

Course Level SLO assessment for BIO181

A comprehensive analysis of the three course level student learning outcomes was completed for a large enrollment STEM gateway course, BIO181.

The data encompasses:

Spring 2019: 5 sections, 2 instructors (1FT, 1 adjunct). 95 students.

Fall 2019: 9 sections, 6 instructors (1 FT, 5 adjunct). 164 students

A common lab final exam is used in this class. The course level SLO's for BIO181 were reviewed and lined up with three separate questions in the lab exam.

SLO#1: Students should be able to demonstrate an understanding of the characteristics of the biological organization at the molecular, cellular, and organismal level. Drawing upon this knowledge, they will be able to describe important cellular and molecular details that are important to cell functioning.

Aligned to Q1: [Enzyme structure / function](#)

SLO#2: Students should be able to demonstrate critical thinking skills and problem solving skills in the classroom and laboratory.

Aligned to Q4: [Osmosis](#)

SLO#3: Students should be able to communicate biological concepts effectively, using the correct terminology, in both written and oral format.

Aligned to Q2: [Graphing](#)

The data is available in the spreadsheet that accompanies this report.

Overall SLO attainment

Each question was reviewed and threshold scores were identified to indicate whether a student was “exceeding”, “meeting” or “developing” for that SLO.

For SLO#1, 70% of students were meeting or exceeding the SLO (53% exceeding, 16% meeting).

For SLO#2, 39% of students were meeting or exceeding the SLO (21% exceeding, 18% meeting)

For SLO#3, 74% of students were meeting or exceeding the SLO (29% exceeding, 45% meeting)

This is consistent with data that shows that the general student success rate in BIO181 is around 65 - 70%. It indicates that our overall ABC grading pattern is a good reflection (or proxy) of SLO attainment. (i.e. 70% of students meet the stated course SLO's, 70% of students get an A,B or C in the class).

It is also clear that students struggle the most with SLO#2 (SLO#2: Students should be able to demonstrate critical thinking skills and problem solving skills in the classroom and laboratory.).

While not a surprising finding, this does give us an actual measurement of where our students are currently at with critical thinking, and a benchmark to compare to in future semesters. The obvious “closing the loop” action to take would be to “modify curriculum to develop critical thinking skills”. Hahaha. Easier said than done. I would argue that pretty much all of the BIO181 curriculum requires critical thinking skills and has been designed and redesigned over multiple years to try develop those skills, so attempting to come up with an additional intervention is daunting. The requirement for critical thinking skills in BIO181 and the obvious lack of those skills in our students (as evidenced by this data) clearly explains the poor completion/success rate in BIO181, and why BIO181 is considered a gateway course for STEM and some Allied Health pathways. There also may be weakness in this data, since critical thinking is needed for multiple questions on this lab exam - it could be that the question I selected as a measure of SLO#2 was not the most appropriate. That might be the topic of another CATS :)

However, despite 16 years (!) of trying with BIO181, this does refocus me on looking at ways to develop critical thinking skills in our students, so personally I will be looking for conferences and publications that address this issue, or the underlying causes of why students arrive in our classes with such underdeveloped skills.

It should be noted that this data only includes students who took the lab final, so it does not consider students who had withdrawn or been dropped from the class before the last week of classes when the exam was administered. Assuming close to full enrollment at the beginning of each semester (which is usually the case for BIO181 sections) this would mean that 216 students started the class. Given that the n in this study is 164, this means an additional 52 students (24%) did not meet these SLO's, or at least did not take this assessment to determine if they met the SLO's.

Instructor comparisons

In general, when comparing at average from each instructor in Fall 2019, all instructors were within one standard deviation of the overall mean score. In cases where an instructor varied from the mean by more than one SD it was barely outside, and there was no consistent pattern with the same instructor being too high or being too low:

SLO1 instructor A was high, instructor B was low

SLO2 instructor B was high, C was low

SLO3 Instructor E was low

This data gives me confidence that all instructors are applying the grading rubric fairly and equivalently across all 9 sections. Any variation likely reflects each individual instructor's

personal preferences in teaching/stressing particular content over the course of a semester, and overall in the total student exam scores these preferences balance out across all instructors (since there isn't one consistently high or low grader) leading to equivalent student scores, regardless of instructor.

This data will allow me to share with each instructor which questions their students performed below the average on so that they can address that content area with more focus in future semesters. For example, I can tell instructor C that their students performed below average on the SLO2 (osmosis) question and I can help them with refining how they present that material in future semesters.

Semester to semester comparisons

I started collecting this data in Spring 2019 to pilot this process. This is why I have a much smaller data set for that semester. Comparing between the semesters, Spring 2019 students scored better on SLO#2 but worse on SLO#1 and SLO#3 compared to their Fall 2019 peers. I have no explanation for this other than the inherent variability in our incoming students, which was probably amplified by the smaller Spring data set (n=95 in Spring compared to n=164 in Fall). The larger dataset from Fall evens out some of that extreme variability. I think this variability is a problem inherent in many CATS (that often use extremely small data sets of one or two sections over one or two semesters) and in many attempts to measure the impacts of various interventions we try at EMCC. The dramatic extremes of preparedness that our students bring to the table outweighs or overshadows any small level of impact any one intervention may have, when looking at a small dataset.

Only one instructor (Instructor A, the FT faculty member) appears in both the Spring and Fall data sets. Comparing between semesters for all the SLO's, this instructor shows generally consistent numbers of students meeting or exceeding each SLO, summarized in the table below:

	Spring 2019	Fall 2019
Meet/Exceed SLO1	85% of students	82% of students
Meet/Exceed SLO2	64% of students	70.5 of students
Meet/Exceed SLO3	85% of students	82% of students

In conclusion, this analysis has once again underscored a need to develop critical thinking skills in our beginning STEM students, and has confirmed my confidence in our adjunct instructors, and that we are offering a consistent experience across our many BIO181 sections.