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EXPLORING THE STUDENT EXPERIENCE IN AN ASYNCHRONOUS VIRTUAL INTRODUCTORY BIOLOGY COURSE

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Introduction

Large, introductory STEM classes are notorious for perpetuating systems of inequity that pervade higher education: traditional lecturing and the “banking” model (Freire, 1990) of education, multiple-choice tests based on memorization, a lack of student-professor rapport, and “weed-out” or gate-keeping approaches. To address issues of equity and accessibility within the classroom, instructors should not only rely on evidence-based literature and best practices that are often discussed and tested within educational research fields, but they should also regularly elicit and reflect on student perspectives in the classroom.

Based on shared philosophies on inclusive classroom practices, we (**Lauren Crowe**, instructor of Biology; and **Eve Abraha**, student of Biology) together hoped to explore student perceptions within an introductory cell and molecular biology course that was held online during the COVID-19 pandemic. We reflect here on our experiences in Tufts University’s Pedagogical Partnership Program (P3) based on our own positionalities and past histories; furthermore, we provide suggestions for faculty wishing to gather feedback within their own classes with an eye towards inclusion and equity.

Positionalities of Selves and Institutions

We feel that it is important to preface the exploration of our experiences with statements of positionality, as our own identities and experiences shape our perceptions.

Lauren: I am a white, cis woman. While by some definitions I am a first-generation student (my father, who was enlisted military, earned his Bachelor’s through an online institution when I was 13), I was also privileged to go to a well-resourced high school and was admitted into and attended a competitive state university with many resources and plentiful access to undergraduate research experiences. I entered a PhD program directly after my undergraduate studies, but I struggled with finding my footing in the research world. After much reflection and growth, I realized that many of my struggles were due to a fixed mindset of my research abilities and a lack of resilience when experiments failed to work or produce promising results; this mindset was fostered through a heavy focus on academic achievement in my formative years, and simply put, when my research didn’t produce expected results (or even any results), it was easy to feel like a failure. It was from these experiences that my teaching philosophy emerged, providing the motivation to design my courses to facilitate growth mindsets, metacognition, and resilience and to foster the ability for students with similar experiences to find value in challenges and learning.

I started my first full-time faculty position as a non-tenure track Lecturer at Tufts University in Fall of 2019, 8 short months before universities around the country transitioned to remote learning for the pandemic. My primary instructional responsibility is the lecture component of Bio 13: Cells and Organisms. This is the cellular/molecular foundational biology course needed for pre-health students and advanced biology electives. It is a required course for Biology and Biology-related majors at Tufts, and to my knowledge, the largest class taught at the university. In Fall of 2020, when this project took place, enrollment was 480 students, mostly first- and second-year students. I am also a mother; that fall, my daughter was only 1.5 years old, and it's worth noting that most of the summer prior to this semester, daycares were also closed, and many of my approaches to this class were limited by a lack of child-care support and the anxiety of navigating a pandemic world with so many unknowns.

Tufts University is a private, predominantly white institution (PWI). In large classes like Bio 13, it is conceivable that well-documented phenomena such as stereotype threat and a lack of belonging further marginalize students already historically marginalized within the STEM fields, and it has been my goal since I began teaching this course to create a learning environment that was as equitable and inclusive as possible.

Eve: I am a Black, low-income, first-generation cis woman. I grew up in Memphis, Tennessee, where a lot of times, my intelligence and capabilities were undervalued and undernourished. It was hard finding teachers who wanted to invest in me and viewed me as a student with promise. Many times it felt as if they did not believe in me or want to invest time in me, so it was hard to emotionally balance knowing my worth and potential with the actions and lack of action from my teachers and with my desire to grow as an intellectual. In 8th grade, I did a science fair project comparing the genomic data of genes in the pancreas and liver. I hypothesized that since the organs had similar functions that they could have similar overexpressed genes as it relates to cancer. I remember using the Cancer Genome Database and even reaching out to a local college professor for support. After receiving an award for my work on this project, I realized the level of innovation and resilience I had naturally and knew that I was an intelligent person who was being undervalued by the systems and structures around me due to my identities.

With this major experience in my back pocket, I entered high school with the same motivation and mindset. Although much of my hard work paid off, the many times that my teachers and the system let me down during my grade and secondary school time finally caught up to me when I began my college coursework at Tufts. I realized that my skills around problem solving in academia were lacking as it was something that was not that thoroughly practiced in my public school, which was discouraging as it made me feel as if I was not smart enough to succeed in my college courses. Furthermore, I noticed that all my friends who were struggling in their own courses shared similar identities and educational backgrounds to me; they were Black, Latinx, low-income, and/or first-generation and went to underserved public schools. It appeared that many professors were unprepared to support a student coming from a background like mine.

In spring of 2018, I realized that for me to be successful, I would need to be able to intentionally guide my professors and student tutors to ask specific questions to help me break down big problems (essentially guiding them through a way that would help me critically think through a question and solve it with the knowledge I already have). This was very difficult to do as it

meant that I was building a skill for myself, my professors and peers around me while simultaneously trying to utilize this skill to pass and do well in the course. This resulted in a lot of B letter grades, but as long as I was making an upward trend and developing my skill set, and learning, that is all I cared about.

This growth was really put to the test when I took an intensive summer introductory biology course. As I juggled an internship and overnight job, I was lucky to have active engagement with professors who helped me succeed by giving me one-on-one attention and having a small class size. Both the lab and lecture professors taught me how to break down information and understand it in smaller loads before seeing the big picture and then taught me how to utilize that skill in real life scenarios (word problems). Having a small class size also allowed me to have honest dialogue with my professor, especially when traumatic racial dynamics were occurring for me from other students.

This active engagement with my professors helped me develop into a stronger problem solver and scientist and promoted my success in upper-level biology courses. This type of engagement is particularly hard to come by in the larger introductory biology sections during the academic year, which is another issue I wanted to tackle during my time in P3 and with Lauren. I wanted to prioritize ensuring that students feel engaged and supported in large lectures to prevent many students from dropping the course.

Pedagogical Approach and the Beginning of a Partnership

Lauren: When I was first approached to join the first academic year cohort of P3, I enthusiastically accepted. Due to classroom capacity restrictions and the size of the course, Bio 13 was slated to be taught in an asynchronous, remote modality for Fall of 2020.

The course primarily enrolls first- and second-year college students, many of whom had never taken an asynchronous course before. It was important that the course be highly structured with many low-stakes assignments to help pace students through the material and provide mechanisms for engagement with each other. Each week had a suggested workflow and a comprehension worksheet that guided students through mini-lectures and textbook readings. Weekly problem sets enabled students to check their understanding of the material, and discussion board prompts asked students to reflect on how the material connected to their lives and current events and identify topics with which they found the most difficult to understand. Semester-long case study teams of 2-3 students each were developed that allowed students to work together analyzing data and applying the course material biweekly along with reflections on how the group was working together, and low-stakes quizzes with quiz corrections functioned as the sole summative assessments and helped develop metacognition and growth mindsets. Students also had synchronous virtual lab sessions weekly, which focused on learning about laboratory techniques and analyzing data and sources of error, which also hopefully promoted an understanding that lab work does not always yield expected results and instills a sense of challenge and problem-solving.

In a class with so many students, it is difficult for me to get a feel for the student experience, even in person. I was concerned that, as an introductory class taken by many new students, especially those who were starting their college tenure fully remote, the format might not promote engagement and big-picture understanding while promoting the self-regulated learning skills, collaboration skills, and intrinsic curiosity that are necessary for upper-level STEM classes. I wanted to know whether students felt like the training provided through various assessments in the class amounted to busy work or if they could appreciate their growth within the class, regardless of their starting point. Furthermore, I wanted to know if the materials for the class were inclusive and accessible, as perceived by students. I had participated in an online course development program and had checked my materials for “on-paper” accessibility (captions, alt-text, etc.), but was the language and examples within the recorded videos able to be understood even by students who had not had prior biology experience or were from different cultures than what is often perceived as the traditional Tufts student? In summary, I was looking for a partner in exploring the student experience and hearing the student voice: someone who had taken the course previously and someone who could create a relationship with the current enrolled class; another person to translate what’s happening behind the scenes in the context of student learning and with whom I could have deep conversations with about student interactions.

Eve: When I first was introduced to P3, I immediately thought it was an amazing idea but had some hesitations. My major hesitation and thought in my head was, “Will this professor take my feedback seriously?” Many times I have given professors feedback on how their teaching techniques or assignments may not support the learning of certain (underserved) students in their classroom, and I am usually greeted with dismissiveness and demeaning comments. With that being said, I made sure (and P3 leaders had this in mind, too) to have a discussion with my P3 partner, Lauren, about how we both want to receive feedback and updates, and also what we wanted to get out of this partnership. I wanted to ensure I was being 100% heard and taken seriously. Overall, I wanted to transfer my own horrible experiences in my courses and give feedback on what worked and what didn’t, especially as it related to Bio 13. I also wanted to bring in the experiences of my fellow Black, Latinx, low-income, and first-generation peers and combine that with my own ideas that were backed by literature to give recommendations for the course.

Lauren and Eve: The normal parameters of P3 partnerships (i.e., sitting in on classes, interacting with students in the class, and providing feedback on discussion facilitation and assessment that could be implemented quickly) weren’t always applicable to our situation. For one, since Bio 13 was being held online and asynchronously, there were no “class meetings” that Eve could attend to provide feedback on weekly. To work around this, Eve needed access to all of the course materials through Canvas, our Learning Management System (LMS). Eve knew students enrolled in the course and was also still a student taking courses within the Biology Department, and so a confidentiality statement was drafted. The statement focused on 1) Lauren agreeing that if any of the experiences through the program were shared to create departmental or curricular change, it would be done with Eve’s permission and anonymity for any students involved, and 2) Eve was added to the Canvas site with “Designer” permissions, which enabled her to access all course materials but not access grades; Eve also agreed to not share any course materials with anyone currently enrolled in the class. Secondly, as the class had to be completely created and launched before the start of the semester as one of the parameters of the online

course development program, few changes would be able to be implemented during the semester of the program. However, we agreed that the feedback and information was still valuable and could be applicable to future iterations of the course, even if the course resumed in-person modality.

During our first meeting, we shared our goals for the semester and determined that we would explore the course based on the following two goals: Goal 1: How inclusive is the curriculum in terms of language, problem solving guidance and examples? Goal 2: How can we increase inclusivity based on Goal 1, and how can we measure the impact of those changes?

Lauren: While these goals changed slightly over the course of the semester, we both felt extremely supported by each other from the very beginning. When I met Eve, I was amazed at her ability to light up the (Zoom) room, her mindset as she approached challenges, her passion and creativity in creating engaging and accessible learning experiences, and her openness in sharing both constructive and uplifting/confidence-boosting feedback. Knowing what was going right and was well received by students was just as, if not more, important than just knowing what I needed to change to create my ideal class climate.

Collecting and Reflecting on Student Perceptions

Eve: While taking more formal measures to collect feedback, I had many friends enrolled in the course. I was able to collect more feedback from them especially as it related to how they felt about the class and the various course aspects that were implemented that semester. Many students felt that this was one of the first courses in which they learned a lot and also felt supported by their professor. One reason for that feeling of support was that Lauren consistently followed up with students who she saw were not performing well. Those students felt the sense of care and it made them want to stay in the course and work it through rather than dropping it. This is important because it especially showed the subset of students who were struggling (especially those who were Black and/or Latinx) that they were capable and there was someone who believed in them rather than falling prey to misguided negative beliefs about their own intellectual capacity.

In addition to such, I recall towards the first half of the semester a few students mentioning that they felt like the course was rigorous and a lot of work; I asked if they felt like they were learning a lot and they immediately agreed as they noted all of the work was worth it as it not only helped them learn and retain the information, but also allowed them to be more successful on their assessments, especially with the implementation of an adapted mastery grading approach. This prompted us to start wondering about which assessments students found to be most helpful for their learning, and if that varied between different groups of students.

Lauren and Eve: To understand more about how students were experiencing the course, we designed a mid-term feedback survey. This survey asked about three particular groups of course aspects: (1) whether core aspects of the course supported student learning (for example, aspects of content delivery, such as mini-lectures and readings; assessments, such as discussion board prompts and case studies; and communications, such as emails and suggested workflows); (2)

whether students accessed or found useful supplementary aspects of the course (for example, resources, such as concept visualization sites, Mastering Biology study areas, and prior semester's recorded lectures; and academic resource center resources, such as study groups and tutoring); and (3) whether certain aspects of the course contribute to a sense of community (collaborative exercises, including lab, case studies, discussion boards, and Piazza). We also collected demographic data, including gender, racial, generational, and socioeconomic identities. Our goal was to not only understand how the class as a whole was experiencing the course, but also ensure that no aspects of the course were significantly harming students with marginalized identities.

What we found was striking. For the most part, students felt that most of the aspects of the course supported student learning—with a huge exception for discussion board prompt assignments. Only approximately 30% of students felt that discussion board prompts supported their learning. However, when we looked into the demographics of those numbers, students who self-identified as having a low socioeconomic status were more likely to report that the discussion board prompts were helpful. Students who found that the discussion board prompts were helpful were also more likely to report that they utilized resources on the discussion boards and more likely to report that discussion boards contributed to their sense of community within the class. Overall, if we had only relied on aggregate data, we likely would have struck an aspect of the course that was especially benefiting students with marginalized economic backgrounds. Marginalized identities are also almost always minoritized in the Tufts student population (with the exception of female-identifying students), so the aggregate data tends to mask the experiences of students with marginalized identities.

We spent a lot of time thinking about these data and how we could then adjust the course to continue offering this support for students who felt it was useful while also increasing the buy-in from other students in the class. In the last few weeks of class, we offered choices in discussion board prompts and ways of demonstrating knowledge (e.g., written responses vs. video responses or diagrams). Not only did discussion boards become more engaging for the instructional team, but on end-of semester course evaluations, 90.91% of students responded that these changes to discussion board prompts better supported their learning.

Lessons Learned

Eve: Overall, by having the chance to have open communication between the instructor (Lauren) and the student (myself), it has helped me figure out why Lauren and other instructors make the decisions they do. For example, why choose multiple choice examinations over free response? When you have a class of up to 500 students, free response just doesn't not seem like a viable option. As a teacher now, I see how hard it is to make these decisions and do the work that instructors do especially when it comes to creating the content to teach the students, ensuring it is accessible to all, and also assessing students in a way that challenges them to critically think and overall tests them on the learning standards we set forth.

In addition to this, I was exposed to the difference between student feelings of learning versus learning itself. There must be synergy between the two where students not only feel like they are

learning and being supported in their learning, but also having the results to prove that they have learned. Ensuring that assessments tests students' knowledge accurately and equitably was one of the first things I was able to practice with Lauren; the next step was assessing students' feelings towards their learning—did they feel that learning the material was presented in many ways, did they get different ways of assessing their knowledge, and did they have access to support when needed? Overall, doing a survey in the middle of the semester allowed us to check what was working and what needed revision. I have taken all of these skills and new language around equitable evidence-based pedagogy that I have learned from Lauren with me as I teach underserved high school students in physics!

Lauren: In the end, we realized that student feedback is really more nuanced than it seems, especially if you take the time to dissect the feedback and understand the student experience from multiple perspectives. This information gave us confidence in the pedagogical decisions we made, and also made us realize that students tend to work hard and find value in work that they see purpose in. It could be that students from marginalized economic backgrounds found more of a sense of community and more value in discussion board prompts because they enjoyed learning from their peers and found comfort in seeing that their peers were struggling with similar topics. Either way, without breaking down student demographics, we likely would have removed this aspect of the course due to its overall perception as being unhelpful to student learning in the aggregate data, but would have taken away a core sense of support for students who relied on that resource. Paradoxically, the larger the class, the easier it is to feel isolated, especially as a student with a marginalized identity amongst peers with many more privileged identities. Building community and providing multiple means of support are key means for providing connection and confidence for these students.

Lauren and Eve: With this in mind, we would like to propose a few recommendations to faculty:

(1) Get creative to discover more about the experience of all students in your classroom, not just the majority voice. Undergraduate partners often know students in the course, or can at least collect informal information and pair it with their own experiences to provide helpful feedback. Even when the suggestions are difficult to implement, creating an open line of communication between students and the instructor is helpful to establish trust and understanding across power dynamics. Most faculty are aware that it is difficult (or even impossible in large classes) to satisfy every student, but when our departments struggle to retain and empower students with marginalized identities, especially those who are in the minority, we miss important information when we collect data in aggregate only.

(2) If you do discover aspects of the course that are differentially helpful, think about who is benefitting, and how you can adjust the aspect in question to better support all students, rather than jumping to rash conclusions.

Lauren: Without my partnership with Eve, it would have been difficult to really understand the student experience in this course and really easy to default to my prior wiring and focus on achievement: I could have easily taken away discussion boards and viewed them as a failure in pedagogical exploration. Being an online and asynchronous course, my primary interactions with

students were through virtual office hours or perusing the gradebook to identify students who were slipping behind to connect them with resources as soon as possible. Understanding more about how social identities affect experience in the class has shifted how I seek to understand the student experience in all classes and how I view my own growth as an instructor. I'm forever grateful for these lessons, and my students will continue to benefit in semesters to come.