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Exploring representation in Microbiology introductory courses can encourage a more inclusive and inspiring environment for students and instructors

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Exploring representation in Microbiology introductory courses can encourage a more inclusive and inspiring environment for students and instructors

Cover Page Footnote

We would like to acknowledge all our students over the years who have helped us grow as instructors.

Exploring Representation in Microbiology Introductory Courses can Encourage a More Inclusive and Inspiring Environment for Students and Instructors

Hidden figures in our teaching of microbiology's origin story

Discoveries in microbiology are often linked with major events in human history - from disease outbreak to industrialization to climate change. The Covid-19 Pandemic provided a modern exemplar of the confluence of science, politics, and the 'influencer,' with microbes taking center stage (e.g., Atlani-Duault et al., 2020; Brown, 2021; Navarro & Markel, 2021; Rocha et al., 2021). Scientists working to understand Covid-19 will become part of the historical narrative, all of which will be viewed through the lens of our political and social landscape, with perceptions molded by those who present the 'facts.' In the recording of scientific discovery, voices of women and minorities have largely been excluded (McCullagh, 2000). Introductory textbooks tend to center the lone scientist, typically a white male, having an 'ah-hah' moment (Simpson et al., 2021). In reality, many minority voices play critical, yet hidden roles, as they remain excluded from educational material (Cordy, 2021; Torres, 2022). Recognizing historical scientists who were not in a position of power due to biases, yet persevered and made significant contributions to their field can inspire students to see themselves as change makers (Simpson et al., 2021). By creating a classroom grounded in feminist pedagogy, where we are a community working together to learn and solve problems (Shrewsbury, 1987), we can share the excitement of discovery and the important impact diversity has on science and society, so the next generation can be empowered to tackle complex social problems together.

Group activities designed to discover 'hidden' influencers can enable discussions of societal disparities in introductory Microbiology courses

During the pandemic, we adopted a group activity to engage students in the online environment and encourage reflection. Students researched selected minority voices that have shaped our understanding of microbiology. Students shared their findings by creating short videos for presentation in class. The basic structure of this activity was inspired by Dr. Marian Johnson-Thompson (2017) who challenged herself and her students to identify the work of early African American microbiologists. We further developed our assignment to encourage students to reflect on the political and social context at the time their scientist was active, to help them understand the intersection of politics and the legacy of inequity and consider how this may have led to current societal disparities (Kozik & Taylor, 2021). When students are encouraged to be active participants, they come to understand that their personal experiences and perspectives can influence the direction of the course and material we engage with.

Unexpected impacts of instituting this assignment on the instructors

While we made a conscious effort to create an inclusive activity to inspire our students, we found that developing and expanding this assignment inspired and enriched us faculty. Working on this assignment has created space for informal conversation with colleagues around a shared interest in the historical figures and their significant contributions to our field. Since its inception in 2020, at least six additional faculty (approximately a third of our department) have

instituted some form of this exercise in their class. Further, the number of scientists identified and incorporated within the course has grown significantly.

By making historical disparities a point of discussion in our classes, we are also creating a space for us to grow as instructors (Smith et al., 2017). We learn with our students and seek to deconstruct false narratives of who advanced our field and who our field supports and serves. This assignment offers a non-confrontational way to help our students not only reflect on, but to share their values with us. We gain insight into our students' perspective, which is ultimately what will drive the future of STEM. This in turn democratizes our classroom by encouraging students to teach each other and their professors. Together we can explore the causes and consequences of long-standing disparities and provide the key foundational understanding for this next generation to address such challenges.

While a key goal is to provide students with the foundational science, contextualization is critical to solving problems in our complex, global society. For example, in pathogenesis, we discuss "unsung" problems in medicine, including inequities in women's and minority health (Hoyert, 2023; WHO, 2023). This is acutely highlighted in maternal mortality rates in the United States, with a sharp divide among racial lines (Arias et al., 2022). Beyond the U.S., disparities worldwide for disease prevention and research abounds; simply demonstrating to students the staggering rates of death of children under five from preventable diarrheal diseases provides context for the current state of global affairs. Indeed, we have received comments from many students across genders about how unaware they were of these disparities: as future health care providers and policy makers, this was the first-time many were exposed to such facts. This has in turn inspired us to help develop a new course that emphasizes global medicine.

Impact of this assignment on student discussion

Students need to critically evaluate data to discern the role of minority voices as well as put into context the vast amount of work that results in a single line or figure in a textbook. For example, including the story of Onesimus and his critical role in explaining variolation to his enslaver as part of the lectures on vaccinations allows students to question their assumptions about how scientific ideas germinate and grow (Kayser & Ramzan, 2021). Onesimus's story is an example of how observations of the natural world led to learning and knowing; it is not just experiments conducted in the laboratory that lead to knowledge. This captivating story of a 'vaccine pioneer' led the instructors to read historical accounts and current opinions on diversity, equity, and inclusion with a new perspective.

In conclusion, we found renewed enthusiasm for teaching the historical perspective of Microbiology. Presenting the hidden past better informs the reality of our current world. A growing awareness of the true community of scientists that have advanced our field enables us to understand the 'why' behind the health status of humans and our planet. Ultimately, our goal is to help train the next generation of scientists and introduce the hard questions surrounding complex issues to them. Reducing the power gap within the classroom, by creating room for discussion and storytelling in traditional lecture style courses like microbiology will empower our future STEM workforce.

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