CALIFORNIA STATE UNIVERSITY LONG BEACH
Biennial Report on Assessment
(rev. 9/2014)

Academic Year: 2018-2019
Degree Program Name: BS in Biological Sciences (all options)/ Marine Biology/Microbiology
Department Name: Biological Sciences

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Program Assessment Coordinator: Kelly Young
Campus Extension / email: 54859

1. Which student learning outcome(s) for this degree program were assessed over the past year?

The WASC Core Competency selected for the 2018-2019 year is Quantitative Reasoning; however, we continue to administer our BIOL 480 Capstone/Exit exam to seniors in their last semester at CSULB.

1B. Which General Education student learning outcomes were assessed? These do not need to have been taught in GE courses. Please refer to the LEAP learning model available at http://www.csulb.edu/divisions/aa/ge/faculty/skills/index.html#Written.

Our BIOL 480 Capstone/Exit exam and GE pre-post tests assess mastery of a variety of content knowledge, and cover aspects of the following LEAP learning outcomes: Critical Thinking, Quantitative Reasoning, Information Literacy, Inquiry and Analysis, Creativity and Discovery, Skills for Lifelong Learning, and Problem Solving.

2. Briefly describe how these outcomes are linked to CSULB's Institutional learning outcomes (http://www.csulb.edu/divisions/aa/assessment/institutional_objective.html).

Students in courses in the Biological Sciences Department gain conceptual understanding of key biological principles, develop analytical skills to interpret the meaning of data, and experience scientific inquiry through hands-on research or hearing experts share results of their research. Through analysis of data and reading of scientific literature, students develop key quantitative abilities that align with CSULB's Institutional Learning Objectives to cultivate problem solving skills through scientific research and analysis of data.

3. How was student learning assessed for each outcome?

Student Learning Outcome(s):

1. Describe basic biological principles operating at the molecular, cellular, organismal, population and community levels.

2. 2. Use appropriate instruments, experimental techniques and quantitative methods to collect, organize and interpret data. (WASC Quantitative Reasoning)

How Assessed: Capstone/Exit exam for graduating seniors.
History:
Dr. Ashley Carter was again in charge of analyzing our 50-question assessment Capstone exam given to graduating seniors in their last semester at CSULB. Our Capstone assessment exam tests higher level critical thinking skills, including determining statistical tests to apply and interpreting graphical data results based on statistics given. This test requires that students understand the process of biology and that they are able to think and reason through biological issues and problems.

The exam was restructured in 2012 to better reflect content and skills learned in our courses. The exam offers higher order concern questions (HOCs) that require knowledge of the scientific process, data interpretation, and broader concept understanding. Many questions incorporate critical thinking and application of knowledge. These questions correspond to CSULB's Institutional Learning Objectives, and because questions include data interpretation, we are in line with LEAP learning outcomes to have students critically assessing information within our field. The 50-question exam covers the following topics: Botany, Cellular and Molecular Biology, Diversity, Ecology and Evolution, Genetics, Marine Biology, Microbiology, Physiology, and Statistics; however, the aim is to test critical thinking within the context of these fields in addition to general content knowledge.

2019 Capstone/Exit Exam
The biology department offers three majors, a Marine Biology BS, a Microbiology BS, and a Biology BS. The Biology BS has four major options: General Biology, Molecular Cell Biology and Physiology, Organismal Biology, and Education.

All graduating Biology, Marine Biology, and Microbiology majors take an exit exam as part of a required one credit course, Bio 480, during their last semester. The exam has 50 multiple choice questions, with each question testing the understanding of one or two subcategories of biological knowledge. These subcategories are: botany, cell & molecular biology, diversity of life, ecology & evolution, genetics, marine biology, microbiology, physiology, and statistics and logic. Stress is placed on questions using higher order of Bloom's Taxonomy thought processes in addition to content knowledge.

4. What were the results of the assessment for each learning outcome?
Results Analyzed and Written by Dr. Ashley Carter

Student Learning Outcome(s):

1. Describe basic biological principles operating at the molecular, cellular, organismal, population and community levels.
2. Use appropriate instruments, experimental techniques and quantitative methods to collect, organize and interpret data. (WASC Quantitative Reasoning)

Results of Assessment:

Exit Exam Analysis by Major and Option

In 2019 a total of 177 graduating students took this exam. The overall average score for all students taking the exam and covering all topics was 62% . This result has been steady over the last several years, with previous averages at: 61% (2018), 62% (2016), 61% (2015), 63% (2014), 63% (2013), 61% (2012), 54% (2011 old exam) and 52% (2010 old exam). These results are also an improvement as compared to the GRE-style professionally administered biology capstone exams from 2006 and 2007, where the average student scored in the 50th, and 41st percentile, respectively. Figure 1 shows the performance of all students on the questions, separated by major and option.

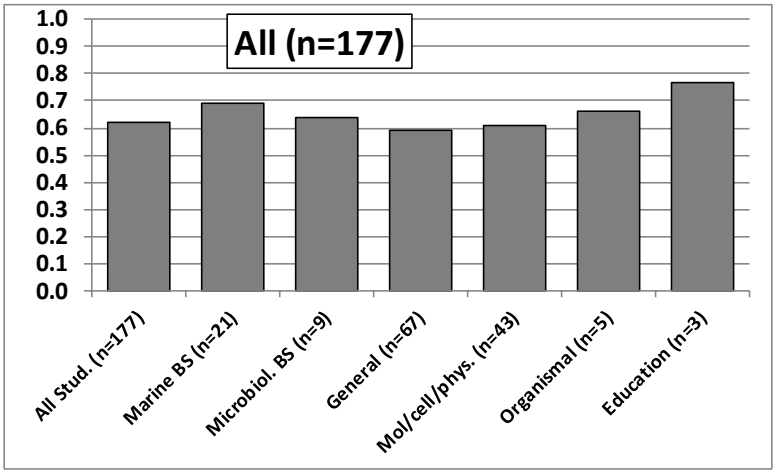
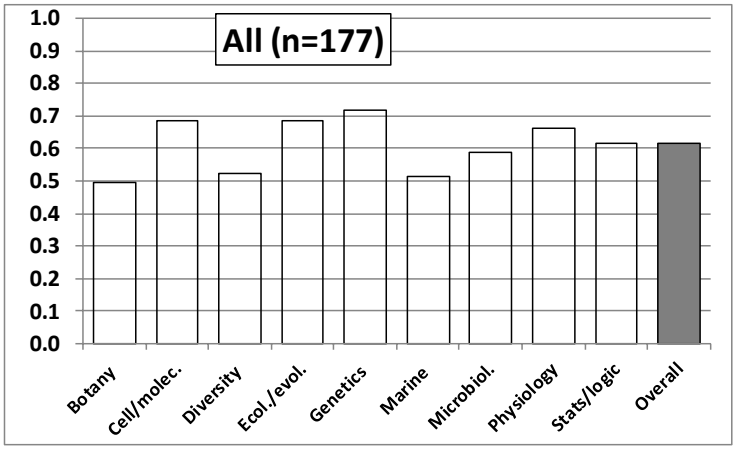


Figure 1. Raw percentage scores on Bio 480 exam for all students, separated by major and option. Note, students did not study or prepare for this general exam.

Figure 2 shows the performance of all students on questions in each subcategory and overall. The exam was designed be challenging and the overall mean percentage correct was 61.8% Three categories appeared to have more difficult questions: botany, diversity, and marine biology. Three categories appeared to have easier questions: cell and molecular biology, ecology and evolution, and genetics. The categories had questions that were answered correctly at the same rate as the overall average: microbiology, physiology, statistics and logic.



These results are in line with the data for 2018 (61.1% overall score and same categories in each difficulty grouping)

Figure 2. Raw percentage scores on Bio 480 exam for all students, separated by topic subcategory of question.

Figures 3 and 4 show the performance of students on questions in each subcategory and overall, according to their major or option.

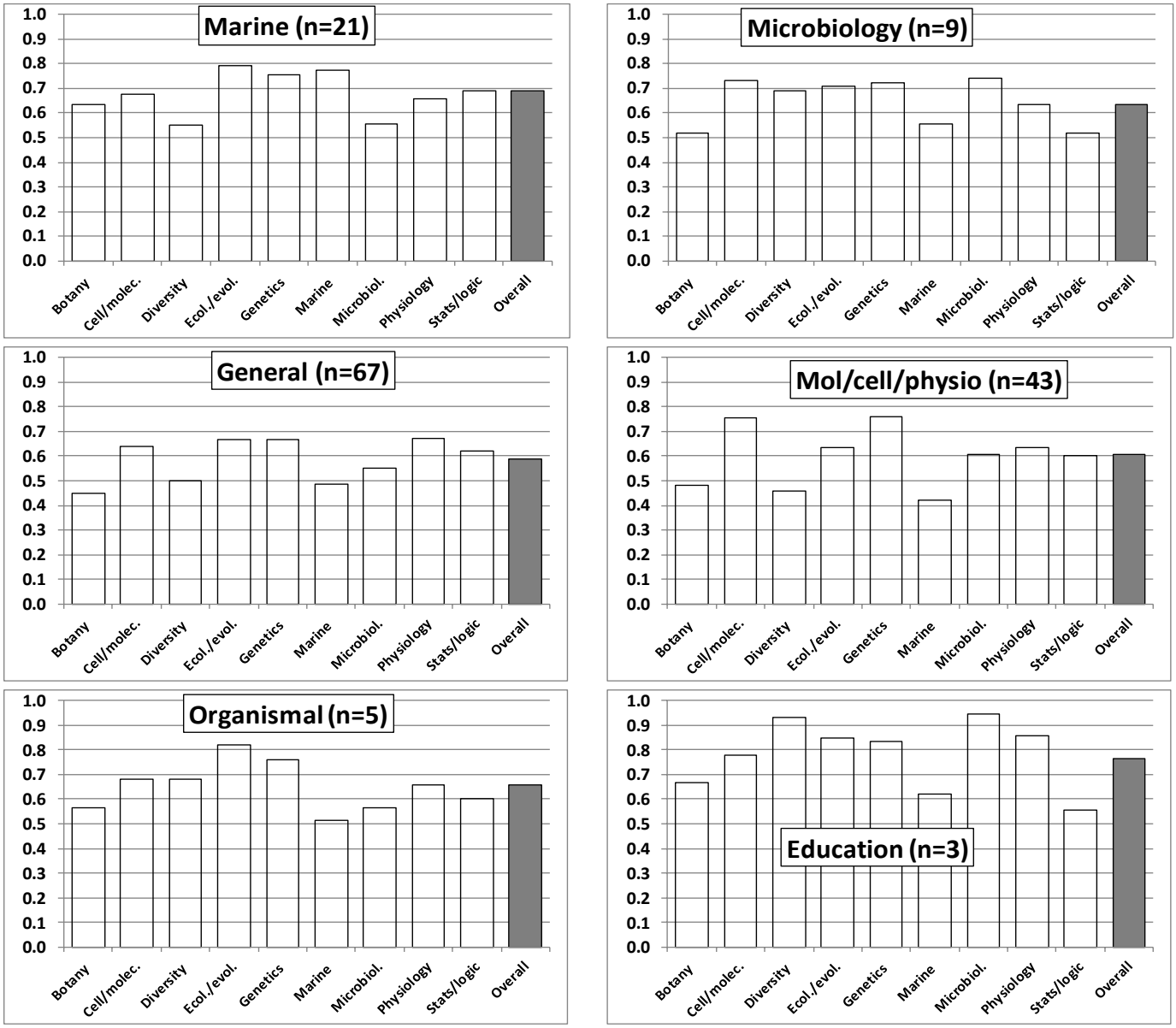


Figure 3. Raw percentage scores on Bio 480 exam for all students, according to their degree option, separated by topic subcategory of question. (Note that the unusual results from the education majors is likely due to the very small sample size)

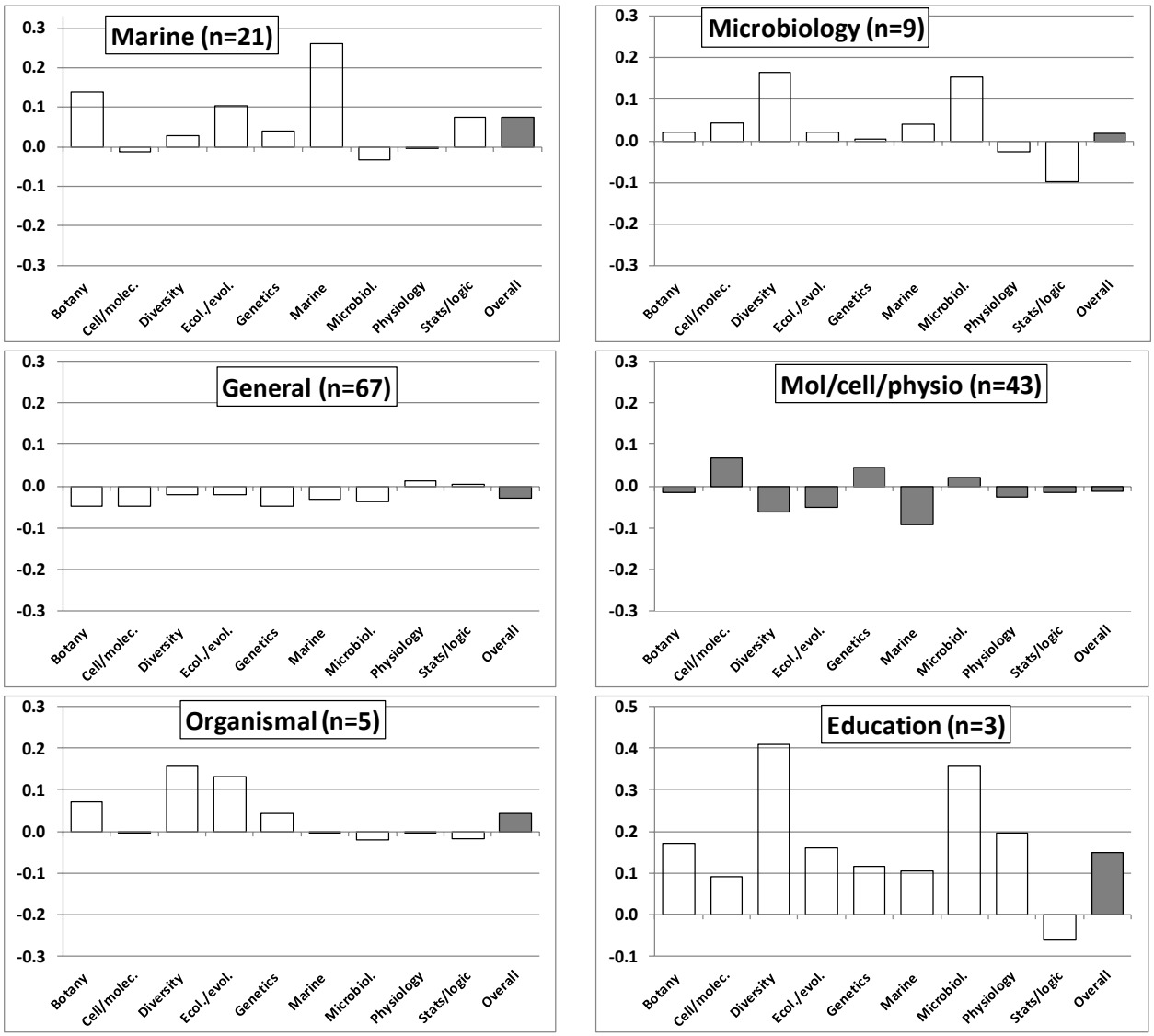


Figure 4. Relative (i.e., compared to overall score for all students) percentage scores on Bio 480 exam for all students, according to their degree option, separated by topic subcategory of question. (Note that the unusual results from the education majors is likely due to the very small sample size)

Overall Assessment of Major/Option Results:

The data in figures 1-4 reveals the following interesting patterns.

(1) Scores for the different majors and options varied by up to 10% (i.e., from highs of 76.7% and 69.2% for education and marine majors respectively down to 60.7% and 59.0% for molec/cell/physio and general options respectively). This pattern is very similar to that seen in 2018.

(2) Within the biology BS degree, the general option students did slightly worse than the molec/cell/physio option students. Student self-selection may be responsible, with weaker than average students choosing the general option and stronger than average students choosing the molec/cell/physio option, but since the opposite pattern was seen in 2018 this is likely just random noise.

(3) Although the education option students appeared to do extremely well, the education option students' results are potentially skewed by the extremely small sample size.

(4) As expected the organismal option students outperformed other students on the diversity and ecology/evolution questions whereas the cell/molec option students outperformed other students on the cell/molec questions

(5) As expected the BS in Microbiology students outperformed most other students (i.e., non-education option) on the microbiology questions. They also did very well on the diversity questions.

(6) As expected the BS in Marine Biology students outperformed other students on the marine biology questions. They also did very well on the ecology/evolution and statistics questions which likely arises from the ecology focus of the marine biology faculty.

(7) When we focus just on quantitative reasoning, the WASC outcome for 2019, differences in the statistics and logic section were noted. Marine majors scored an average of 70%, Microbiology majors scores just over 50%, General Biology majors scored just over 60%, Molecular Cellular Physiology students scored 60%, Organismal majors scored 60%, and Biology Education majors scored 55%. While these scores speak well for the majority of our majors, all can be improved, especially in Microbiology and Biology Education.

Exit Exam Analysis by Transfer Status

The department receives a number of transfer students from other institutions and a comparison of their performance to that of native majors was performed. Native or transfer status was defined according to their reporting of where they took Bio 211, Bio 212, and Bio 213 or the equivalent. Students who took all three courses at CSULB were defined as "Native" while those that took all three courses elsewhere were defined as "Transfer"; students taking these courses at a mix of both places or not providing this information were omitted.

Figure 5. This figure shows the raw and relative performances of students on questions in each subcategory and overall, according to their status as a native or transfer student.

The data in those figures reveals the following patterns.

(1) Mean overall scores for the two groups were similar 63.6% for native students (n=77) and 59.8% for transfer students (n=48); a 3.8% overall difference.

(2) Native students performed better on all categories of questions, particularly physiology and genetics for which the differences were moderate to large (approx. 6-8%).

(3) The introductory sequence covers material in all these categories except statistics. Transfer

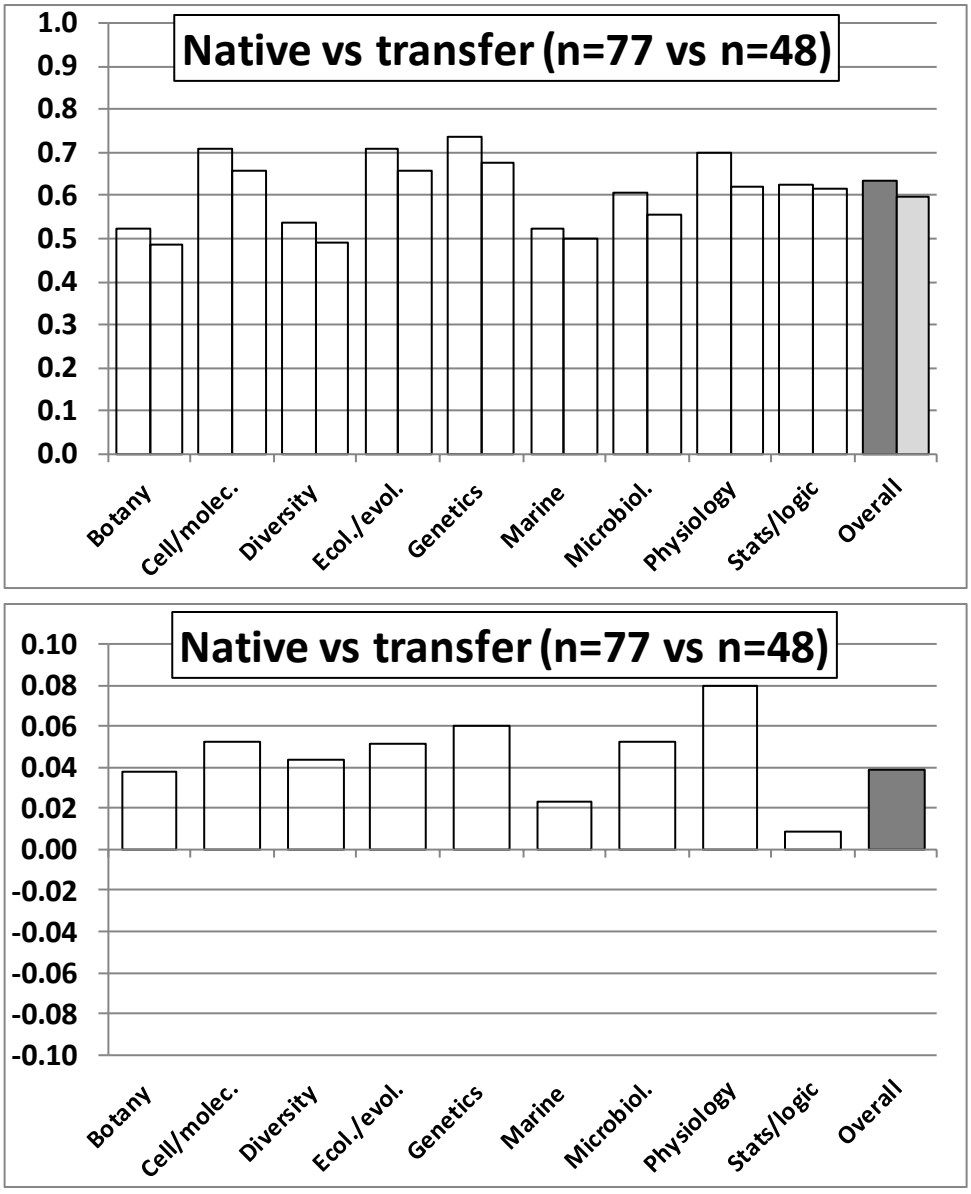


Figure 5. Top: Raw percentage scores for all examined students separated by topic subcategory of question: native students (dark) and transfer students (light). Bottom: difference in raw percentage scores native students and transfer students, positive values indicate native students scoring better while negative values indicate the opposite.

students typically take their statistics course at CSULB (very few community colleges offer a transferable version of this course) **so the stats/logic category having the smallest difference between groups likely arises from the fact that the vast majority of transfer students take their statistics course here.** The slightly lower scores for transfer students may therefore indicate a lower degree of overall academic or mathematics preparedness. The overall difference is only ~1% so a large difference in overall student academic ability between native and transfer students is unlikely, and if present, it is quite small.

(4) Taking the patterns seen in points (1) - (3) as a whole these comparisons suggest that the introductory sequence taught at **CSULB does a better job of leading to student retention of material** than alternative introductory sequences taken elsewhere by transfer students.

5. How were the results used for program improvement (how are you "closing the loop")?

Student Learning Outcome(s):

1. Describe basic biological principles operating at the molecular, cellular, organismal, population and community levels.
2. Use appropriate instruments, experimental techniques and quantitative methods to collect, organize and interpret data. (WASC Quantitative Reasoning)

Scores on the exam and the exam itself was discussed in the Biological Sciences Curriculum and Assessment Committee, and during attendance at the Southern California (SC) Partnership for Life Sciences Education (PULSE) Institute (SCPI) attended by Chair Dr. Dessie Underwood, Dr. Erika Holland, and Dr. Kelly Young in June 2018. Discussion of how we could adopt recommendations from the NSF/NIH/HHMI Vision and Change document occurred and Dr. Underwood launched a restructure of BIOL 211. Aspects of the PULSE institute were also discussed at the Departmental Retreat in 2018 and are the planned focus for the 2019 Departmental retreat. Scores from our BIOL 480 exam will be shared at the 2019 retreat.

6. Please provide an update on actions regarding your MOU if appropriate and attach the update to this report if necessary.

N/A

7. What are your plans for assessment for the next assessment cycle?

We are waiting to hear the outcome for the GE aspect of assessment. If GE remains as a key element for assessment, we will continue with our individualized reports from each GE course. The new form providing guidelines and structure for reflection on the effectiveness of the assessment will be provided to each faculty member teaching a GE course- offered as an option for the upcoming year. The new form also connects the assessment and reflection to each SLO, and asks for an action plan with timeline for each course. This form could be something that is potentially shared between different instructors of the same course, potentially providing more continuity and opportunity for discussion.

We would like to revisit our BIOL 480 exit exam to better reflect the principles and skills of the Vision and Change Document for Biological Sciences Undergraduate Education produced by the NIH/NSF/HHMI. This would allow for additional problem solving and data interpretation skills to be assessed. Unfortunately, there is not an instrument designed based on the Vision and Change document; however, we will continue to look for validated instruments that may help us expand our assessment of these higher levels of Bloom's Taxonomy.

General Education Assessment 2018

Preface, History, and Summary: The Assessment Committee met with instructors of GE courses in the Biological Sciences in F10 to discuss strategies for assessment. To determine value added knowledge from the course, the use of a pre-post test was proposed and accepted. The idea was to administer the same exam both before and after the students had completed the course. Students were not asked to study for either the pre or post test, and different instructors used different incentives for students to take the exams (small amount of extra credit, points given if students reached a certain threshold, or actually building the post test into the point system of the course). We first used this system in S11, with positive results. All faculty members teaching GE courses agreed to again use the pre-post system from F11- the present.

For the 2018-2019 year, we again asked faculty to reflect on the class- specifically, we asked them to consider where learning went well, where students may have struggled, and what their plan was for addressing challenges in the upcoming semester. While we saw the same variation in quality of these reflections, a more serious issue arose: many of our GE courses do not have transfer of materials from one instructor to the next, and many new faculty members are teaching these courses as more senior professors retire. In addition, new classes (e.g., BIOL 101 Introduction to Human Disease) did not have a system set up for evaluation beyond summative exams, and other courses provided multiple view points depending on the instructor. Finally, it is challenging to remind some instructors that Assessments are due and to follow up when reports are missing or the task is misunderstood.

To directly address this, I created a form that I plan to distribute to all instructors of GE courses for subsequent semesters as an optional framework to follow for this report. The intent of this form is to provide deadlines, set guidelines and goals, and provide rationale for these assessments. I've asked faculty members to paste in their course-level SLOs, to identify the measurements used to assess each SLO and the criteria which were used to determine that the goals for each SLO were met. The form also asks for the outcomes of those measurements for that particular course/semester, what changes had previously been made for that SLO, what went well with meeting that SLO, and what issues (if any) were identified. Finally, the form concludes with asking for an action plan and timeline for the next steps. The intent of this form is to provide a guide for the reflection needed to close the loop when learning outcomes aren't met. Should this form prove useful, it might be something to consider at the Department level- it could be used by faculty members teaching any level of course to reflect on the progress and learning of their students in addition to their own pedagogical development—and may provide insight to the teaching section of their evaluation files.

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Proposed Form for Course Assessment Reflection:

Faculty Name: **Course Name:** **Course Number:** **Semester/Year**

Lecture or Laboratory (circle one) **Number of students this semester:** **GE Course: Yes No (circle one)**

	Student Learning Outcomes	**How was SLO specifically assessed?**	**Outcomes/ findings from measurement?**	**What changes have been made previously to address this SLO?**	**What went well for this SLO?**	**Issues identified this semester for this SLO (learning challenges, course structure, etc)**	**Action plan for this SLO for the next time you teach this course**
1		Measurement used: Criteria used to determine achievement of SLO goal:		Change: Semester/Year Change Introduced:	Overall: Specifically, in response to previous changes (if applicable):		Action Plan: Timeline:
2		Measurement used: Criteria used to determine achievement of SLO goal:		Change: Semester/Year Change Introduced:	Overall: Specifically, in response to previous changes (if applicable):		Action Plan: Timeline:
3		Measurement used: Criteria used to determine achievement of SLO goal:		Change: Semester/Year Change Introduced:	Overall: Specifically, in response to previous changes (if applicable):		Action Plan: Timeline:

Individual GE Reports from CSULB Department of Biological Sciences
The following are the reports from the GE Courses in the Department of Biological Sciences. The reports were written by the faculty members teaching the course, each faculty member is credited.

BIOLOGY 101 Introduction to Human Disease
Report Written by Dr. Lisa Romero

This was my first semester teaching this class and I followed the previous instructor's model. Overall it went well, but I'm already thinking of changes I would make.

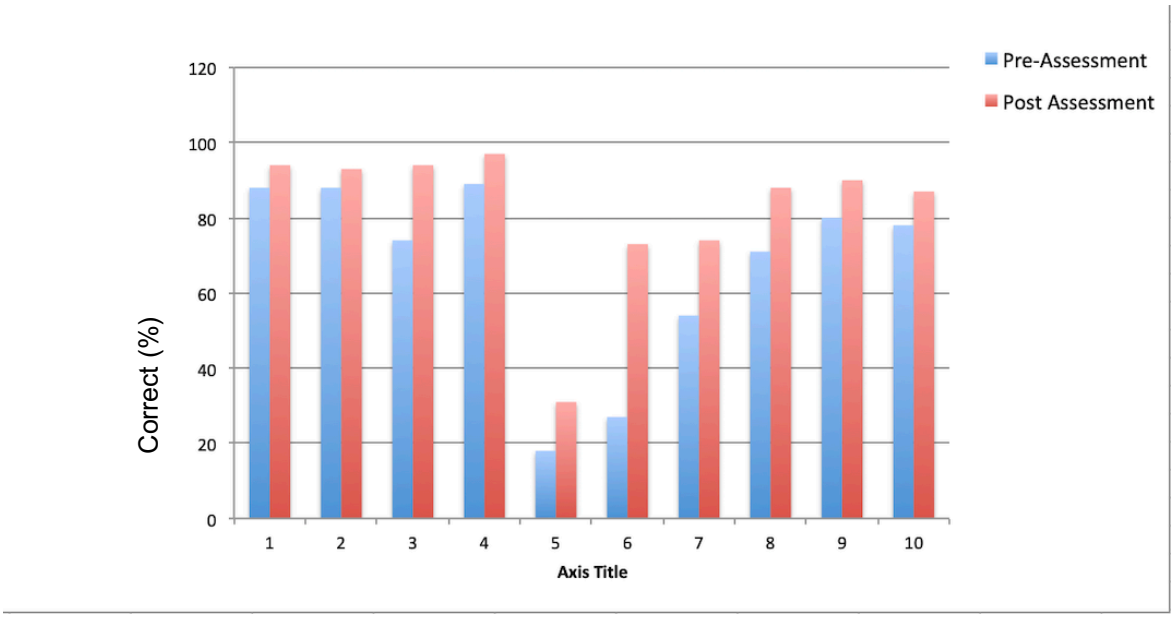
I had group presentations at the end of the year which I was very pleased with and would do again.

I tried to include relevant videos and make connections to various majors of fields of study, but could have done more with this. Maybe make the videos more personal (focus on specific disease testimonials to show the human side of biology) I would like to increase student participation and attendance, so I think I would incorporate iClickers or similar technology and include participation points in overall grades next time. I also would like to look into a textbook that offers more interactive formats (reaching out to the Pearson rep is another possibility for this).

BIOLOGY 153 Introduction to Marine Biology
Report Written by Dr. Gwen Goodmanlowe

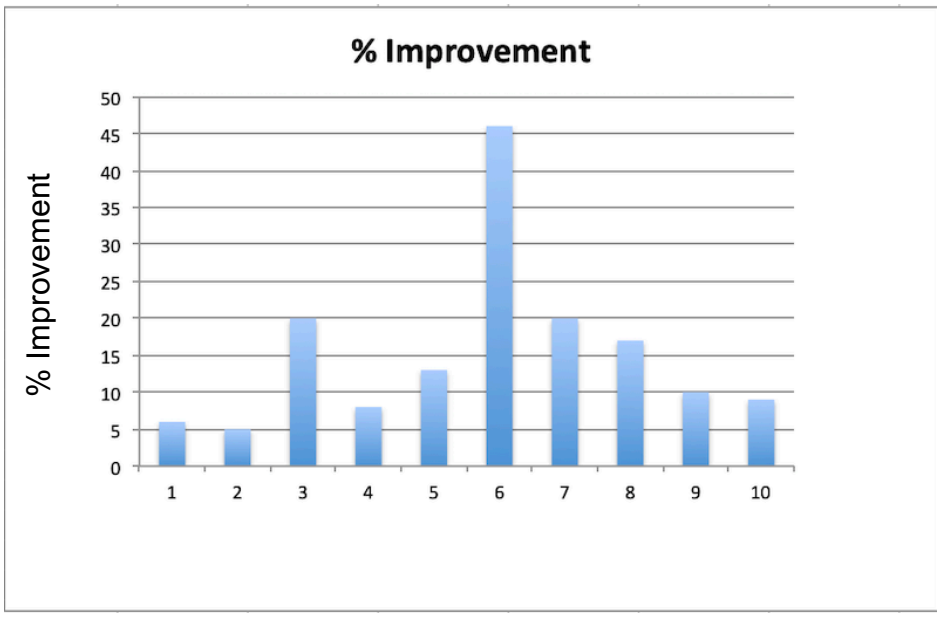
Pre-Assessment:
Overall, students initially scored highest (range 88-89%) on questions 1, 2, and 4, which ask about continental drift, scientific theory and trends in ocean depth. Initially students scored lowest (range 18-54%) on questions 5,6, and 7. Question 5 asks about the formation of tides, 6 asks about the categorization of seaweed and question 7 asks students to order organisms from most primitive to most advanced. Students scored the highest on the question about ocean depth (89%) and the lowest on the formation of tides (18%).

Post Assessment
Students scored highest on the same three questions in which they performed well in the pre-assessment: Questions 1, 2, and 4 (range 94-97%), and did most poorly on the same three questions as in the pre-assessment: Questions 5, 6, and 7 (range 31-74%). Students scored the highest on the question about ocean depth (97%) and the lowest on the formation of tides (31%).



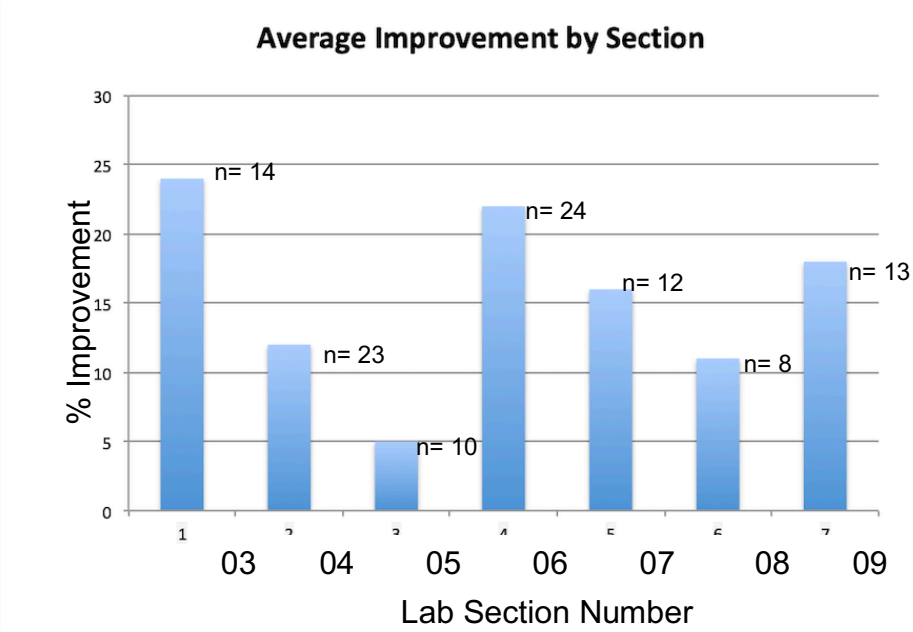
Overall Percent Improvement

The greatest improvement was seen for Question 6 (46%). This question concerns seaweeds, which most students interested in marine biology have no experience with. The lowest improvement was seen for Question 2 (5%). This question concerns understanding the scientific theory, which many students are exposed to in other, previous classes in high school and college, including chemistry, physics, and math.



Percent Improvement by Lab Section

The overall improvement for all questions combined was 15.6%, with all but 5 students scoring higher in the post assessment. Considering the high scores in the pre-assessment, this indicates the students are coming in with a good base knowledge about marine biology topics, but also that they are learning in both the lecture and the laboratory enough to improve their scores. Section 05 did very poorly on Question 10 in the post-assessment. This question concerns marine amphibians, which they do not learn about in lab. I cannot explain why all 10 students answered this question correctly in the pre-assessment, but only 6 answered it correctly in the post-assessment. My only explanation is that there was a grading error for this section between the pre- and post-assessments.



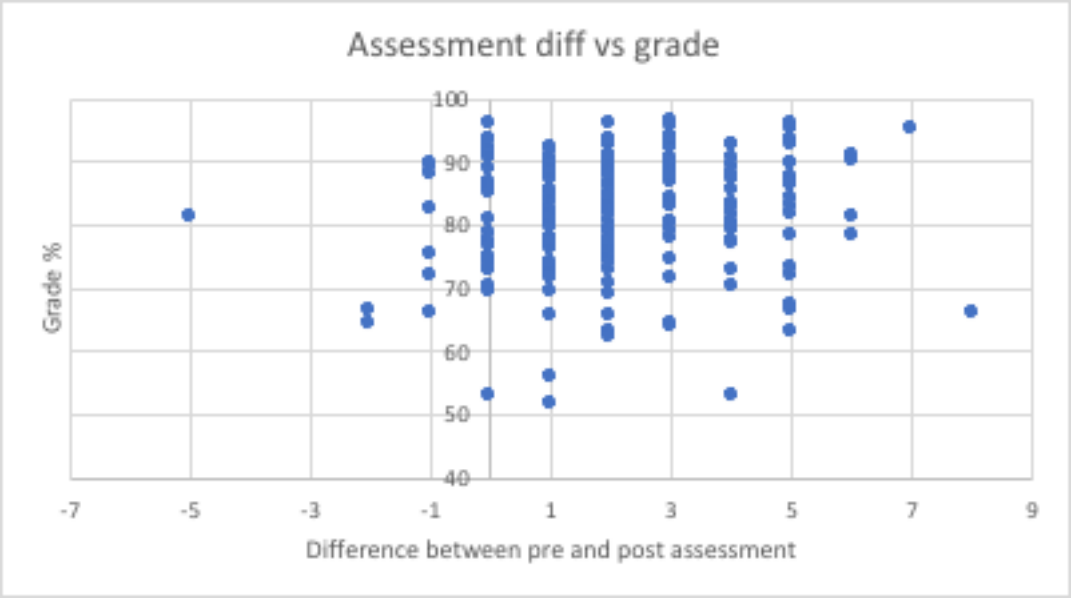
Conclusions

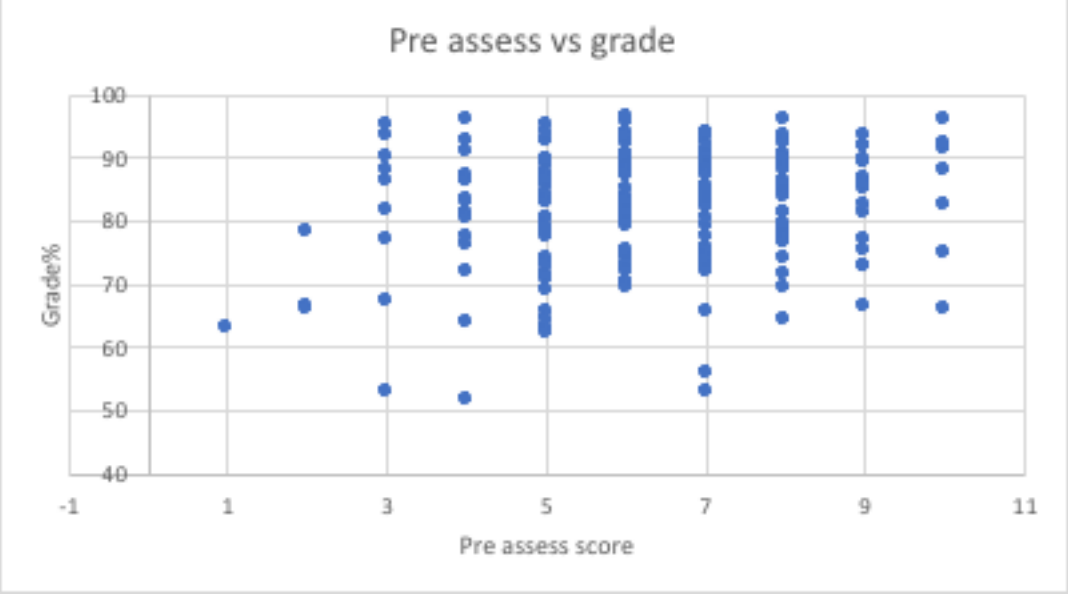
Overall I feel that the students are doing well in the course and are improving based on the material taught. Although this assessment is given in lab, the questions are designed to cover information from both the lecture AND lab. Due to the nature of the lab and the fact that it is hands-on with many field trips, there are topics that are covered in lecture that we cannot cover in lab (e.g. marine amphibians). Additionally, while the lab material remains consistent each semester, the lecture material varies to a certain degree relating to which instructor is teaching that semester, and what their area of expertise might be.

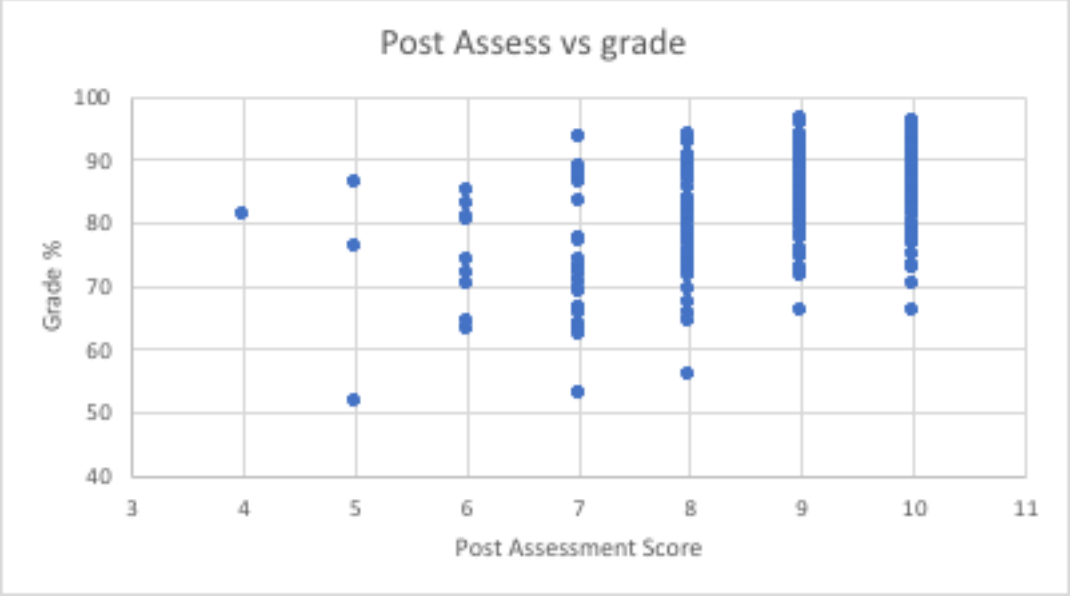
BIOL 200 General Biology
Report Written by Dr. Caleb Jones

There is an improvement in assessment scores that is associated with overall class grade among the students in both sections of BIOL 200. It appears the improvement was seen not just in students with high grades but across all grades. This is what I expected.

I would like to see more of a relationship between assessment score improvement and student grades. I plan on tweaking the assessment to try and improve its representation of students' knowledge. Dessie Underwood (Biological Sciences Department Head) and I evaluated the BIOL 200 course and made changes so that it better serves the students.






Post Assess vs grade
Grade %
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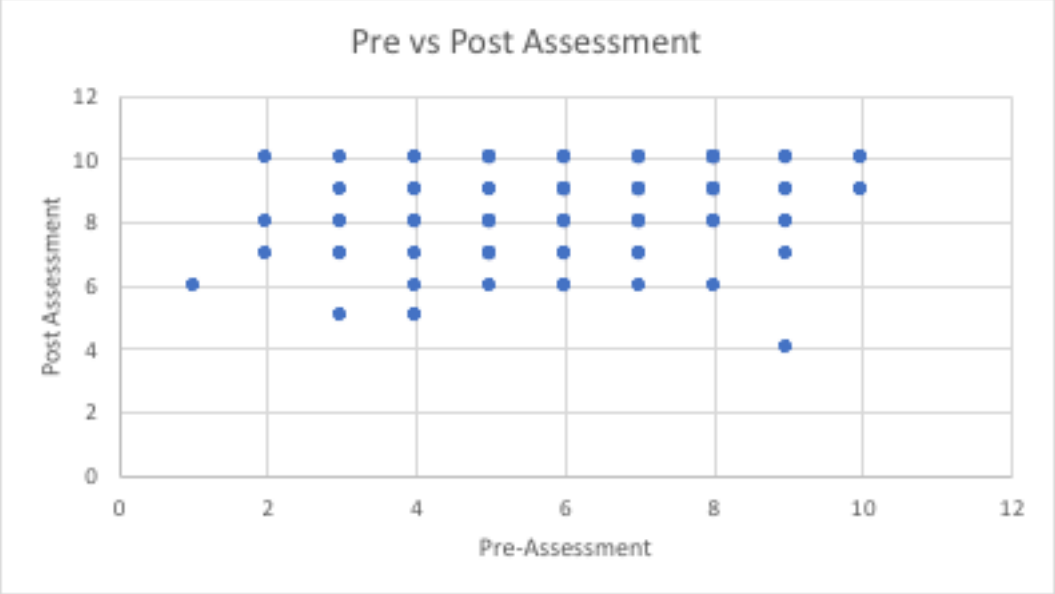
Post Assessment Score


Pre vs Post Assessment
Post Assessment
12
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12
Pre-Assessment

BIOLOGY 205 Human Biology
Report Written by Dr. Mia Nobles
Course Goals
1) introduce basic anatomical structures, 2) provide an understanding of the applications of human biology to everyday life, and 3) teach students to work collaboratively as a group and to present information to the class.

To assess if the course objectives were achieved, students across all the labs were surveyed and asked to rate their experience/ability to do the following, **prior to** taking BIO205 and **then after** BIO205. A scale of 1-10 was used, and then I compared the average from "prior" to the average from "after" for each of the following:

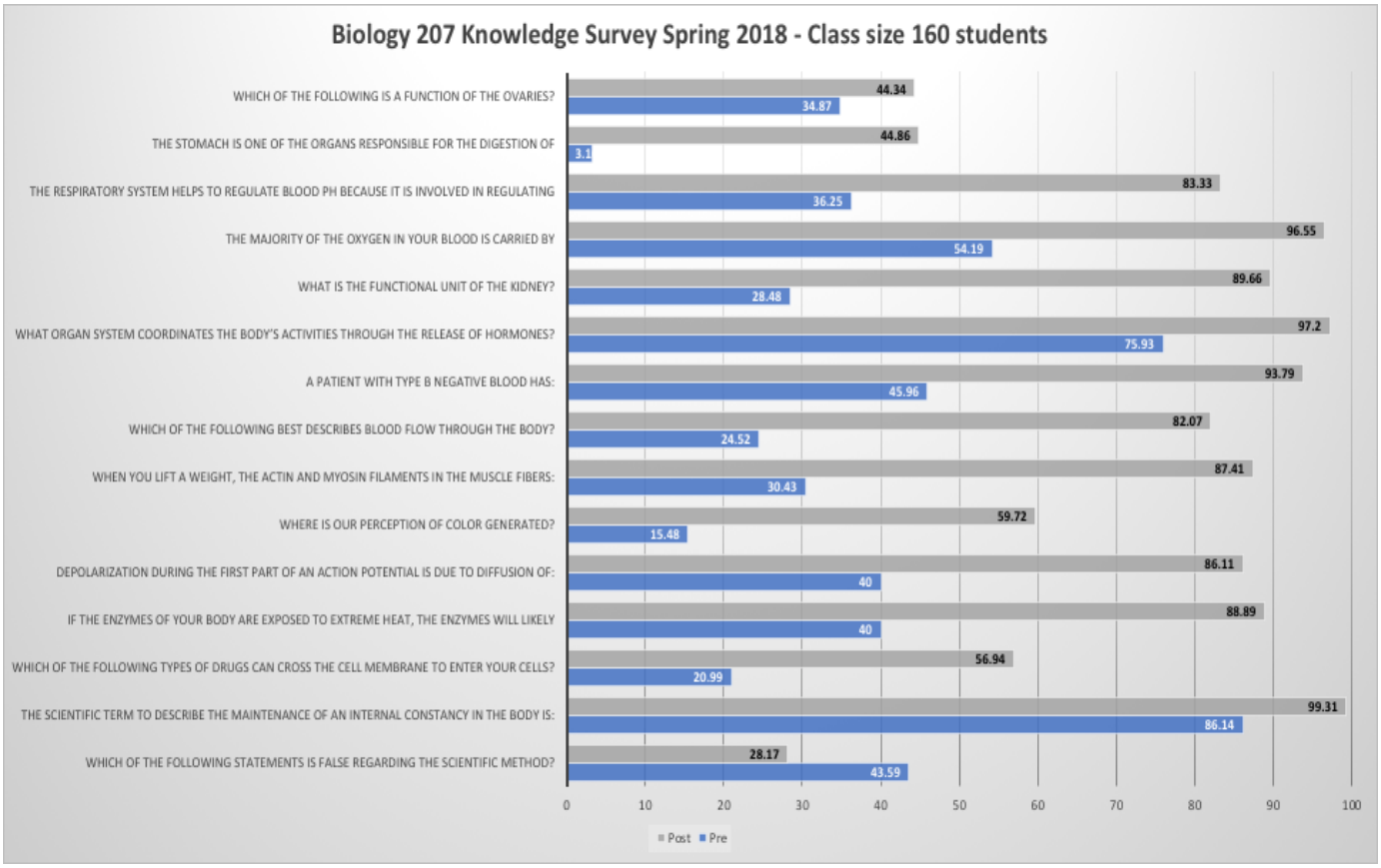
1.What was/is your level of experience/comfort identifying various bones (such as humerus, femur, ulna, radius)?
2. What was/is your level of experience/comfort identifying various large abdominal organs including the stomach, pancreas, liver, small intestine, large intestine, etc.?
3. What was/is the level of your ability to describe the pathway of blood flow through the heart?
4. What was/is your level of ability to describe the male/female reproductive system and how sexually transmitted infections spread?
5. What was/is your level of experience/comfort working collaboratively as a group (including together in class such as stations and/or presentations)?

In all of these survey categories, students were more experienced/comfortable/had increased level of abilities in all surveyed topics after taking BIO205 compared to before they had taken the course. However, the margin was least great in students ability to describe the pathway of blood flow through the heart. While the course seemed to achieve its objective of introducing basic anatomical structures, help students understand applications, and teach them to work collaboratively, improvements could be made to the course to connect student understanding of anatomical structures and how they apply to human physiology, rather than strictly anatomy. In the future, the labs can encourage the lab instructors to teach and assess student knowledge of simple pathways like taking a piece of food through the digestive system (this can be added to a station where students can physically trace the pathway of food along the model), pathway of air into the respiratory system to the alveoli of the lungs (again this can be added to a station where students can follow along the model to trace where air would travel), etc. Overall, BIO205 achieved the course objectives, but will make modifications next semester to improve students' ability to make more connections across the anatomical structures they are learning.

BIOL 207 Human Physiology
Report Written by Dr. Bryan Rourke

Pretty pleased with everything, they took it right after studying for the final so they were on top of most things. The "Ovaries Make Hormones" question was better addressed this semester and it shows. We rushed Endocrine at the end of the semester so the fat-soluble transport thing was not strongly reinforced. I don't know what happened with the scientific method question. It was from week 1 and it's kind of an opaque question.

	Pre	Post
Which of the following statements is FALSE regarding the scientific method?	43.59	28.17
The scientific term to describe the maintenance of an internal constancy in the body is:	86.14	99.31
Which of the following types of drugs can cross the cell membrane to enter your cells?	20.99	56.94
If the enzymes of your body are exposed to extreme heat, the enzymes will likely	40	88.89
Depolarization during the first part of an action potential is due to diffusion of:	40	86.11
Where is our perception of color generated?	15.48	59.72
When you lift a weight, the actin and myosin filaments in the muscle fibers:	30.43	87.41
Which of the following best describes blood flow through the body?	24.52	82.07
A patient with type B negative blood has:	45.96	93.79
What organ system coordinates the body's activities through the release of hormones?	75.93	97.2
What is the functional unit of the kidney?	28.48	89.66
The majority of the oxygen in your blood is carried by	54.19	96.55
The respiratory system helps to regulate blood pH because it is involved in regulating	36.25	83.33
The stomach is one of the organs responsible for the digestion of	3.1	44.86
Which of the following is a function of the ovaries?	34.87	44.34



BIOLOGY 207 (2) Human Physiology
Report Written by Dr. Mia Nobles
For BIO207, the course goals are as follows:

a) solidify major physiological concepts, b) learn basic laboratory methodology, c) learn to use various instruments to gather scientific data, and d) learn to evaluate scientific data by calculations, graphing and analysis.

To assess if the course objectives were achieved, students across all the lab sections were surveyed and asked to rate their experience/ability to do the following, **prior to** taking BIO207 and **then after** BIO207. A scale of 1-10 was used, and then I compared the average from "prior" to the average from "after" for each of the following:

1.What was/is your level of experience/comfort using pipettes to measure out solutions?
2. What was/is your level of experience/comfort determining the pH of a solution?
3. What was/is the level of your ability to describe the pathway of blood flow through the heart?
4. What was/is your level of ability to interpret lung volumes (tidal volume, vital capacity, etc.) from a spirometry tracing?
5. What was/is your level of ability to carry out calculations including Beer's law, serial dilutions, mean arterial pressure, etc.?

In all of these survey categories, students were more experienced/comfortable/had increased level of abilities in all surveyed topics after taking BIO207 compared to before they had taken the course. However, the margin varied significantly across the various lab sections in regard to the last question (#5) regarding student ability to carry out calculations. In general, some labs had a wide margin (i.e. no experience prior to taking BIO207, and a high level of ability after taking BIO207), however some other lab sections, while there was an improvement, the improvement was much less (some only a one point improvement across their class average).

Next semester, the following changes can be made to make the lab sections more consistent across the various lab instructors, to ensure that students are receiving similar opportunities to practice and apply the calculations in the course:

a) require all lab instructors to provide students with a set number of examples / practice problems as a minimum (currently, the minimum number of examples is to each lab instructor's discretion)
b) require all lab instructors to make a certain percentage of their quizzes and exams calculation problems (currently, the number of calculations is left up to each lab instructor's discretion, but it is expected that most of the major calculations are to be tested)
c) as the lab coordinator, enforce that lab instructors are requiring their students to show their work on their practice problems, and to grade that work in the 'critically graded' lab reports and give more personalized feedback to students regarding their calculations

Overall, the course objectives for BIO207 have been met, yet improvements can absolutely be made in regard to giving students more opportunities to practice calculations as well as receive feedback regarding their work.

BIOL 207 (3) Human Physiology
Report Written by Dr. Manuela Gardner

I had over 80% freshmen in 207 this semester. I always inform students about studying tools and discuss studying habits. I tell students every lecture that I am available to help if something is unclear. I remind them to email me with questions if outside of class and/or use the discussion board on BB to post questions. If the average is lower on Test 1, I reinforce this strategies. I do in class reviews, in class activities. I also started doing pre-test quizzes that covered test material and the points earned were added to the Test grade. In 207, I think the most issue is with studying habits. At least for my section. I had students tell me that they studied for only about 2 to 3 days prior to the exam and then only about 2 to 3 hours. I kept reminding students that they must read daily, do the online homework activities, ask me questions, go to the Learning Center to help the succeed. Sadly, in my section this semester the majority did not improve studying habits. So I will do more in class quizzes that will be part of the grade such as Retain and Maintain that is used in 208. For each test I will do a short pre-test that will be part of the test grade. I am hoping to improve studying habits with these strategies. If students are no doing well, I will require them to meet with me and will add something like 1 point to their grade. Hopefully, that will also improve studying habits and learning outcomes.

BIOLOGY 211 Diversity and Evolution
Report Written by Dr. Bruno Pernet with input from Dr. Benjamin Perlman.

In Spring 2019, two lecture sections of BIOL 211 were offered. Section 01 was taught by Bruno Pernet, and had ~240 students enrolled. Section 02 was taught by Benjamin Perlman, and had ~50 students enrolled. The two courses differed in at least one other way – students in the smaller section participated in a new laboratory course, but those in the larger section took the same traditional lab course that has been taught for years.

The evaluation survey we use is 17 questions, focused on three aspects of evolution: natural selection, genetic drift, and phylogeny interpretation. The survey is administered in the first two weeks of class (presurvey), and then again in the last two weeks (postsurvey).

On average, more students answered correctly on the postsurvey than on the presurvey. Mean improvement was ~17% and 11% in sections 01 and 02, respectively. We can examine these results in a bit more detail by breaking results down by topic:

Natural selection – In section 01, students improved on all natural selection questions with the exception of question #4, where they did slightly worse (-2.6% on the postsurvey compared

to the presurvey). In section 02, students improved on all natural selection questions (though the increase was marginal for #3).

Genetic drift – In section 01, students improved on average on all questions related to genetic drift. In section 02 performance improved on one question (#9), did not change on one question (#8), and declined substantially on two other questions (#7, #10).

Phylogeny interpretation – In both sections students improved substantially on all of the phylogeny interpretation questions, on average.

These results suggest that BIOL 211 has a strong positive effect on student understanding of natural selection and phylogenies, but the signal is more ambiguous for the difficult concept of genetic drift. There were substantial differences between sections on student understanding of drift, even though both sections were assigned a new extra-credit assignment on this topic, in which we asked students to use an online evolution simulator to explore various questions related to drift. It was the first time we gave this assignment, and we have ideas on how to improve it, and will do that in future. It is possible, of course, that the differences between sections are simply due to increased variability in section 02, which had a much smaller sample size of students than section 01.

A broader comment is that though on average student scores increase from pre to post-survey, the final average percentage of students that answer questions correctly is still relatively low – 60-65%. One possible reason for this is that the evolutionary mechanisms part of the course takes up its first half, and then the subject material changes for the second half of the course; thus it's possible that students don't improve more on the postsurvey simply because we haven't asked them to explicitly practice that material for ~6 weeks. One way to deal with that might be to work harder to weave concepts from the first half of the class throughout the second half. Admittedly, this is an introductory course with a student population that varies dramatically in preparation and motivation, but despite that, it should be possible to increase this percentage to at least 75%.

SECTION 01: BRUNO PERNET (traditional lab)				
	Presurvey (224 attempts)	Postsurvey (212 attempts)	**CHANGE**	
Question #	% correct	% correct		
1	58.93%	84.91%	**25.98**	natural selection
2	55.80%	72.17%	**16.37**	
3	44.20%	71.70%	**27.5**	
4	54.02%	51.42%	**-2.6**	
5	64.29%	81.13%	**16.84**	
6	30.36%	60.38%	**30.02**	
7	76.79%	85.85%	**9.06**	genetic drift
8	40.18%	55.19%	**15.01**	
9	72.77%	88.21%	**15.44**	
10	62.95%	74.06%	**11.11**	
11	21.43%	45.28%	**23.85**	phylogeny interpretation
12	16.07%	35.85%	**19.78**	
13	57.14%	69.34%	**12.2**	
14	58.04%	78.30%	**20.26**	
15	30.80%	43.87%	**13.07**	
16	50.89%	63.21%	**12.32**	
17	24.55%	51.89%	**27.34**	
Mean score	**48.19%**	**65.46%**	**17.27**	

SECTION 02: BENJAMIN PERLMAN (new lab)				
	Presurvey 51 attempts)	Postsurvey 44 attempts)	**CHANGE**	
Question #	% correct	% correct		
1	68.63%	84.09%	**15.46**	natural selection
2	64.71%	84.09%	**19.38**	
3	64.71%	65.91%	**1.2**	
4	52.94%	61.36%	**8.42**	
5	60.78%	84.09%	**23.31**	
6	35.29%	56.82%	**21.53**	
7	86.27%	61.36%	**-24.91**	genetic drift
8	43.14%	43.18%	**0.04**	
9	68.63%	79.55%	**10.92**	
10	70.59%	54.55%	**-16.04**	
11	21.57%	38.64%	**17.07**	phylogeny interpretation
12	15.69%	52.27%	**36.58**	
13	52.94%	54.55%	**1.61**	
14	41.18%	63.64%	**22.46**	
15	37.25%	40.91%	**3.66**	
16	33.33%	56.82%	**23.49**	
17	23.53%	50%	**26.47**	
Mean score	**49.48%**	**60.70%**	**11.21**	

Please send the completed report to your College Dean, Vice Provost Cecile Lindsay, and the Director for Program Review and Assessment Sharlene Sayegh. Please save a copy for your

files. If you have any questions, please contact Sharlene at { HYPERLINK "mailto:Sharlene.Sayegh@csulb.edu" }.