or above	Measure 3: 100% of students scored 80% or better	Measure 3: Students successfully documented levels of development of the skills indicated in Folder 2 and successfully assessed their skill level in each	Measure 3: No curricular or pedagogical changes needed at this time	Measure 3: Continue current practice of requiring students to compile artifacts and conduct a self-assessment of skills indicated in Folder 2
			Measure 3:			

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	<p>Includes artifacts to document development of each skill and a self-assessment of skill level in each.</p> <p>Measure 4: Final grade on Folder 3 (Career Planning). Includes a current resumé, CV and a cover letter for a job or graduate school application.</p> <p>Measure 5: Final grade on Folder 4 (Achievements). Includes a list of awards, achievements, etc. with dates and brief explanations. Copies of certificates, etc. are included.</p> <p>Measure 6: Final grade on Folder 5 (Capstone experience). Includes artifacts associated with</p>	<p>90% of students will score 80% or above</p> <p>90% of students will score 80% or above</p> <p>90% of students will score 80% or above</p> <p>90% of students will score 80% or above</p>	<p>100% of students scored 80% or better</p> <p>Measure 4: 100% of students scored 80% or better</p> <p>Measure 5: 100% of students scored 80% or better</p> <p>Measure 6: 100% of students scored 80% or better</p>	<p>Measure 4: Students successfully demonstrated the ability to write a resumé, CV and professional cover letter</p> <p>Measure 5: Students successfully documented their achievements during their time as an undergraduate</p> <p>Measure 6: Students successfully documented their capstone experience, including a self-assessment of and a reflection on the experience.</p>	<p>Measure 4: No curricular or pedagogical changes needed at this time</p> <p>Measure 5: No curricular or pedagogical changes needed at this time</p> <p>Measure 6: No curricular or pedagogical changes needed at this time</p>	<p>Measure 4: Continue current practice of requiring students to write drafts &amp; final versions of a resumé, CV and cover letter for Folder 3</p> <p>Measure 5: Continue current practice of requiring students to document their achievements for Folder 4</p> <p>Measure 6: Continue current practice of requiring students to document, reflect on and self-assess their capstone experience in Folder 5.</p>

Evidence of Learning: Courses within the Major						
Measurable Learning Outcome	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
	<p>their capstone experience (thesis, independent research or Co-Op work experience project, or seminar) as well as a reflection on and self-assessment of their capstone experience.</p> <p>Measure 7: Final grade on Folder 6 (Overall self-assessment of and reflection on their undergraduate experience)</p>	90% of students will score 80% or above	Measure 7: 100% of students scored 100% or better	Measure 7: Students successfully wrote a self-assessment of and reflection on their undergraduate experience.	Measure 7: No curricular or pedagogical changes needed at this time	Measure 7: Continue current practice of requiring students to reflect on and self-assess their undergraduate experience in Folder 6.

\*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Fall 2020 was the first time that BTNY 4990: Botany Capstone Seminar was offered in its new format for the new Botany major. Prior to that, Botany Portfolio and Botany Seminar were housed in two separate courses (BTNY 4980: Portfolio Summative Assessment and BTNY 4990: Seminar in Botany). The new BTNY 4990 course combines the two with the Botany seminar counting for 60% of the grade and the Botany Portfolio counting as 40% of the grade.

There were only two students enrolled in the class in Fall 2020 (graduated in Fall 2020). However, it seemed more relevant to assess this new course going forward, rather than the previous courses that have been discontinued/revamped.

**c. Evidence of Learning: General Education Courses**

(Area-specific EOL grids can be found at [https://www.weber.edu/ie/Review and Assessment/Checklists and Templates.html](https://www.weber.edu/ie/Review%20and%20Assessment/Checklists%20and%20Templates.html); they can replace this page.)

**Evidence of Learning: General Education, Life Science Courses**  
**Course BTNY 1203, Section CRN 22367, N= 54, Fall 2019, in person**

Gen Ed Learning Goal	Measurable Learning Outcome	Method of Measurement	Threshold	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will demonstrate understanding of:	Students will demonstrate their understanding by:	Direct and Indirect Measures*				
<b>Nature of Science.</b> Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.	Answering questions and designing their own botanical experiment	Measure 1: 2 multiple choice questions in 1 exam.	70% or higher	Measure 1: 79.6% of students achieved 70% or higher	Measure 1 Students successfully demonstrated competence.	Measure 1: no action needed
		Measure 2: Designing a botanical experiment	NA (only participation)	Measure 2: 90% of students participated and about 50% of students did reasonably well	Measure 2: Students participated and did reasonably well	Measure 2: a more thorough introduction to the problem should be achieved.

GE Learning Goal	Measurable Learning Outcome	Method of Measure.	Threshold	Findings	Interpretation	Action Plan
<b>Integration of Science</b> All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Answering exam questions and using their knowledge to describe a fictional ecosystem	Measure 1: 3 questions in 2 exams	80% of students should achieve 70% or higher in these questions	65.7% of students achieved 70% or higher	Students failed to show competence in multiple choice exam questions	Students should be confronted with relevant questions more often to avoid exam failure
		Measure 2: Describing a fictional ecosystem	80% of students should achieve 70% or higher in this assignment	96% of students achieved a 70% or higher	Students demonstrated competence in describing complex scientific phenomena	no action needed

\*At least one measure per objective must be a direct measure.





<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Threshold</b>	<b>Findings</b>	<b>Interpretation</b>	<b>Action Plan</b>
<b>Science and Society</b> The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.	Answering exam questions and several in-class think-pair-share sessions on the impact of plants on humans and vice versa	Measure 1:  3 multiple choice exam questions in 1 exam	80% of students should achieve 70% or higher in these questions	74.1% of students achieved 70% or higher in exam questions	students did not demonstrate competence in exam level questions	no action needed
		Measure 2:  think-pair-share sessions and quiz questions on relevant topics	not assessed to keep the method free	many good ideas were shared, but commonly by a small percentage of students present; quiz questions tend to be answered correctly by more than 75% of students	even in an open think-pair-share format, many students don't feel comfortable sharing ideas  quiz questions are a good feedback mechanism for students, but their predictive value for exams is low	quiz questions can remain as are, but should be open for revision in preparation for exams  think-pair-share sessions should be extended to allow for more exchange between students

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Threshold</b>	<b>Findings</b>	<b>Interpretation</b>	<b>Action Plan</b>
<b>Problem Solving &amp; Data Analysis</b> Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	multiple choice data interpretation questions in exams and data interpretation worksheet in class	Measure 1:  6 multiple choice exam questions across 2 exams	80% of students should achieve 70% or higher in these questions	63.9% of students achieved 70% or higher in exam questions	Although the numbers suggest that students do not show competence, I am overall happy with this outcome. Scientific data analysis is hard	Provide more questions of the same kind in weekly quizzes.

		Measure 2: data interpretation worksheets in class and homework , peer reviewed	NA (only for participation)	more than 85% of students finished the worksheet in group work. Results were exchanged within class for review and a detailed review followed for feedback	Many students struggle, but doing this for participation with feedback hopefully takes away some of the pressure to “get it right”.	no action needed
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GE Learning Goal	Measurable Learning Outcome	Method of Measure	Threshold	Findings	Interpretation	Action Plan
<b>Levels of Organization</b> All life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.	exam questions and several worksheets	Measure 1: 8 multiple choice questions across 2 exams	80% of students should achieve 70% or higher in these questions	89.8% of students achieved 70% or higher	Students demonstrated competence	no action needed
		Measure 2: several worksheets (in class or homework) on cell structure, cell division, ecosystems etc	NA- participation only	worksheets are usually finished by more than 85% of students	Students demonstrated competence	no action needed

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Threshold	Findings	Interpretation	Action Plan
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<b>Metabolism and homeostasis:</b> Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.	exam and quiz questions, concept maps and worksheets	<b>Measure 1:</b> 6 multiple choice questions across 3 exams	80% of students should achieve 70% or higher in these questions	65.7% of students achieved 70% or higher	Students did not show competence	Ask more of the same questions and vary how they're being asked for different angles
		<b>Measure 2:</b> concept maps in photosynthesis and respiration, worksheets on organic macromolecules	Participation only (with feedback)	concept maps tend to good with only formal errors, macromolecules and most chemistry is difficult for students, even with guidance	Measure 2 doesn't seem to foster a better understanding of the relevant mechanisms	provide better feedback and emphasize importance of these processes

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Threshold	Findings	Interpretation	Action Plan
<b>Genetics and evolution:</b> Shared genetic processes and evolution by natural selection are universal features of all life	exam and quiz questions  description of plant and animal adaptations in a fictional non-terrestrial ecosystem	7 exam questions across 2 exams	80% of students should achieve 70% or higher in these questions	63.9% of students achieved 70% or higher	Students did not demonstrate competence	connect exam and quiz questions more closely to examples used in class to emphasize principles
		<b>Measure 2:</b> evaluation of the detail and accuracy of fictional adaptations in a given ecosystem	80% of students should achieve 70% or higher in this assignment	79.6% of students achieved 70% or higher	Students did demonstrate competence	no action needed

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Threshold	Findings	Interpretation	Action Plan
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<b>Ecological interactions:</b> All organisms, including humans, interact with their environment and other living organisms.	exam and quiz questions  worksheet foodchains  description of a fictional foodchain	<b>Measure 1:</b>  6 multiples choice exam questions across 2 exams	80% of students should achieve 70% or higher in these questions	64.8% of students achieved 70% or higher	Students did not demonstrate competence	include more relevant questions in quizzes to deepen the learning experience
		<b>Measure 2:</b>  evaluation of describing a fictional, non-terrestrial ecosystem including a foodchain	80% of students should achieve 70% or higher in this assignment	96% of students achieved a 70% or higher	Students did demonstrate competence	no action needed

Evidence of Learning: General Education, Life Science Courses

**Course\_BTNY 1203, in person, Davis campus CRN 33163 (Spring 2020) Note: end of semester disrupted by Covid-19 shut down**

<b>Gen Ed Learning Goal</b> Students will demonstrate understanding of:	<b>Measurable Learning Outcome</b> Students will demonstrate their understanding by:	<b>Method of Measurement</b> Direct and Indirect Measures*	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Nature of Science.</b> Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.	Learning Outcome 1.  Students will demonstrate understanding of how humans came to understand photosynthesis and how the process of discovery in photosynthesis can be applied to many scientific topics	Measure 1: An in-class activity with students working in groups to explain how humans came to understand photosynthesis	All student groups will be able to successfully explain how trial, error, and patient examination of plants by many different scientists has led to our current understanding of photosynthesis. Use this as a model	Measure 1: All 5 student groups were able to successfully explain learning outcome and apply to broader scientific topics.	Measure 1: All groups were successful, but not all students participated equally in this assignment.	Measure 1: Create a more individualized approach to this assignment

<b>Gen Ed Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measurement</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
Students will demonstrate understanding of:	Students will demonstrate their understanding by:	Direct and Indirect Measures*				
			for scientific explanations in general			

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure.</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Integration of Science</b> All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Students will explain a natural science topic choosing	Measure 1: 3-5 page paper written on the topic of their choice. Paper is graded out of 100	80% of students will receive a score of 70% or higher on written paper	79% of students received a score of 70% or higher	Several students (6/29) failed to turn in assignment. Of those that turned in the paper, 23/23 achieved target score.	Help students stay on task and complete assignments. Find ways to motivate struggling students

\*At least one measure per objective must be a direct measure.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Science and Society</b> The study of science provides explanations that have significant impact on society,	Students will understand the changing nature of food production and plant breeding	Measure 1: Two short quizzes covering plant biotechnology, history of agriculture and ecology	80% of students will average 70% or higher on quizzes	Due to covid at the end of the semester, these quizzes did not occur Spring 2020		

including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.	through study of bioengineering and ecology	Measure 2: 10 questions covering this material on Exam 4	80% of students will achieve 70% or higher on Exam 4 questions covering this material	94% of students achieved 70% or higher on Exam 4 questions covering this material	Students demonstrated competence in this learning outcome	Maintain teaching style/presentation type for this learning outcome
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GE Learning Goal	Measurable Learning Outcome	Method of Measure	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
<b>Problem Solving &amp; Data Analysis</b> Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	Students will examine the data and interpretation of the genetic experiments of Gregor Mendel as a model of how careful experimentation and data analysis is used in understanding the world around us	Measure 1: Exam 3 will cover this material with various questions about Mendel's experiments, and scientific problem solving specifically	80% of students will achieve 70% or higher on Exam 3 questions covering this material	77% of students who took the exam achieved 70% or higher on Exam 3	Did not meet the threshold target student performance for this learning outcome * note this exam was taken shortly after shutdown for COVID Spring 2020	Reevaluate how this material is taught.
		Measure 2: One quiz covering mendelian genetics and experimentation	80% of students will average 70% or higher on quizzes	100% of students who took the quiz achieved 70% or higher (5/29 did not take this quiz)	Those students who take the quiz, demonstrated understanding	

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
<b>Levels of Organization</b> All life shares an organization that is based on molecules and cells and extends	Students will demonstrate an	Measure 1: Two online quizzes, these quizzes can be taken multiple times to reinforce content covered	80% of students will average 70% or higher on quizzes	86% of students achieved 70% or higher on quizzes	Students successfully demonstrated understanding of this learning outcome	

to organisms and ecosystems.	understanding of atoms, molecules, macromolecules, cells, and organisms within ecosystems	Measure 2: 30 points on Exam 1 will be taken from this material (true/false, multiple choice, short answer) covering this material	80% of students will achieve 70% or higher on Exam 1	72% of students achieved 70% or higher on Exam 1	Threshold number of students did not demonstrate understanding of this learning outcome <b>Note</b> I did not clearly link learning outcome in exam, so difficult to clearly interpret results.	More clearly link learning outcomes in Exams so that I can examine the students' understanding of material.
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GE Learning Goal	Measurable Learning Outcome	Method of Measure	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
<b>Metabolism and homeostasis:</b> Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.	Students will demonstrate a basic understanding of photosynthesis, cellular respiration, nutrient transport, water transport, and plant growth regulation.	Measure 1: Two online quizzes, these quizzes can be taken multiple times to reinforce content covered	80% of students will average 70% or higher on quizzes	76% of students averaged 70% or higher on quizzes (24% of students failed to take one or more of the quizzes)	24% of students did not demonstrate understanding of topic, but many students also failed to attempt quizzes	Emphasize the importance of taking quizzes
		Measure 2: Exam 2 will consist of 100 points of various types of exam questions (true/false, multiple choice, short answer) covering this material	80% of students will achieve 70% or higher on Exam 2	69% of students achieved 70% or higher on Exam 2	31% of students were unable to demonstrate understanding of this topic.	This material is new and quite foreign to many students. Moving forward spend additional time to help students become more familiar and comfortable.

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
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<b>Genetics and evolution:</b> Shared genetic processes and evolution by natural selection are universal features of all life	Students will demonstrate a basic understanding of Mendelian Genetics, the genetic basis of natural selection, and recognize evolutionarily advantageous traits in different types of plants.	Measure 1: Exam 3 will cover this material with various questions about Mendelian Genetics, and evolution by natural selection	80% of students will achieve 70% or higher on Exam 3 questions covering this material	77% of students who took the exam achieved 70% or higher on Exam 3	Did not meet the threshold target student performance for this learning outcome * note this exam was taken shortly after shutdown for COVID Spring 2020	Reevaluate how this material is taught.
		Measure 2: Online quiz covering genetics and evolution	80% of students will achieve 70% or higher on quiz	89% of students achieved 70% or higher on quiz	Students met the threshold target student performance for this learning outcome	

GE Learning Goal	Measurable Learning Outcome	Method of Measure	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
<b>Ecological interactions:</b> All organisms, including humans, interact with their environment and other living organisms.	Students will demonstrate an understanding of plant interactions with other organisms and their environment with regards to pollination, seed dispersal, and nutrient cycling	Measure 1: Exam 4 will contain 30 points worth of questions covering this material	80% of students will achieve 70% or higher on Exam 4 questions covering this material	No performance data for this learning goal. Due to COVID in Spring 2020, teaching schedule was unable to accommodate this topic		Incorporate this topic throughout the semester as well as a focused unit on this subject matter
		Measure 2: Online quiz covering this material	80% of students will achieve 70% or higher on quiz	No performance data for this learning goal. Due to COVID in Spring 2020, teaching schedule was unable to accommodate this topic		Incorporate this topic throughout the semester as well as a focused unit on this subject matter

Evidence of Learning: General Education, Life Science Courses

**Course\_BTNY 1203 Plant Biology, Fall 2020, 22731 and 22732, n=87 - virtual during Covid 19**

<b>Gen Ed Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measurement</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
Students will demonstrate understanding of:	Students will demonstrate their understanding by:	Direct and Indirect Measures*				
<b>Nature of Science.</b> Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.	Written assignment on current topics in plant biology	Direct	80% of students receiving a 70% or higher on test questions		Students successfully understood the topic.	

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure.</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Integration of Science</b> All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Answering 2 multiple choice questions on exams	Answering 2 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	76% met this threshold.	Students are slightly below threshold.	In future classes, an additional in-class activity will be conducted to help students better understand integration of science.

\*At least one measure per objective must be a direct measure.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Science and Society</b> The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	74% met this threshold.	Students are slightly below threshold.	In future classes, an additional in-class activity will be conducted to help students better understand science and society.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Problem Solving &amp; Data Analysis</b> Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	Written assignment on current topics in plant biology	Direct	80% of students receiving a 70% or higher on test questions	100% met this threshold.	Students successfully understood the topic.	

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Levels of Organization</b> All life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	58% met this threshold.	Students are below threshold.	In future classes, this topic will be emphasized to a larger extent and more time will be spent on the organization of life.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Metabolism and homeostasis:</b> Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.	Answering 2 multiple choice questions on exams	Answering 2 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	71% met this threshold.	Students are slightly below threshold.	In future classes, an additional in-class activity will be conducted to help students better understand metabolism and homeostasis.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Genetics and evolution:</b> Shared genetic processes and evolution by natural selection are universal features of all life	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	67% met this threshold.	Students are below threshold, but some topics concerning evolution were better understood than others.	In future classes, this topic will be emphasized to a larger extent and more time will be spent on genetics and evolution.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Ecological interactions:</b> All organisms, including humans, interact with their environment and other living organisms.	Answering 3 multiple choice questions on exams	Answering 3 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	76% met this threshold.	Students are slightly below threshold.	In future classes, an additional in-class activity will be conducted to help students better understand science and society.

**Course:** Botany LS 1203 (Plant Biology) **Semester Taught:** Combined 3 **online** sections 1 each for Summer 2019, Fall 2019, Spring 2020 (N=164)

Evidence of Learning: General Education Area						
Measurable Learning Outcome	Method of Measurement	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	Closing the Loop
Students will...						
Learning Outcome 1:  LS1: Levels of Organization	Multiple questions from 4 exams	80% of students will score 70% or better	78% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of the levels of organization.	The performance is just below the threshold. Conduct review of student performance by question and incorporate additional learning resources for the students: such as videos and practice on study worksheets	Analyze the performance on the lower-scoring criterion and determine if clarity of instruction improved student performance.
Learning Outcome 2:  LS2: Metabolism and Homeostasis	Multiple questions from 4 exams	80% of students will score 70% or better	95% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of metabolism and homeostasis.	No curricular or pedagogical changes needed at this time	
Learning Outcome 3:  LS3: Genetics and Evolution	Multiple questions from 2 exams	80% of students will score 70% or better	84% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of genetics and evolution.	No curricular or pedagogical changes needed at this time	
Learning Outcome 4:  LS4: Ecological Interactions	Multiple questions from 4 exams	80% of students will score 70% or better	93% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of ecological interactions	No curricular or pedagogical changes needed at this time	

Evidence of Learning: General Education Area						
Measurable Learning Outcome	Method of Measurement	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	Closing the Loop
Students will...						
Learning Outcome 5: S1: Nature of Science	Multiple questions from 1 exam	80% of students will score 70% or better	91% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of the nature of science.	No curricular or pedagogical changes needed at this time	
Learning Outcome 6: S2: Integration of Science	Multiple questions from 3 exams	80% of students will score 70% or better	80% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of the integration of science.	The performance barely meets the threshold. Incorporate additional learning resources for the students: such as videos and practice on study worksheets	
Learning Outcome 7: S3: Science and Society	Multiple questions from 1 exam	80% of students will score 70% or better	100% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of science and society.	No curricular or pedagogical changes needed at this time	
Learning Outcome 8: S4: Problem Solving and Data Analysis	Multiple questions from 3 exams	80% of students will score 70% or better	82% of students met the 70% threshold for these questions	Students successfully demonstrated an understanding of problem solving and data analysis.	No curricular or pedagogical changes needed at this time	

**Course: BOTANY LS 1303 (Plants and People), summer 2019, CRN 11024, N=15**

Evidence of Learning: General Education Area Life Science					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					
NS1: Nature of Science	Measure 1: 4 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 78% of the students correctly answered 70% or higher.	Measure 1: Students exceeded an average performance of 70% and were very close to the 80% threshold.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Project 2 Topic discussions	Measure 2: 80% of the students correctly answered 70% or higher.	Measure 2: 88% of students correctly answered 70% or higher.	Measure 2: Students were very successful for this learning outcome.	Measure 2: No curricular or pedagogical changes needed at this time.
NS2: Integration of Science	Measure 2: 5 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 88% of the students correctly answered 70% or higher.	Measure 1: Students performed at an above target.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Project 2 Topic discussions	Measure 2: 80% of the students correctly answered 70% or higher.	Measure 2: 90% of students correctly answered 70% or higher.	Measure 1: Students were very successful for this learning outcome.	Measure 2: No curricular or pedagogical changes needed at this time.
NS3: Science and Society	Measure 1: 5 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 77% of the students correctly answered 70% or higher.	Measure 1: Students performed at an above average level here, but did not achieve the 80% tolerance threshold.	Measure 1: Re-evaluate exam question concentrations. Also review item analysis to replace/reword any heavily missed question.
	Measure 2: Project 1 & 2, Book review and Topic discussions	Measure 2: 80% of the students correctly answered 70% or higher.	Measure 2: 71% of the students correctly answered 70% or higher.	Measure 2: Students were above average, but did not hit target. The low score was more a result of students failing to turn in work and not of the	Measure 2: Create more posts to encourage submission of work. Vigorously encourage them to use the Writing Center.



Evidence of Learning: General Education Area Life Science					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...				quality of the work submitted.	
NS4: Problem Solving and Data Analysis	Measure 1: 5 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 68% of the students correctly answered 70% or higher.	Measure 1: Students were not successful for this learning outcome.	Measure 1: Question concentrations were too low. Add additional general concept questions.
	Measure 2: Project 1 & 2 Book review and Topic discussions	Measure 2: 80% of the students correctly answered 70% or higher.	Measure 2: 69% of the students correctly answered 70% or higher.	Measure 2: Students were not successful for this learning outcome.	Measure 2: The lack of success here was in lay in a decline in submission of work. Additional posts and perhaps recorded video announcements may boost morale and motivation.
S1: Levels of Organization	Measure 1: 5 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 82% of the students correctly answered 70% or higher.	Measure 1: Students exceeded target.	Measure 1: No curricular or pedagogical changes needed at this time.
S2: Metabolism and Homeostasis	Measure 1: 5 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 55% of the students correctly answered 70% or higher.	Measure 1: Students were not successful for this learning outcome. This was the most difficult for them.	Measure 1: Add additional video content to lecture modules to help information transmission and provide visual interest.
S3: Genetics and Evolution	Measure 1: 7 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 82% of the students correctly answered 70% or higher.	Measure 1: Students exceeded target.	Measure 1: No curricular or pedagogical changes needed at this time.

Evidence of Learning: General Education Area Life Science					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					
S4: Ecological Interactions	Measure 1: 4 Multiple Choice Questions	Measure 1: 80% of the students correctly answered 70% or higher.	Measure 1: 66% of the students correctly answered 70% or higher.	Measure 1: Students were not successful for this learning outcome.	Measure 1: Add additional video content to lecture modules to help information transmission and provide visual interest.

\*At least one measure per objective must be a direct measure; indirect measures may be used to supplement direct measure(s).

Additional narrative (optional – use as much space as needed):

This is an online course. It is quite difficult for students to master the concepts of science in an online environment. Online often leads to low exam scores. To compensate for this, students watch short video presentations, read papers and articles, and write discussion posts. They also do a Signature Assignment that requires them to integrate and solidify course concepts. This offsets the deficit in exam score and gives a much more realistic picture of their learning.

Additional difficulties have been incurred as the Covid-19 pandemic continues. Students feel an extreme amount of pressure, stress, and emotional discomfort. This hinders their performance. In an effort to compensate, I have now allowed students to have one 8.5" X 11" page of notes to use on exams. I believe this has helped them manage their exams more effectively and maybe helped improve their study habits.

The tolerance threshold of 80% is quite high. Overall, students were moderately successful at meeting most of the learning outcomes at near or above 70%. They struggled most with metabolism and homeostasis and ecological interactions. This is not uncommon in a GenEd course where many of not most of the students are not science majors.

**BTNY 1403 (Environment Appreciation)****Course: BTNY 1403****Semesters: Fall 2019 & Spring 2020****Sections: 22326, 22379 & 25971****N= 88**

Evidence of Learning: General Education Area LS					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					
Learning Outcome NS1: Nature of Science	Measure 1: 4 Multiple Choice Questions on Exam 1	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 88.2% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of the nature of science.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice/Essay questions on open book Quiz 1	Measure 2: Same as above	Measure 2: 88.9% of students met the 70% threshold for this quiz	Measure 2: Students successfully demonstrated an understanding of the nature of science.	Measure 2: No curricular or pedagogical changes needed at this time.
Learning Outcome NS2: Integration of Science	Measure 1: 15 Multiple Choice Questions on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 83.5% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of the integration of science.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice/Essay questions on open book Quizzes 3,5,6, & 7	Measure 2: Same as above	Measure 2: 95.1% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding of the integration of science.	Measure 2: No curricular or pedagogical changes needed at this time.
	Measure 3: Summary of a New York Times article on an environmental issue	Measure 3: Same as above	Measure 3: 100% of students met the 70% threshold for this paper	Measure 3: Students successfully demonstrated an understanding of the integration of science.	Measure 3: No curricular or pedagogical changes needed at this time.
Learning Outcome NS3: Science and Society	Measure 1: 31 Multiple Choice Questions on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 92.6% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding science and society.	Measure 1: No curricular or pedagogical changes needed at this time.

Evidence of Learning: General Education Area LS					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					
	Measure 2: Multiple Choice/Essay questions on open book Quizzes 2,5,6,7,& 8	Measure 2: Same as above	Measure 2: 97.8% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding science and society.	Measure 2: No curricular or pedagogical changes needed at this time.
	Measure 3: Group paper exploring ways to curb human population growth and equitable distribution of resources globally (environmental & social justice)	Same as above	Measure 3: 89.3% of students met the 70% threshold for this paper	Measure 3: Students successfully demonstrated an understanding science and society.	Measure 3: No curricular or pedagogical changes needed at this time.
	Measure 4: Signature assignment in which students undertake a multi-week project incorporating sustainability and class concepts.	Same as above	Measure 4: 84.6% of students met the 70% threshold for their signature assignment	Measure 4: Students successfully demonstrated an understanding science and society.	Measure 4: No curricular or pedagogical changes needed at this time.
Learning Outcome NS4: Problem Solving and Data Analysis	Measure 1: 15 Multiple Choice Questions requiring calculations or graph interpretation on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 84% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of problem solving and data analysis.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice/Essay questions on open book Quizzes 1 & 2	Measure 2: Same as above	Measure 2: 92.8% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding of problem solving and data analysis.	Measure 2: No curricular or pedagogical changes needed at this time.
Learning Outcome LS1: Levels of Organization	Measure 1: 4 Multiple Choice Questions on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 62.5% of students met the 70% threshold for these questions	Measure 1: Students did not successfully demonstrate an understanding of levels of organization.	Measure 1: More questions on the exam might help. Students are given a study guide that explains &

Evidence of Learning: General Education Area LS					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					summarizes all of the concepts covered. Encouraging students to read this might help.
	Measure 2: Multiple Choice/Essay questions on open book Quiz 3	Measure 2: Same as above	Measure 2: 87.9% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding of levels of organization.	Measure 2: No curricular or pedagogical changes needed at this time.
Learning Outcome LS2: Metabolism and Homeostasis	Measure 1: 8 Multiple Choice Questions on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 81.3% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of metabolism & homeostasis.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice/Essay questions on open book Quizzes 3 & 4	Measure 2: Same as above	Measure 2: 92.2% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding of metabolism & homeostasis.	Measure 2: No curricular or pedagogical changes needed at this time.
Learning Outcome LS3: Genetics and Evolution	Measure 1: 8 Multiple Choice Questions on Exams, including interpretations of cladograms	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 86.8% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of genetics and evolution.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice questions on open book Quiz 4	Measure 2: Same as above	Measure 2: 87.9% of students met the 70% threshold for this quiz	Measure 2: Students successfully demonstrated an understanding of genetics and evolution.	Measure 2: No curricular or pedagogical changes needed at this time.
	Measure 3: Class exercise on interpreting cladograms	Measure 3: Same as above	Measure 3: 97.2% of students met the 70% threshold for this exercise	Measure 3: Students successfully demonstrated an understanding of genetics and evolution.	Measure 3: No curricular or pedagogical changes needed at this time.

Evidence of Learning: General Education Area LS					
Measurable Learning Outcome	Method of Measurement	Threshold for Evidence of Student Learning	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Students will...					
Learning Outcome LS4: Ecological Interactions	Measure 1: 10 Multiple Choice Questions on Exams	Measure 1: Threshold for Evidence of Student Learning is 80% or more of the students achieving 70% or higher.	Measure 1: 84.0% of students met the 70% threshold for these questions	Measure 1: Students successfully demonstrated an understanding of ecological interactions.	Measure 1: No curricular or pedagogical changes needed at this time.
	Measure 2: Multiple Choice/Essay questions on open book Quizzes 4 & 7	Measure 2: Same as above	Measure 2: 97.0% of students met the 70% threshold for these quizzes	Measure 2: Students successfully demonstrated an understanding of ecological interactions.	Measure 2: No curricular or pedagogical changes needed at this time.

Additional narrative (optional – use as much space as needed):

#### **Assignments addressing multiple Learning Outcomes:**

**NS2, NS3, NS4, and LS4 are directly measured in a Signature Assignment (Measure 4 for NS3. 84.6% of students met the 70% threshold for this project.** Each student (or a small group) must undertake a project related to sustainability, preferably impacting the community. Each student must write a short paper and make either a video or PowerPoint, including quantifying their success.

#### **Evidence of Learning: General Education, Life Science Courses**

**Course\_\_BTNY1403 - Spring 2020, CRN 31684, n = 95**

Gen Ed Learning Goal	Measurable Learning Outcome	Method of Measurement	Target Performance	Actual Performance	Interpretation of findings	Action Plan/Closing the Loop
Students will demonstrate understanding of:	Students will demonstrate their understanding by:	Direct and Indirect Measures*				
<b>Nature of Science.</b> Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	92% met the threshold	They did well with the instruction provided..	No changes needed.

those that are not scientific.						
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<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure.</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Integration of Science</b> All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	98% met the threshold	They did well with the instruction provided..	No changes needed.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Science and Society</b> The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	96% met the threshold	They did well with the instruction provided..	No changes needed.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
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<b>Problem Solving &amp; Data Analysis</b> Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	Answering 2 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	72% met the threshold	This competency was not met.	This topic was covered after the course went online during COVID. Students were not successful during this dramatic and unexpected change in pedagogy.
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<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Levels of Organization</b> All life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	90% met the threshold	They did well with the instruction provided..	No changes needed.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Metabolism and homeostasis:</b> Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	92% met the threshold	They did well with the instruction provided..	No changes needed.



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<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Genetics and evolution:</b> Shared genetic processes and evolution by natural selection are universal features of all life	Answering 5 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	98% met the threshold	They did well with the instruction provided..	No changes needed.

<b>GE Learning Goal</b>	<b>Measurable Learning Outcome</b>	<b>Method of Measure</b>	<b>Target Performance</b>	<b>Actual Performance</b>	<b>Interpretation of findings</b>	<b>Action Plan/Closing the Loop</b>
<b>Ecological interactions:</b> All organisms, including humans, interact with their environment and other living organisms.	Answering 2 multiple choice questions on exams	Answering 5 multiple choice questions on exams	80% of students receiving a 70% or higher on test questions	94% met the threshold	They did well with the instruction provided..	This LO was not well-assessed. As with LO4, this was a main topic as the course moved online due to COVID.

## Appendix A

Most departments or programs receive a number of recommendations from their Five/Seven-Year Program Review processes. This page provides a means of updating progress towards the recommendations the department/program is enacting.

The Botany Department did not get a list of recommendations for our last program review. Instead, weaknesses were identified which we are in the process of addressing. Here we report on progress since the 2017-2019 assessment report.

Date of Program Review: 2018-19	Weakness Identified	Progress Description
Weakness 1	Herbarium: The herbarium, however, has not been databased and, because of this, it does not form part of regional or international consortia.	<p>2019: In Fall 2018, Dr. Harley began mentoring a student doing a pilot project to digitize a 1950s collection of Utah mosses made in conjunction with the writing of Utah moss flora. In Fall 2019, a different student took responsibility of the mosses. To date, 326 records have been entered into the Consortium of North American Bryophyte Herbaria. All records are georeferenced.</p> <p>In Summer 2019, the department hired an adjunct instructor for Plant Taxonomy. He incorporated the use of the various herbarium portals into the class. This gave us a nucleus of trained students to draw from when we hired student employees for the herbarium in Fall 2019.</p> <p>In Fall 2019, the department hired an herbarium manager who has worked at USU and is well versed in the full digitization workflow. He made a great start on entering the flowering plants into the Intermountain Regional Herbarium Network database, aided by four students who are learning valuable skills in curation, plant taxonomy, and digitization. Within three months,</p>

		2,608 specimens (of approximately 28,000 vascular plant specimens) had been posted to the Intermountain Regional Herbarium Network, with 22% of the specimens georeferenced.
		2021: In Spring 2020, a tenure-track faculty member was hired to teach plant taxonomy and be herbarium director. He started in Fall 2020. Databasing efforts continue. To date, 5,787 specimens have been entered, with almost 3000 of them georeferenced. An ARCC grant provided funds for a high resolution digital camera so we can start adding photographs of the specimens to the database. In addition, the new director is establishing specimen exchange agreements with other herbaria.
Weakness 2	In terms of evaluation of teaching performance, the evaluation of success in teaching is largely based in the quantification of acquired skills; i.e., the grades and exam results, as is well explained in the Department's Self-Study. There are no set systems to gather student's own feedback on the courses, the curricula, or the perceived quality of the teaching process.	2019: There is a system for student evaluation of teaching. These evaluations are not asked for in the program self-study but are used in the annual review of faculty, rank and tenure reviews, and post-tenure reviews. Students also provide feedback about the curriculum when they graduate. We switched from a face-to-face exit interview to an online one four years ago, and then tacked the online department exist survey to the university's two years ago. Our response rate plummeted when our survey was with the university's. In Fall 2019, we separated the department exit survey and had a 90% response rate.

		2021: Last year, Covid disrupted data gathering.
Weakness 3	The greenhouse needs attention. The glass panes are thermally inefficient and demand a lot of energy to keep cool in summer and warm in winter	2019: An energy audit of the Tracy Hall Science Center was conducted between the time we completed our self-study and the review team site visit. The audit revealed that the greenhouse accounted for approximately 15% of the energy used by the building. Several fixes were identified at that time, and the department supports incorporating them into the greenhouse facility. However, implementation of the fixes requires financial support from the university. Improving the energy efficiency of the greenhouse would be compatible with the university's goal to be carbon neutral by 2050.
		2021: In Fall 2020, two large glass panes fell from the greenhouse. They were replaced with glass and weaknesses in the frame system were identified and repaired, dashing our hopes to improve the energy efficiency of the greenhouse at that time.
Weakness 4	The Department of Botany at WSU is strongly bimodal in its age-class distribution. Three of the faculty members (Harley, Clark, and Wachocki) are senior professors, all of them approaching the age of retirement. The other three faculty members (Hilbig, Root, and Schramm) are Assistant Professors, not yet tenured. Steve Clark is retiring in June this year, and both Sue Harley and Barb Wachocki will retire in	2019: The goals of the current curriculum revision now working its way through the university's curriculum approval process are diverse and take the faculty turnover into account: <ul style="list-style-type: none"> <li>• bring the curriculum into alignment with the AAAS Vision and Change document which would give us a national standard for assessment of learning</li> </ul>

	<p>four years' time. This will generate, in a very short time, a transfer of responsibilities between the two cohorts requiring the advancement to tenure of the younger researchers, plus the need to hire replacements for those that are retiring.</p>	<ul style="list-style-type: none"> <li>• streamline the major for students and bring it in line with the requirements in Microbiology which requires 12 fewer credit hours</li> <li>• provide flexibility in course requirements so that students can complete degrees in a timely manner as several of our courses, including currently required courses, are offered alternate years</li> <li>• provide flexibility in course requirements to make it easier to balance teaching loads among the faculty</li> <li>• keep students on time to graduate by providing flexibility to meet course requirements during the faculty turnover period when some courses might not be offered for several years, new courses will be developed, and some existing courses will be deleted</li> <li>• have the new curriculum in place for 2020-2021 so that it is in place for three years while Drs. Harley and Wachocki are still around to assist with debugging any issues that arise</li> </ul>
		<p>2021: The new learning objectives that align with AAAS Vision and Change went into effect in 2019-2020 and are used in this assessment report. The revised botany major went into effect with the 2020-2021 catalog. Majors on older catalogs have been switching to more recent catalogs in order to graduate sooner. One of the three junior faculty who met with program review team has</p>

		achieved tenure and promotion to associate professor. The other two are undergoing review this academic year. One of the senior faculty (the taxonomist) who met with the program review team has since retired and been replaced by the new taxonomist mentioned above.
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Additional narrative:

## Appendix B

Please provide the following information about the full-time *and adjunct faculty* contracted by your department during the last academic year (summer through spring). Gathering this information each year will help with the headcount reporting that must be done for the final Five Year Program Review document that is shared with the State Board of Regents.

Faculty Headcount	2018-19	2019-20	2020-21
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	3	2	3
Full-time Non-Tenured (includes tenure-track)	3	3	3
Part-time and adjunct	1	1	1
With Master's Degrees			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time and adjunct	4	3	3
With Bachelor's Degrees			
Full-time Tenured	0	0	0
Full-time Non-tenured	0	0	0
Part-time and adjunct	1	1	0
Other			
Full-time Tenured	0	0	0
Full-time Non-tenured	0	0	0
Part-time	0	0	0
<b>Total Headcount Faculty</b>			
Full-time Tenured	3	2	3
Full-time Non-tenured	3	3	3
Part-time	6	5	4

**Please respond to the following questions.**

- 1) Review and comment on the trend of minority students enrolling in your classes (particularly lower-division, GEN Ed) and in your programs.

According to the university data dashboard, the trend for minority students in our programs of study reflects the trend for the university as a whole. We do not have data on enrollment in individual classes.

- 2) What support (from enrollment services, advising, first-year transition office, access & diversity, etc.) do you need to help you recruit and retain students?

The recent difficulty we have heard about is from students who are on Pell grants. Their financial aid decreased as a result of the change to the order of stacking the various types of financial aid awards. Consequently, they are reducing their course loads (therefore increasing time to degree), not enrolling in individualized instruction like research projects, dropping extracurricular activities like student government, or dropping out entirely because they need to work more hours to cover expenses. The stacking order needs to be revisited as the most financially vulnerable students are being hurt.

- 3) We have invited you to re-think your program assessment. What strategies are you considering? What support or help would you like?

We are planning to move to outcome-based assessment, rather than course-based assessment, for courses in the major. We will use our existing portfolio system to do this. During the curriculum revision, we switched to an e-portfolio which will aid in the collection of artifacts for outcome-based assessment.

- 4) Finally, we are supporting our Concurrent Enrollment accreditation process. Does your program offer concurrent enrollment classes? If so, have you been able to submit the information requested from the Concurrent Enrollment office?

We do not offer any concurrent enrollment classes.



## Glossary

### Student Learning Outcomes/Measurable Learning Outcomes

The terms ‘learning outcome’, ‘learning objective’, ‘learning competency’, and ‘learning goal’ are often used interchangeably. Broadly, these terms reference what we want students to be able to do AFTER they pass a course or graduate from a program. For this document, we will use the word ‘outcomes’. Good learning outcomes are specific (but not too specific), are observable, and are clear. Good learning outcomes focus on skills: knowledge and understanding; transferrable skills; habits of mind; career skills; attitudes and values.

- Should be developed using action words (if you can see it, you can assess it).
- Use compound statements judiciously.
- Use complex statements judiciously.

### Curriculum Grid

A chart identifying the key learning outcomes addressed in each of the curriculum’s key elements or learning experiences (Suskie, 2019). A good curriculum:

- Gives students ample, diverse opportunities to achieve core learning outcomes.
- Has appropriate, progressive rigor.
- Concludes with an integrative, synthesizing capstone experience.
- Is focused and simple.
- Uses research-informed strategies to help students learn and succeed.
- Is consistent across venues and modalities.
- Is greater than the sum of its parts.

### Target Performance (previously referred to as ‘Threshold’)

The level of performance at which students are doing well enough to succeed in later studies (e.g., next course in sequence or next level of course) or career.

### Actual Performance

How students performed on the specific assessment. An average score is less meaningful than a distribution of scores (for example, 72% of students met or exceeded the target performance, 5% of students failed the assessment).

### Closing the Loop

The process of following up on changes made to curriculum, pedagogy, materials, etc., to determine if the changes had the desired impact.

### Continuous Improvement

An idea with roots in manufacturing, that promotes the ongoing effort to improve. Continuous improvement uses data and evidence to improve student learning and drive student success.

### Direct evidence

Evidence based upon actual student work; performance on a test, a presentation, or a research paper, for example. Direct evidence is tangible, visible, and measurable.

### Indirect evidence

Evidence that serves as a proxy for student learning. May include student opinion/perception of learning, course grades, measures of satisfaction, participation. Works well as a complement to direct evidence.

### HIEE – High Impact Educational Experiences

Promote student learning through curricular and co-curricular activities that are intentionally designed to foster active and integrative student engagement by utilizing multiple impact strategies. Please see <https://weber.edu/weberthrives/HIEE.html>