2016-2017
Annual Assessment Report Template

For instructions and guidelines visit our **website**
or **contact us** for more help.

Please begin by selecting your program name in the drop down. If the program name is not listed, please enter it below:

BS/BA Biology

OR

Question 1: Program Learning Outcomes

Q1.1.
Which of the following Program Learning Outcomes (PLOs), Sac State Baccalaureate Learning Goals (BLGs), and emboldened Graduate Learning Goals (GLGs) **did you assess?** [**Check all that apply**]

- [ ] 1. **Critical Thinking**
- [ ] 2. **Information Literacy**
- [ ] 3. **Written Communication**
- [ ] 4. **Oral Communication**
- [ ] 5. Quantitative Literacy
- [ ] 6. **Inquiry and Analysis**
- [ ] 7. Creative Thinking
- [ ] 8. Reading
- [x] 9. Team Work
- [ ] 10. Problem Solving
- [ ] 11. Civic Knowledge and Engagement
- [ ] 12. **Intercultural Knowledge, Competency, and Perspectives**
- [ ] 13. Ethical Reasoning
- [x] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. **Global Learning and Perspectives**
- [x] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [ ] 18. **Overall Disciplinary Knowledge**
- [x] 19. **Professionalism**
- [x] 20. Other, specify any assessed PLOs not included above:

a. Self-efficacy
b. Intention to persist in STEM disciplines
c.

Q1.2.
Please provide more detailed background information about **EACH PLO** you checked above and other information including how your specific PLOs are **explicitly** linked to the Sac State **BLGs**/**GLGs**:

In the 2016-17 academic year, we focused on several aspects of student behavior in laboratory courses. These learning outcomes are the focus of the integration of course-based undergraduate research projects into the Biological Sciences curriculum. This year, all of the data collected were based on student surveys in our introductory biology series (the only courses where CUREs are fully implemented currently) to determine student self-confidence, professionalism and intention to persist in STEM disciplines, team work/integrative and applied learning in laboratory classes. All of these elements look at changes in student self-assessment from entry into the program through the completion of an introductory biology sequence.

Q1.2.1.
Do you have rubrics for your PLOs?

- 1. Yes, for all PLOs
- 2. Yes, but for some PLOs
- 3. No rubrics for PLOs
- 4. N/A
- 5. Other, specify: We used validated surveys for data collection

Q1.3.
Are your PLOs closely aligned with the mission of the university?

- 1. Yes
- 2. No
- 3. Don't know

Q1.4.
Is your program externally accredited (other than through WASC Senior College and University Commission (WSCUC))?

- 1. Yes
- 2. No (skip to **Q1.5**)
- 3. Don't know (skip to **Q1.5**)

Q1.4.1.
If the answer to Q1.4 is **yes**, are your PLOs closely aligned with the mission/goals/outcomes of the accreditation agency?

- 1. Yes
- 2. No
- 3. Don't know

Q1.5.
Did your program use the *Degree Qualification Profile* ("DQP", see http://degreeprofile.org) to develop your PLO(s)?

- 1. Yes
- 2. No, but I know what the DQP is
- 3. No, I don't know what the DQP is
- 4. Don't know

Q1.6.
Did you use action verbs to make each PLO measurable?

- 1. Yes
- 2. No
- 3. Don't know

(Remember: Save your progress)

Question 2: Standard of Performance for the Selected PLO

Q2.1.
Select **OR** type in **ONE(1)** PLO here as an example to illustrate how you conducted assessment (be sure you *checked the correct box* for this PLO in Q1.1):

Team Work

If your PLO is **not listed, please enter it here**:

Q2.1.1.
Please provide more background information about the **specific PLO** you've chosen in Q2.1.

The Laboratory Course Assessment Survey (LCAS) was administered to both BIO1 and BIO2 students at the conclusion of the Fall 2015 and Spring 2016 semesters (after these labs were re-designed to include authentic research experiences). The LCAS consists of 17 Likert-like items split into three constructs: collaboration, discovery/relevance, and iteration (not shown), all of which are important design elements of research-based labs. This instrument was used to evaluate student perceptions of the opportunities they had to collaborate with others and perform authentic and relevant research.

Q2.2.
Has the program developed or adopted **explicit** standards of performance for this PLO?

- ○ 1. Yes
- ◉ 2. No
- ○ 3. Don't know
- ○ 4. N/A

Q2.3.
Please **provide the rubric(s)** and **standards of performance** that you have developed for this PLO here or in the appendix.

No standard of performance was developed for this learning outcome.

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Q2.4. PLO	Q2.5. Stdrd	Q2.6. Rubric	Please indicate where you have published the **PLO**, the **standard** of performance, and the **rubric** that was used to measure the PLO:
☑	☐	☐	1. In **SOME** course syllabi/assignments in the program that address the PLO
☐	☐	☐	2. In **ALL** course syllabi/assignments in the program that address the PLO
☐	☐	☐	3. In the student handbook/advising handbook
☐	☐	☐	4. In the university catalogue
☐	☐	☐	5. On the academic unit website or in newsletters
☐	☐	☐	6. In the assessment or program review reports, plans, resources, or activities
☐	☐	☐	7. In new course proposal forms in the department/college/university
☐	☐	☐	8. In the department/college/university's strategic plans and other planning documents
☐	☐	☐	9. In the department/college/university's budget plans and other resource allocation documents
☐	☐	☐	10. Other, specify:

Question 3: Data Collection Methods and Evaluation of Data Quality for the Selected PLO

Q3.1.

Was assessment data/evidence **collected** for the selected PLO?

- (●) 1. Yes
- ( ) 2. No (skip to **Q6**)
- ( ) 3. Don't know (skip to **Q6**)
- ( ) 4. N/A (skip to **Q6**)

Q3.1.1.
How many assessment tools/methods/measures **in total** did you use to assess this PLO?

1

Q3.2.
Was the data **scored/evaluated** for this PLO?

- (●) 1. Yes
- ( ) 2. No (skip to **Q6**)
- ( ) 3. Don't know (skip to **Q6**)
- ( ) 4. N/A (skip to **Q6**)

Q3.2.1.
Please describe how you collected the assessment data for the selected PLO. For example, in what course(s) or by what means were data collected:

Data were collected through student surveys at the end of both BIO 1 and BIO 2. These two courses were the first two courses into which the Course-based research experiences were integrated. Data were collected and compared between Fall 2015 and Spring 2016 (before and after the integration of the research experience). Surveys were completed by all students in these courses. Sample size for BIO 1 was approximately 250 per semester and approximately 150 per semester in BIO 2.

(Remember: Save your progress)

Question 3A: Direct Measures (key assignments, projects, portfolios, etc.)

Q3.3.
Were direct measures (key assignments, projects, portfolios, course work, student tests, etc.) used to assess this PLO?

- ( ) 1. Yes
- (●) 2. No (skip to **Q3.7**)
- ( ) 3. Don't know (skip to **Q3.7**)

Q3.3.1.
Which of the following direct measures (key assignments, projects, portfolios, course work, student tests, etc.) were used? [**Check all that apply**]

- [ ] 1. Capstone project (e.g. theses, senior theses), courses, or experiences
- [ ] 2. Key assignments from required classes in the program
- [ ] 3. Key assignments from elective classes
- [ ] 4. Classroom based performance assessment such as simulations, comprehensive exams, or critiques
- [ ] 5. External performance assessments such as internships or other community-based projects
- [ ] 6. E-Portfolios
- [ ] 7. Other Portfolios
- [ ] 8. Other, specify:

Q3.3.2.
Please **provide** the direct measure (key assignments, projects, portfolios, course work, student tests, etc.) you used to collect data, THEN **explain** how it assesses the PLO:

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Q3.4.
What tool was used to evaluate the data?

- 1. **No** rubric is used to interpret the evidence (skip to **Q3.4.4.**)
- 2. Used rubric developed/modified by the faculty who teaches the class (skip to **Q3.4.2.**)
- 3. Used rubric developed/modified by a group of faculty (skip to **Q3.4.2.**)
- 4. Used rubric pilot-tested and refined by a group of faculty (skip to **Q3.4.2.**)
- 5. The VALUE rubric(s) (skip to **Q3.4.2.**)
- 6. Modified VALUE rubric(s) (skip to **Q3.4.2.**)
- 7. Used other means (Answer **Q3.4.1.**)

Q3.4.1.
If you used other means, which of the following measures was used? [**Check all that apply**]

- 1. National disciplinary exams or state/professional licensure exams (skip to **Q3.4.4.**)
- 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.) (skip to **Q3.4.4.**)
- 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.) (skip to **Q3.4.4.**)
- 4. Other, specify: (skip to **Q3.4.4.**)

Q3.4.2.
Was the **rubric** aligned directly and explicitly **with the PLO**?

- 1. Yes
- 2. No
- 3. Don't know
- 4. N/A

Q3.4.3.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the rubric**?

- 1. Yes
- 2. No
- 3. Don't know
- 4. N/A

Q3.4.4.
Was the **direct measure** (e.g. assignment, thesis, etc.) aligned directly and explicitly **with the PLO**?

- 1. Yes
- 2. No
- 3. Don't know
- 4. N/A

Q3.5.
How many faculty members participated in planning the assessment data **collection** of the selected PLO?

Q3.5.1.
How many faculty members participated in the **evaluation** of the assessment data for the selected PLO?

Q3.5.2.
If the data was evaluated by multiple scorers, was there a norming process (a procedure to make sure everyone was scoring similarly)?

- 1. Yes
- 2. No
- 3. Don't know
- 4. N/A

Q3.6.
How did you **select** the sample of student work (papers, projects, portfolios, etc.)?

Q3.6.1.
How did you **decide** how many samples of student work to review?

Q3.6.2.
How many students were in the class or program?

Q3.6.3.
How many samples of student work did you evaluated?

Q3.6.4.
Was the sample size of student work for the direct measure adequate?

- 1. Yes
- 2. No
- 3. Don't know

(Remember: Save your progress)

Question 3B: Indirect Measures (surveys, focus groups, interviews, etc.)

Q3.7.
Were indirect measures used to assess the PLO?

- (●) 1. Yes
- ( ) 2. No (skip to **Q3.8**)
- ( ) 3. Don't Know (skip to **Q3.8**)

Q3.7.1.
Which of the following indirect measures were used? [**Check all that apply**]

- [ ] 1. National student surveys (e.g. NSSE)
- [ ] 2. University conducted student surveys (e.g. OIR)
- [x] 3. College/department/program student surveys or focus groups
- [ ] 4. Alumni surveys, focus groups, or interviews
- [ ] 5. Employer surveys, focus groups, or interviews
- [ ] 6. Advisory board surveys, focus groups, or interviews
- [ ] 7. Other, specify:

Q3.7.1.1.
Please explain and attach the indirect measure you used to collect data:

The Laboratory Course Assessment Survey is a validated survey using 17 Likert-type items that is divided into three constructs, two of which are reported here. The two constructs that were included are collaboration and discovery/relevance of course information. This instrument was used to evaluate student perceptions of the opportunities that they had for collaboration with other students and the opportunity to perform authentic and relevant research within their laboratory classes.

LCAS_Survey.docx
81.31 KB

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Q3.7.2.
If surveys were used, how was the sample size **decided**?

BIO 1 and BIO 2 were chosen because they were the first courses into which the research experiences were integrated. Future surveys will also include upper division coursework in the Biological Sciences.

Q3.7.3.
If surveys were used, how did you **select** your sample:

All students in the courses were surveyed.

Q3.7.4.

If surveys were used, what was the response rate?

100%

Question 3C: Other Measures (external benchmarking, licensing exams, standardized tests, etc.)

Q3.8.
Were external benchmarking data, such as licensing exams or standardized tests, used to assess the PLO?

- 1. Yes
- 2. No (skip to **Q3.8.2**)
- 3. Don't Know (skip to **Q3.8.2**)

Q3.8.1.
Which of the following measures was used? [**Check all that apply**]

- 1. National disciplinary exams or state/professional licensure exams
- 2. General knowledge and skills measures (e.g. CLA, ETS PP, etc.)
- 3. Other standardized knowledge and skill exams (e.g. ETC, GRE, etc.)
- 4. Other, specify:

Q3.8.2.
Were other measures used to assess the PLO?

- 1. Yes
- 2. No (skip to **Q4.1**)
- 3. Don't know (skip to **Q4.1**)

Q3.8.3.
If other measures were used, please specify:

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Question 4: Data, Findings, and Conclusions

Q4.1.
Please provide simple tables and/or graphs to summarize the assessment data, findings, and conclusions for the selected PLO in **Q2.1**:

For both BIO 1 and BIO 2, we saw gains in student perceptions related to collaboration in the laboratory in student responses to elements of the survey related to collaboration, with the exception of the providing constructive criticism to classmates in BIO 2. These results were more dramatic with the implementation of the CURE into the BIO 1 laboratory. These results indicate that the mindset of introductory students shifted with regard to collaborative learning with the implementation of a course-based research experience.

With regard to discovery and relevance of results, students also show gains in these aspects of the laboratory course. Interestingly, students do not always see that they are generating novel results that could be of interest to the scientific community. This is particularly true in BIO 1.

LCAS_Results_F15-Sp16.docx
84.56 KB

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Q4.2.
Are students doing well and meeting the program standard? If not, how will the program work to improve student performance of the selected PLO?

Students are doing well with most aspects of collaborative learning. One of the elements that emerged for both BIO 1 and BIO 2 is that students aren't engaging in the peer review process at this level.

These results indicate a few instances where instructors may be able to provide more context to students so that they see the relevance of their work.

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Q4.3.
For the selected PLO, the student performance:

- 1. **Exceeded** expectation/standard
- 2. **Met** expectation/standard
- 3. **Partially** met expectation/standard
- 4. Did not meet expectation/standard
- (•) 5. No expectation/standard has been specified
- 6. Don't know

Question 4A: Alignment and Quality

Q4.4.
Did the data, including the direct measures, from all the different assessment tools/measures/methods directly align with the PLO?

- (•) 1. Yes
- 2. No
- 3. Don't know

Q4.5.
Were **all** the assessment tools/measures/methods that were used good measures of the PLO?

- (•) 1. Yes
- 2. No
- 3. Don't know

Question 5: Use of Assessment Data (Closing the Loop)

Q5.1.
As a result of the assessment effort and based on prior feedback from OAPA, do you anticipate *making any changes* for your program (e.g. course structure, course content, or modification of PLOs)?

- 1. Yes
- 2. No (skip to **Q5.2**)
- (•) 3. Don't know (skip to **Q5.2**)

Q5.1.1.
Please describe *what changes* you plan to make in your program as a result of your assessment of this PLO. Include a description of how you plan to assess the impact of these changes.

Q5.1.2.
Do you have a plan to assess the *impact of the changes* that you anticipate making?

- (●) 1. Yes
- ( ) 2. No
- ( ) 3. Don't know

Q5.2.

Since your last assessment report, **how have the assessment data from then been used** so far?	1. Very Much	2. Quite a Bit	3. Some	4. Not at All	5. N/A
1. Improving specific courses	( )	( )	( )	(●)	( )
2. Modifying curriculum	( )	( )	(●)	( )	( )
3. Improving advising and mentoring	( )	( )	( )	( )	(●)
4. Revising learning outcomes/goals	( )	( )	( )	(●)	( )
5. Revising rubrics and/or expectations	( )	( )	(●)	( )	( )
6. Developing/updating assessment plan	( )	( )	(●)	( )	( )
7. Annual assessment reports	(●)	( )	( )	( )	( )
8. Program review	( )	( )	( )	(●)	( )
9. Prospective student and family information	( )	( )	( )	(●)	( )
10. Alumni communication	( )	( )	( )	(●)	( )
11. WSCUC accreditation (regional accreditation)	( )	( )	( )	(●)	( )
12. Program accreditation	( )	( )	( )	(●)	( )
13. External accountability reporting requirement	( )	( )	( )	(●)	( )
14. Trustee/Governing Board deliberations	( )	( )	( )	(●)	( )
15. Strategic planning	( )	( )	(●)	( )	( )
16. Institutional benchmarking	( )	( )	( )	(●)	( )
17. Academic policy development or modifications	( )	( )	(●)	( )	( )
18. Institutional improvement	( )	( )	(●)	( )	( )
19. Resource allocation and budgeting	( )	( )	( )	(●)	( )
20. New faculty hiring	( )	( )	( )	(●)	( )
21. Professional development for faculty and staff	(●)	( )	( )	( )	( )
22. Recruitment of new students	( )	( )	(●)	( )	( )

23. Other, specify:

Q5.2.1.
Please provide a detailed example of how you used the assessment data above:

Q5.3.
To what extent did you apply **last year's feedback** from the Office of Academic Program Assessment in the following areas?

	1. Very Much	2. Quite a bit	3. Some	4. Not at All	5. N/A
1. Program Learning Outcomes	○	○	○	◉	○
2. Standards of Performance	○	○	○	◉	○
3. Measures	○	○	○	◉	○
4. Rubrics	○	○	○	◉	○
5. Alignment	○	○	○	◉	○
6. Data Collection	○	○	○	◉	○
7. Data Analysis and Presentation	○	○	○	◉	○
8. Use of Assessment Data	○	○	○	◉	○
9. Other, please specify:	○	○	○	○	○

Q5.3.1.
Please share with us an example of how you applied **last year's feedback** from the Office of Academic Program Assessment in any of the areas above:

(Remember: Save your progress)

Additional Assessment Activities

Q6.
Many academic units have collected assessment data on aspect of their program *that are not related to the PLOs* (i.e. impacts of an advising center, etc.). **If** your program/academic unit has collected data on program *elements*, please briefly report your results here:

See attached file for survey data regarding student self-efficacy and intentions to persist in the STEM disciplines/professionalism.

SelfEficacy_Persistence_Results.docx
956.24 KB

No file attached

Q7.
What PLO(s) do you plan to assess next year? [**Check all that apply**]

- [ ] 1. **Critical Thinking**
- [ ] 2. **Information Literacy**
- [x] 3. **Written Communication**
- [ ] 4. **Oral Communication**
- [ ] 5. Quantitative Literacy
- [ ] 6. **Inquiry and Analysis**
- [ ] 7. Creative Thinking
- [ ] 8. Reading
- [x] 9. Team Work
- [ ] 10. Problem Solving
- [ ] 11. Civic Knowledge and Engagement
- [ ] 12. **Intercultural Knowledge, Competency, and Perspectives**
- [ ] 13. Ethical Reasoning
- [x] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. **Global Learning and Perspectives**
- [x] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [ ] 18. **Overall Disciplinary Knowledge**
- [x] 19. **Professionalism**
- [ ] 20. Other, specify any PLOs not included above:

a.
b.
c.

Q8. Please attach any additional files here:

No file attached | No file attached | No file attached | No file attached

Q8.1.
Have you attached any files to this form? If yes, please list every attached file here:

LCAS_Survey.docx

LCAS_Results_F15-Sp16.docx

SelfEfficacy_Persistence_Results.docx

BioSci_AssessmentPlan_063017.docx

BS_Curriculum_Map.pdf

Program Information (**Required**)

Program:

(If you typed your program name at the beginning, please skip to Q10)

Q9.
Program/Concentration Name: [skip if program name appears above]
BS/BA Biology

Q10.
Report Author(s):

Q10.1.
Department Chair/Program Director:

Q10.2.
Assessment Coordinator:

Q11.
Department/Division/Program of Academic Unit
Biological Sciences

Q12.
College:
College of Natural Science & Mathematics

Q13.
Total enrollment for Academic Unit during assessment semester (see Departmental Fact Book):
1483

Q14.
Program Type:

- (●) 1. Undergraduate baccalaureate major
- ( ) 2. Credential
- ( ) 3. Master's Degree
- ( ) 4. Doctorate (Ph.D./Ed.D./Ed.S./D.P.T./etc.)
- ( ) 5. Other, specify:

Q15. Number of **undergraduate degree programs** the academic unit has?
8

Q15.1. List all the names:

BA Biological Sciences

BS Biological Sciences, Concentrations:

- General Biology
- Biomedical Sciences
- Cell and Molecular Biology
- Clinical Laboratory Sciences
- Ecology, Evolution and Conservation
- Forensic Biology
- Microbiology

Q15.2. How many concentrations appear on the diploma for this undergraduate program?
6

Q16. Number of **master's degree programs** the academic unit has?
5

Q16.1. List all the names:

MA Biological Sciences, Concentrations:

- No Concentration
- Stem Cell Biology

MS Biological Sciences, Concentrations:

- No Concentration
- Ecology, Evolution and Conservation
- Molecular and Cellular Biology

Q16.2. How many concentrations appear on the diploma for this master's program?
3

Q17. Number of **credential programs** the academic unit has?
0

Q17.1. List all the names:

Q18. Number of **doctorate degree programs** the academic unit has?
0

Q18.1. List all the names:

When was your **assessment plan**...	1. Before 2011-12	2. 2012-13	3. 2013-14	4. 2014-15	5. 2015-16	6. 2016-17	7. No Plan	8. Don't know
Q19. developed?	○	○	○	◉	○	○	○	○
Q19.1. last updated?	○	○	○	○	○	◉	○	○

Q19.2. (REQUIRED)
Please **obtain** and **attach** your latest **assessment plan**:

BioSci_AssessmentPlan_063017.docx
134.08 KB

Q20.
Has your program developed a **curriculum map?**

- ◉ 1. Yes
- ○ 2. No
- ○ 3. Don't know

Q20.1.

Please **obtain** and **attach** your latest **curriculum map**:

BS_Curriculum_Map.pdf
86.98 KB

Q21.
Has your program indicated in the curriculum map where assessment **of student learning** occurs?

- 1. Yes
- (•) 2. No
- 3. Don't know

Q22.
Does your program have a capstone class?

- (•) 1. Yes, indicate: Different in each concentration
- 2. No
- 3. Don't know

Q22.1.
Does your program have **any** capstone project?

- (•) 1. Yes
- 2. No
- 3. Don't know

(**Remember**: **Save your progress**)

LCAS (Collaboration questions are 1-6, Discovery/Relevance are 7-11). I left off Iteration, since it didn't really match a PLO.

Use the following scale to respond to the statements in 1-6.

1- Weekly
2- Every Other Week
3- Monthly
4- One or Two Times
5- Never
6- I Don't Know
7- I Prefer Not to Respond

In this course…

_____1. I was encouraged to discuss elements of my investigation with classmates or instructors.

_____2. I was encouraged to reflect on what I was learning.

_____3. I was encouraged to contribute my ideas and suggestions during class discussions.

_____4. I was encouraged to help other students collect or analyze data.

_____5. I was encouraged to provide constructive criticism to classmates and challenge each other's interpretations.

_____6. I was encouraged to share the problems I encountered during my investigation and seek input on how to address them.

Use the following scale to respond to the statements in 7-11.

1- Strongly Disagree
2- Disagree
3- Somewhat Disagree
4- Somewhat Agree
5- Agree
6- Strongly Agree
7- I Don't Know
8- I Prefer Not to Respond

In this course…

_____7. I was expected to generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.

_____8. I was expected to conduct an investigation to find something previously unknown to myself, other students, and the instructor.

_____9. I was expected to formulate my own research questions or hypothesis to guide an investigation.

_____10. I was expected to develop new arguments based on data.

_____11. I was expected to explain how my work has resulted in new scientific knowledge.

Summary of LCAS responses from BIO1 students in the Fall 2015 and Spring 2016 semesters.

			Fall 2015	Spring 2016
Item	Construct	I was encouraged to…	% Weekly/ Every Other Week	% Weekly/ Every Other Week
1	Collaboration	discuss elements of my investigation with classmates or instructors.	72%	81%
2		reflect on what I was learning.	81%	86%
3		contribute my ideas and suggestions during class discussions.	75%	78%
4		help other students collect or analyze data.	63%	76%
5		provide constructive criticism to classmates and challenge each other's interpretations.	31%	46%
6		share the problems I encountered during my investigation and seek input on how to address them.	60%	70%
Item	Construct	I was expected to…	% Agree*	% Strongly Agree/Agree
7	Discover/Relevance	generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.	38%	42%
8		conduct an investigation to find something previously unknown to myself, other students, and the instructor.	56%	55%
9		formulate my own research questions or hypothesis to guide an investigation.	68%	76%
10		develop new arguments based on data.	49%	67%
11		explain how my work has resulted in new scientific knowledge.	49%	61%

Summary of LCAS responses from BIO2 students in the Fall 2015 and Spring 2016 semesters.

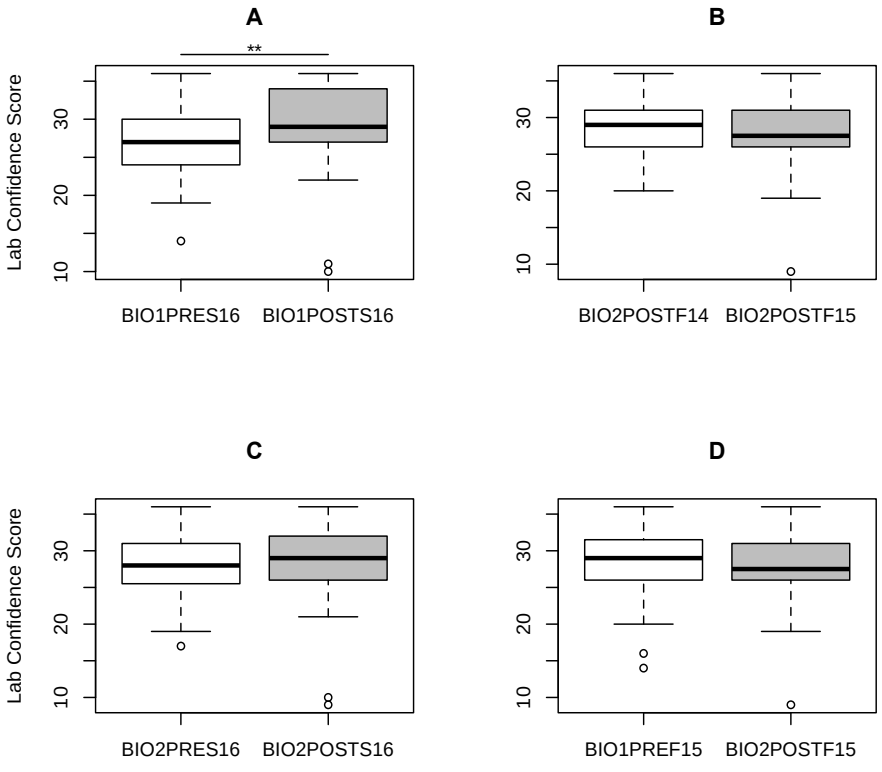
			Fall 2015	Spring 2016
Item	Construct	I was encouraged to…	% Weekly/ Every Other Week	% Weekly/ Every Other Week
1	Collaboration	discuss elements of my investigation with classmates or instructors.	75%	87%
2		reflect on what I was learning.	81%	83%
3		contribute my ideas and suggestions during class discussions.	78%	78%
4		help other students collect or analyze data.	74%	77%
5		provide constructive criticism to classmates and challenge each other's interpretations.	61%	54%
6		share the problems I encountered during my investigation and seek input on how to address them.	81%	82%
Item	Construct	I was expected to…	% Agree*	% Strongly Agree/Agree
7	Discover/Relevance	generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.	49%	53%
8		conduct an investigation to find something previously unknown to myself, other students, and the instructor.	63%	61%
9		formulate my own research questions or hypothesis to guide an investigation.	60%	73%
10		develop new arguments based on data.	54%	57%
11		explain how my work has resulted in new scientific knowledge.	59%	63%

Self-efficacy/Foundations and Skills for Lifelong learning/Integrative and Applied Learning:

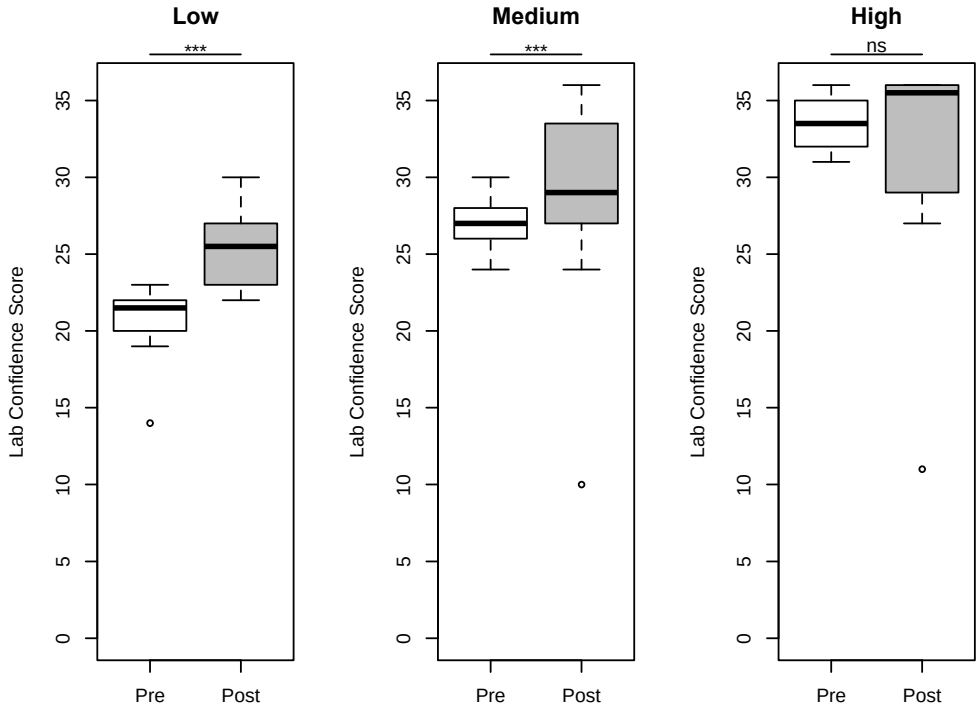
The Lab Confidence Score (LCS) is a summative score calculated from student responses to 9 Likert-like survey items (shown below) that assess self-efficacy related to a range of laboratory tasks/skills. The survey is administered online as a pre- and post-test. The scale ranges from 1 (strongly disagree) to 4 (strongly agree) and total scores range from 9-36.

_____1. I am confident in my ability to construct a testable hypothesis.
_____2. I am confident that I could design controls for an experiment.
_____3. I feel confident communicating the results of an experiment to a group of my peers.
_____4. I feel confident communicating the results of an experiment to a group of scientific experts, e.g., my professors and other scientists.
_____5. I am confident in my ability to do research with others.
_____6. I am confident in my ability to interpret data from an experiment.
_____7. I am confident in my ability to write a clear and succinct scientific paper.
_____8. I am confident in my ability to read and analyze scientific papers.
_____9. I am confident in my ability to understand graphs and tables in scientific papers.

In Spring 2016, BIO1 students reported a gain in overall lab confidence score (LCS) over the course of the semester (A), yet no significant change in LCS was observed for BIO2 students over the same timeframe (C). Boxplots show median Lab Confidence Scores. ** p<.01



BIO1 students' *LCS* values (indicating self-efficacy level) were categorized as low, medium, or high, using their pre-test responses from the beginning of the semester. These were then compared to post-LCS values to determine if different groups responded differently over time. BIO1 students entering the course with low and medium LCS scores demonstrated a significant increase in self-efficacy by the end of the semester, while those with high LCS scores at the beginning of the semester demonstrated no significant change by the end.

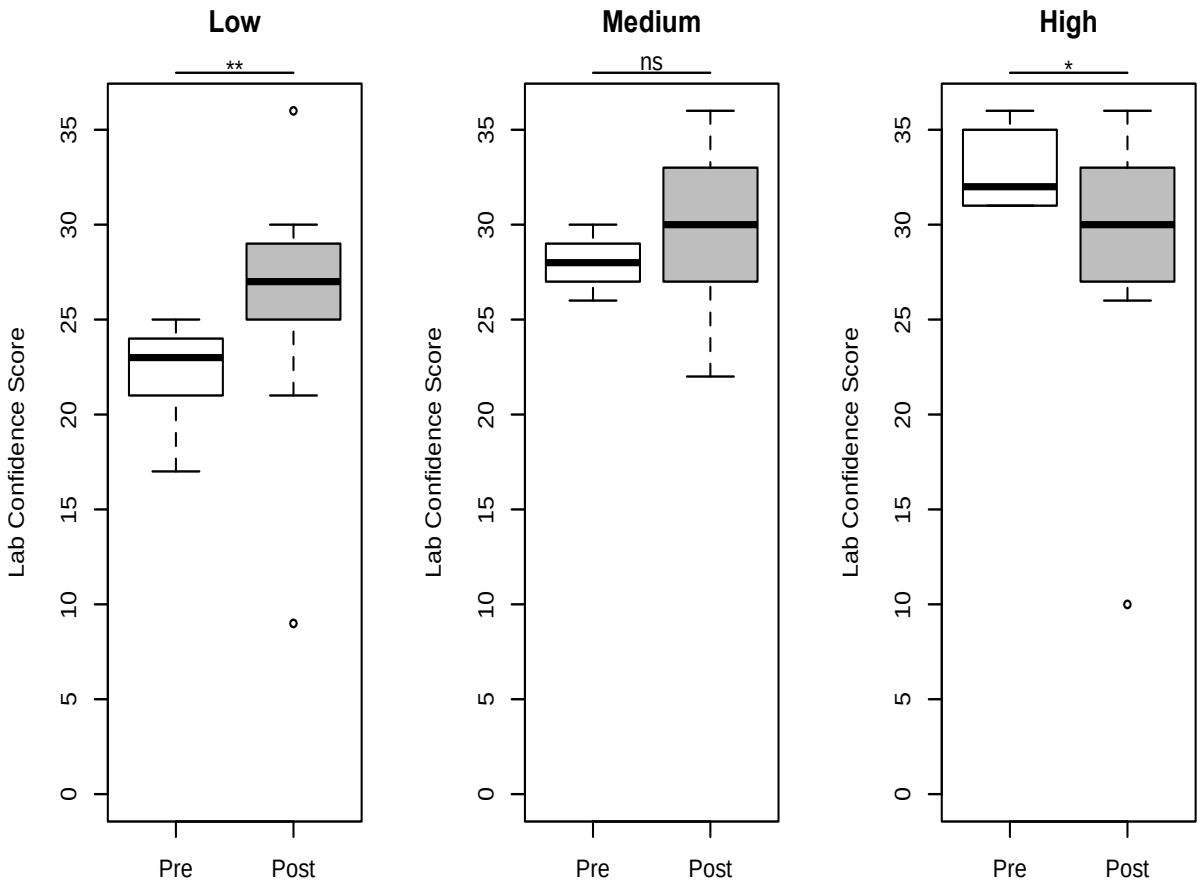


Several analyses were performed to identify relationships between BIO1 students' demographic variables and pre- (LCS_1), post- (LCS_2) and change (ΔLCS) in self-efficacy. While few relationships were observed overall, there were differences between males and females and students who qualified or did not qualify for Pell grants. These differences were eliminated by the end of the semester (LCS_2). There were no significant difference in any of the values for the BIO2 students.

			LCS_1		LCS_2		$\triangle LCS$	
Variable		***n***		*M*		*M*		*M*
Gender	Female	59	26.71	27	28.66	28	1.95	2
	Male	36	28.81	28.5	30.92	30	2.11	1.5
		p-values	0.01604*		0.0526		0.6973	

			LCS_1		LCS_2		$\triangle LCS$	
Variable		***n***		*M*		*M*		*M*
Pell	No	43	29.19	29	30.05	29	0.86	1
	Yes	52	26.12	26	29.08	29	2.96	3
		p-values	0.000023**		0.2399		0.03064*	

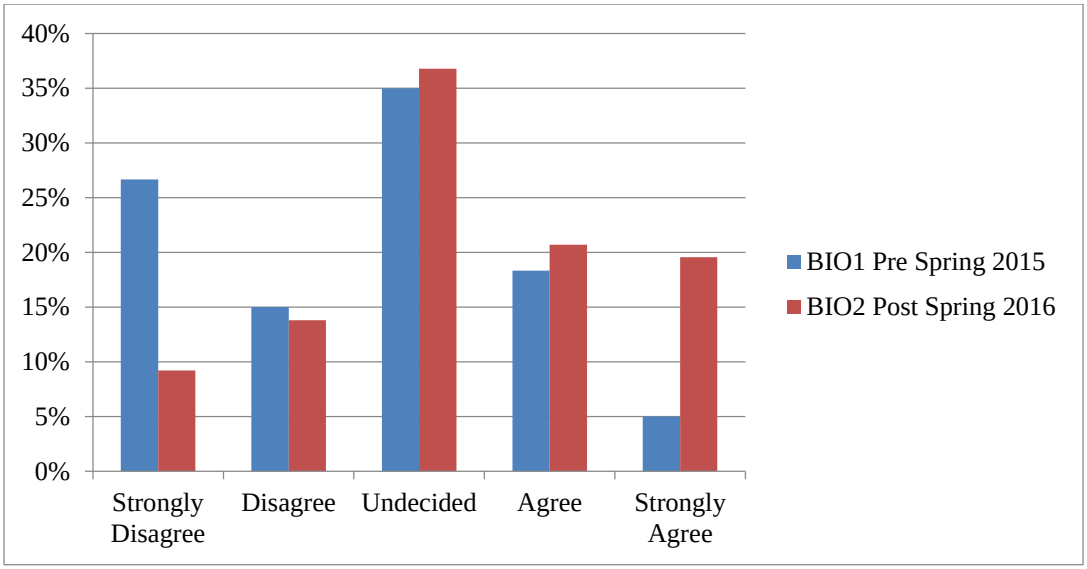
The same analysis performed on BIO2 students revealed a different trend. Students with low pre-LCS demonstrated a significant increase by the end of the semester, while those with high pre-LCS demonstrated a significant decrease. Those with medium confidence levels of the beginning of the semester showed no change over the time course.



Intentions to persist in the STEM discipline/Professionalism:

Students were asked several questions to gauge their likelihood to persist in the major and continue to post-graduate work or a career in a STEM filed. For example, students were asked to rate the following statement on a scale of 1-5 (1 = strongly disagree and 5=strongly agree): "I intend to enroll in a Ph.D. program in science mathematics, or engineering."

Chi squared analyses showed differences in responses from students surveyed at the beginning of BIO1 to those surveyed at the end of BIO2 ($\chi^2 = 9.7640$, d.f. = 4, $p<.05$).



Biological Sciences Assessment Plan

Revised 6/30/17

Learning Outcomes: As a part of the curriculum revision in Biological Sciences that was approved in 2011, revised learning outcomes were developed for the program that were approved by the Department in 2014 (Attachment 1). These learning outcomes include five knowledge domains in addition to skills and attitudinal factors.

Curriculum Map: The Department has developed a DRAFT curriculum map indicating the courses in which each of the program learning outcomes is addressed (Attachment 2). The courses marked "I" are intended to introduce the knowledge/concept, "D" indicates developmental coverage of the concept, and "M" indicates mastery, or application of the learning outcome.

Assessment plan for learning outcomes: In 2013, the Department developed a plan to assess Learning Goal 2, subgoals A and B (Communication, Critical thinking, hypothesis testing and quantitative analysis) using a series of modified VALUE rubrics. These assessments were planned to take place using a key assignment in BIO 188 (Evolution). We conducted the first formal assessment of the Critical Thinking learning outcomes in Spring 2014 using a modified Critical Thinking VALUE rubric (See attached rubrics), with the intention of rotating the outcome that was assessed each year (Table 1). As a result of staffing changes in BIO 188, the key assignment has been discontinued. As a result of these changes, the Department has been reconsidering the assessment plan and intends to develop a revised assessment plan in Fall 2017. For direct assessment of student learning, we will work with faculty teaching both lower and upper divison core courses in the Biological Sciences, with a focus on student work in capstone courses within each concentration. Furthermore, we will continue to collect survey data on student self-efficacy and self-assessment of learning outcomes, including these within a comprehensive, modified assessment plan.

Table 1. Learning Outcomes Assessment plan.

Year	Outcome Assessed	Student Work to be assessed	Method of Assessment
1	Critical Thinking	Key assignment in BIO 188	Modified VALUE Rubric
2	Written Communication	Key assignment in BIO 188	Modified VALUE Rubric
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4	Quantitative Reasoning	Key assignment in BIO 188	Modified VALUE Rubric
5	Foundational Knowledge	TBD	TBD

Draft Curriculum Map
Biological Sciences BA & BS Degree Options

	Learning Goal 1 Students will demonstrate foundational knowledge in the Biological Sciences in the following core concepts				
	Sub-Goal A: Evolution: diversity of life evolved over time by mutation, selection and genetic change	**Sub-Goal B: Structure and Function**: The basic units of structure and function define all living things	**Sub-Goal C: Information flow, exchange and storage**: The growth and behavior of organisms are activated through the expression of genetic information in context	**Sub-Goal D: Pathways and transformations of energy and matter**: Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics	**Sub-Goal E: Interconnectedness and interactions of living systems**: Living systems are interconnected and interacting
Learning Outcomes/Courses	**Department Outcome 1**. Mechanisms of genomic change. Students will differentiate the processes by which genomic change occurs in living organisms, including mutation, genome rearrangement and changes in gene expression. Furthermore, students will predict the role of genomic change in diversification of life on earth. **Department Outcome 2**. Evolutionary Mechanisms within Populations. Students will analyze allele frequencies to infer the role of selection, mutation, drift and nonrandom mating within populations. **Department Outcome 3**. Natural Selection and Adaptive Evolution. Students will describe the process of natural selection within populations and the role of selection in the diversity of life on earth. Students will also integrate comparative (phylogeny-based) and experimental approaches to test hypotheses of adaptation. **Department Outcome 4**. Diversity of organisms on earth. Students will read, interpret, and infer relationships from a phylogenetic tree for the Domains, Kingdoms, and representative Phyla of life on earth. Students will also describe the characteristics that define each of these monophyletic groups.	**Department Outcome 1**. Molecular Structure and Function. Students will explain how the function of molecules is determined by their three-dimensional structure and the resulting interactions with other molecules. **Department Outcome 2**. Cellular Structure and Function. Students will explain how the function of cellular structures and, therefore, cells is determined by the three-dimensional structure created by multiple molecules and the resulting interactions with their environment. **Department Outcome 3**. Organismal Structure and Function. Department Outcome 3. Informational Organization in Multicellular Organisms. Students will explain how organisms regulate their signal transduction, cellular homeostasis and physiological regulation; and how that might change in response to internal or environmental changes. **Department Outcome 4**. Ecological Structure and Function. Ecological Structure and Function. Students will explain how the function of ecological structures is determined by the structures and functions of multiple organisms and the resulting interactions with the environment.	**Department Outcome 1**. Informational Organization in the Cell. Students will explain how individual cells regulate their gene expression and movement of materials; and how that can change in response to environmental change. **Department Outcome 2**. Informational Organization in Single-Celled Populations. Students will explain how groups of cells regulate their cellular recognition, communication and quorum sensing; and how that can change in response to environmental change. **Department Outcome 3**. 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Bio 1	I	I	I	I	I
Bio 2	I	I	I	I	I
Bio 100					
Bio 184	D	D	D		
Bio 121	D	D	D	D	D
Bio 139	D	D	D	D	
Bio 160		D		D,M	D,M
Bio 188	M		M		
Electives	Varies by course; individual courses not currently mapped	Varies by course; individual courses not currently mapped	Varies by course; individual courses not currently mapped	Varies by course; individual courses not currently mapped	Varies by course; individual courses not currently mapped

Learning Goal 2: Students will demonstrate functional skills in the Biological Sciences in the following core competencies Students will demonstrate the ability to communicate in the Biological Sciences

Subgoal A: Students will demonstrate the ability to communicate in the Biological sciences			**Subgoal B.** Students will demonstrate the ability to apply critical thinking, hypothesis testing, and quantitative analysis		**Subgoal C.** Students will be able to understand and articulate the relevance of their training in biology to their own life-long learning and to larger global and social issues.					
Written Communication: Students will write a paper, research poster and/or research proposal in the format used in common scientific venues. This product will demonstrate adequate consideration of the purpose of the assignment, use appropriate content for the topic of the product, consistently use discipline-specific conventions, consistently use relevant and credible sources and use language that clearly conveys the meaning to readers.	**Oral Communication:** Students will organize material into a clear presentation, use language appropriate to the audience, develop visual aids for the presentation and deliver a clear and consistent message.	**Information Literacy:** Students will use appropriate sources in oral and written communication. Specifically, students will select sources that are relevant to research questions, demonstrate the ability to perform an effective search, organize and synthesize information from sources, and correctly paraphrase and cite sources.	**Critical Thinking:** Students will state a hypothesis to be tested, provide and interpret background information in a coherent summary, recognize the complexities of the hypothesis and acknowledge opposing viewpoints, and provide a conclusion that is logically tied to the information provided.	**Quantitative Reasoning**: Students will perform necessary statistical calculations needed to solve a problem, provide accurate interpretations of results, portray results in an appropriate graphical or tabular format, and use of the quantitative information to address the specific hypothesis associated with the work.	**Evidence-Based Personal Values.** Students will develop and express evidence-based personal values on current implications and applications of biological science.	**Relationship to other Disciplines.** Students will not only explain the importance of connections within the disciplines of biology, but also between biological disciplines and other disciplines.	**Social Relevance.** Students will critically evaluate and explain the social relevance of biology, particularly those issues that might have wide-ranging social impacts and/or generate controversy.	**Collaboration.** Students will collaborate to solve scientific problems and explain the importance of collaboration.	**Life-Long learning.** Students will demonstrate self-regulatory behaviors that deepen, monitor, manipulate and improve their own learning.	Learning Outcomes/Courses
I	I	I	I	I	I	I	I	I	I	**Bio 1**
I,D	I,D	I,D	I,D		I,D	I,D	I,D	I,D	I,D	**Bio 2**
D	D	D	D	D	D		D	D	D	**Bio 100**
			D	D?	D	D	D	D	D	**Bio 184**
			D		D	D	D		D	**Bio 121**
D			D	D	D,M	D,M	D,M	D,M	D,M	**Bio 139**
D	D	D	D	D	D,M	D,M	D,M	D,M	D,M	**Bio 160**
M		M	M	M	M	M	M		M	**Bio 188**
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			D	D?	D	D	D	D	D	**Bio 184**
			D		D	D	D		D	**Bio 121**
D			D	D	D,M	D,M	D,M	D,M	D,M	**Bio 139**
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Summary of LCAS responses from BIO1 students in the Fall 2015 and Spring 2016 semesters.

			Fall 2015	Spring 2016
Item	Construct	I was encouraged to…	% Weekly/ Every Other Week	% Weekly/ Every Other Week
1	Collaboration	discuss elements of my investigation with classmates or instructors.	72%	81%
2		reflect on what I was learning.	81%	86%
3		contribute my ideas and suggestions during class discussions.	75%	78%
4		help other students collect or analyze data.	63%	76%
5		provide constructive criticism to classmates and challenge each other's interpretations.	31%	46%
6		share the problems I encountered during my investigation and seek input on how to address them.	60%	70%
Item	Construct	I was expected to…	% Agree*	% Strongly Agree/Agree
7	Discover/Relevance	generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.	38%	42%
8		conduct an investigation to find something previously unknown to myself, other students, and the instructor.	56%	55%
9		formulate my own research questions or hypothesis to guide an investigation.	68%	76%
10		develop new arguments based on data.	49%	67%
11		explain how my work has resulted in new scientific knowledge.	49%	61%

Summary of LCAS responses from BIO2 students in the Fall 2015 and Spring 2016 semesters.

			Fall 2015	Spring 2016
Item	Construct	I was encouraged to…	% Weekly/ Every Other Week	% Weekly/ Every Other Week
1	Collaboration	discuss elements of my investigation with classmates or instructors.	75%	87%
2		reflect on what I was learning.	81%	83%
3		contribute my ideas and suggestions during class discussions.	78%	78%
4		help other students collect or analyze data.	74%	77%
5		provide constructive criticism to classmates and challenge each other's interpretations.	61%	54%
6		share the problems I encountered during my investigation and seek input on how to address them.	81%	82%
Item	Construct	I was expected to…	% Agree*	% Strongly Agree/Agree
7	Discover/Relevance	generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.	49%	53%
8		conduct an investigation to find something previously unknown to myself, other students, and the instructor.	63%	61%
9		formulate my own research questions or hypothesis to guide an investigation.	60%	73%
10		develop new arguments based on data.	54%	57%
11		explain how my work has resulted in new scientific knowledge.	59%	63%

LCAS (Collaboration questions are 1-6, Discovery/Relevance are 7-11). I left off Iteration, since it didn't really match a PLO.

Use the following scale to respond to the statements in 1-6.

1- Weekly
2- Every Other Week
3- Monthly
4- One or Two Times
5- Never
6- I Don't Know
7- I Prefer Not to Respond

In this course…

_____1. I was encouraged to discuss elements of my investigation with classmates or instructors.

_____2. I was encouraged to reflect on what I was learning.

_____3. I was encouraged to contribute my ideas and suggestions during class discussions.

_____4. I was encouraged to help other students collect or analyze data.

_____5. I was encouraged to provide constructive criticism to classmates and challenge each other's interpretations.

_____6. I was encouraged to share the problems I encountered during my investigation and seek input on how to address them.

Use the following scale to respond to the statements in 7-11.

1- Strongly Disagree
2- Disagree
3- Somewhat Disagree
4- Somewhat Agree
5- Agree
6- Strongly Agree
7- I Don't Know
8- I Prefer Not to Respond

In this course…

_____7. I was expected to generate novel results that are unknown to the instructor and that could be of interest to the broader scientific community or others outside of class.

_____8. I was expected to conduct an investigation to find something previously unknown to myself, other students, and the instructor.

_____9. I was expected to formulate my own research questions or hypothesis to guide an investigation.

_____10. I was expected to develop new arguments based on data.

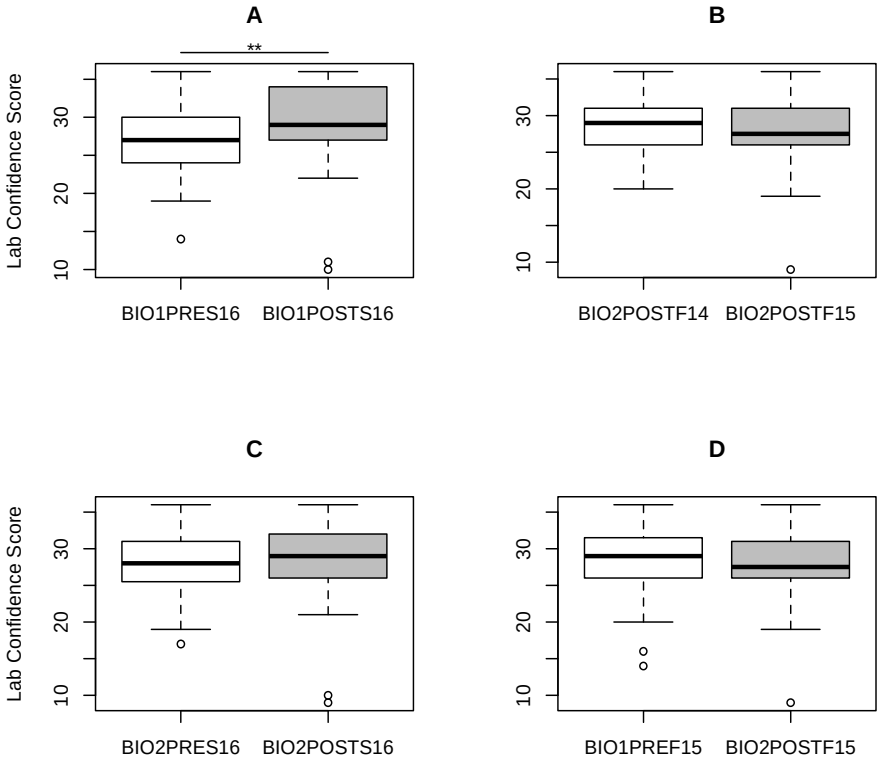
_____11. I was expected to explain how my work has resulted in new scientific knowledge.

Self-efficacy/Foundations and Skills for Lifelong learning/Integrative and Applied Learning:

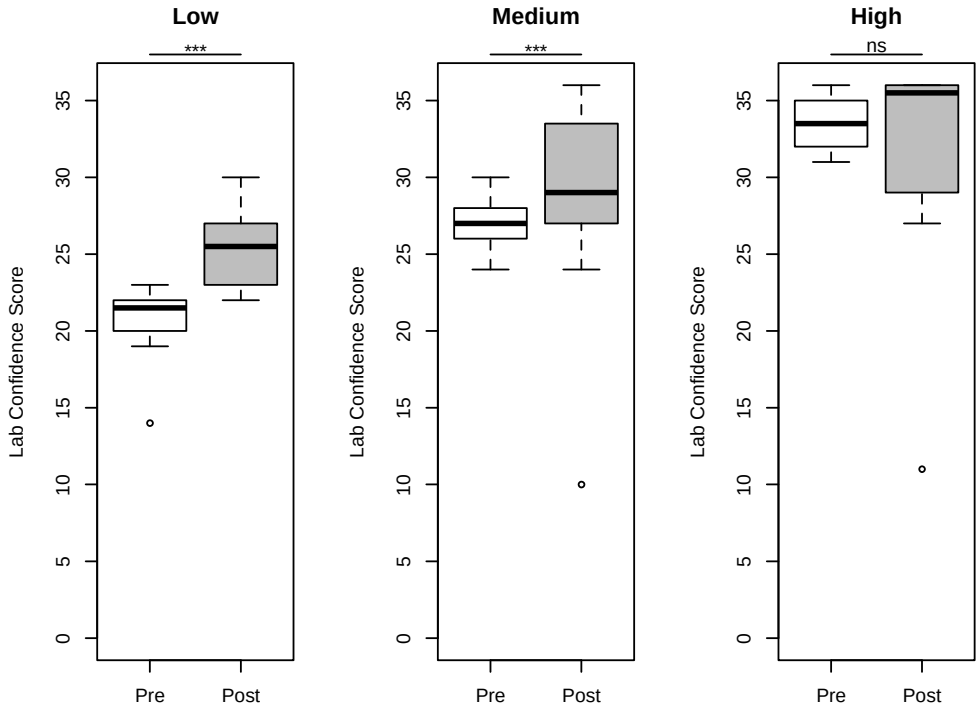
The Lab Confidence Score (LCS) is a summative score calculated from student responses to 9 Likert-like survey items (shown below) that assess self-efficacy related to a range of laboratory tasks/skills. The survey is administered online as a pre- and post-test. The scale ranges from 1 (strongly disagree) to 4 (strongly agree) and total scores range from 9-36.

_____1. I am confident in my ability to construct a testable hypothesis.
_____2. I am confident that I could design controls for an experiment.
_____3. I feel confident communicating the results of an experiment to a group of my peers.
_____4. I feel confident communicating the results of an experiment to a group of scientific experts, e.g., my professors and other scientists.
_____5. I am confident in my ability to do research with others.
_____6. I am confident in my ability to interpret data from an experiment.
_____7. I am confident in my ability to write a clear and succinct scientific paper.
_____8. I am confident in my ability to read and analyze scientific papers.
_____9. I am confident in my ability to understand graphs and tables in scientific papers.

In Spring 2016, BIO1 students reported a gain in overall lab confidence score (LCS) over the course of the semester (A), yet no significant change in LCS was observed for BIO2 students over the same timeframe (C). Boxplots show median Lab Confidence Scores. ** $p<.01$



BIO1 students' *LCS* values (indicating self-efficacy level) were categorized as low, medium, or high, using their pre-test responses from the beginning of the semester. These were then compared to post-LCS values to determine if different groups responded differently over time. BIO1 students entering the course with low and medium LCS scores demonstrated a significant increase in self-efficacy by the end of the semester, while those with high LCS scores at the beginning of the semester demonstrated no significant change by the end.

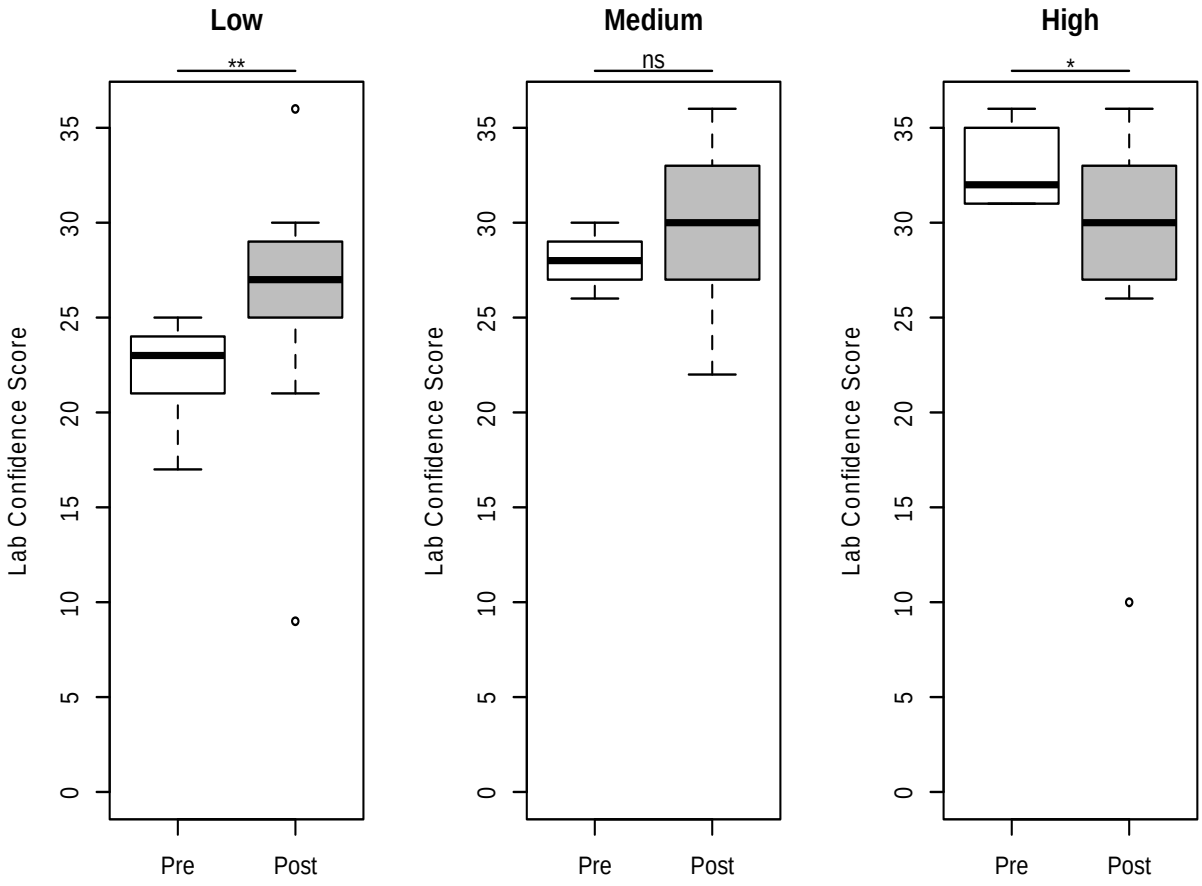


Several analyses were performed to identify relationships between BIO1 students' demographic variables and pre- (LCS_1), post- (LCS_2) and change (ΔLCS) in self-efficacy. While few relationships were observed overall, there were differences between males and females and students who qualified or did not qualify for Pell grants. These differences were eliminated by the end of the semester (LCS_2). There were no significant difference in any of the values for the BIO2 students.

			LCS_1		LCS_2		$\triangle LCS$	
Variable		***n***		*M*		*M*		*M*
Gender	Female	59	26.71	27	28.66	28	1.95	2
	Male	36	28.81	28.5	30.92	30	2.11	1.5
		p-values	0.01604*		0.0526		0.6973	

			LCS_1		LCS_2		$\triangle LCS$	
Variable		***n***		*M*		*M*		*M*
Pell	No	43	29.19	29	30.05	29	0.86	1
	Yes	52	26.12	26	29.08	29	2.96	3
		p-values	0.000023**		0.2399		0.03064*	

The same analysis performed on BIO2 students revealed a different trend. Students with low pre-LCS demonstrated a significant increase by the end of the semester, while those with high pre-LCS demonstrated a significant decrease. Those with medium confidence levels of the beginning of the semester showed no change over the time course.



Intentions to persist in the STEM discipline/Professionalism:

Students were asked several questions to gauge their likelihood to persist in the major and continue to post-graduate work or a career in a STEM filed. For example, students were asked to rate the following statement on a scale of 1-5 (1 = strongly disagree and 5=strongly agree): "I intend to enroll in a Ph.D. program in science mathematics, or engineering."

Chi squared analyses showed differences in responses from students surveyed at the beginning of BIO1 to those surveyed at the end of BIO2 ($\chi^2 = 9.7640$, d.f. = 4, $p<.05$).