Background and Introduction

- Traditional lecture formats have been shown to be less effective than active learning formats, particularly among underrepresented minorities (URMs), possibly contributing to the so-called “Achievement Gap,” or underperformance of URMs students as compared to non-URMs (1).

- Case-based learning (CBL) is a form of active learning in which students collaboratively address problems raised by a “case,” which is typically a short topical story describing a conflict, mystery, or controversy. CBL has been considered a promising teaching approach to help overcome barriers rooted in cultural and preparatory differences (2).

Methods

- We collected data (course performance as well as demographic information reported to the university) for students in BIO 152, the second semester Introductory Biology sequence course.

- Data are pooled across two semesters for which the case-based learning alternative was offered (Spring 2015 and Spring 2016).

- We assessed performance outcomes (final course grade and grades for aspects of the Independent Project) between traditional lecture students and students in the case-based learning alternative and focused on impacts both within and across URMs and non-URMs students.

Results and Conclusions

- Enrollment of URMs students was proportional higher for the case-based learning alternative as compared to traditional lecture (Figure 1). Interestingly, this was observed for both semesters despite students being ‘blind’ to course type during registration in 2015.

- An achievement gap was observed for course formats, but was diminished for the case-based learning alternative (Figure 2). Consistent with national findings, URMs students underperformed compared to non-URM students, and this effect remained statistically significant (p values <0.001) even when statistically controlling for parent income level, despite a drop in sample size (709 of 948 students reported income).

- Improvement of oral presentation (but not paper or project) grades for case-based learning students (Figure 3). Possible explanation: Students gave briefer oral presentations in the case-based learning whereas traditional lecture students had limited opportunities. However, effect was not observed when examined within URMs students only (N=114, p=0.38).

- ACT scores differentially predict student success across course type and student demographic. Among non-URM students in traditional lecture, course grade is positively predicted by ACT English arises as a predictor for URM students in case-based learning, particularly for the Independent Paper and Project.

Greater enrollment proportion of URM students in case-based learning alternative than traditional lecture

Traditional lecture (587 students)  vs  Case-based learning (361 students)

![Figure 1. Enrollment in traditional lecture (N=587) and case-based learning alternative (N=423). Data pooled across Spring 2015 and 2016 semesters.](image)

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<thead>
<tr>
<th>Traditional lecture</th>
<th>Case-Based learning</th>
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<td>N=587</td>
<td>N=423</td>
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<tr>
<td>ACT English</td>
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Table 1. Correlation coefficients (Spearman ρ) for ACT test scores and aspects of Bio 152 grades: Bolded if significant after Bonferroni correction (alpha=0.004). Course grade predicted by ACT scores for non-URM students in traditional lecture, whereas ACT English predicts URM student Independent Project/Paper in the case-based learning alternative.

![Figure 2 (left). Final course grades (mean +/- st. error) in traditional lecture and case-based-learning alternative. Underrepresented minority students show lower final grades than non-URM students across both formats (Mann-Whitney U tests, p values <0.001). However, mean grade ranges from B to C (Cohen’s D effect size= 0.82) in traditional lecture whereas mean grade ranges from AB to B (Cohen’s D effect size= 0.72 ) in case-based learning alternative.](image)

![Figure 3. Higher Independent Project Presentation grades (middle) by students in the Case-Based Learning alternative (N=361) than students in traditional lecture (N=587). Mann Whitney Z=-4.40, p<0.001. IP Paper grades (left) and IP Project grades (right) did not differ across Case-Based Learning and Traditional lecture sections (p=0.05).](image)