Infusing COVID-19 into an undergraduate parasitology research course

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Background

Science educators have the responsibility to train students to be scientifically informed citizens. The COVID-19 pandemic has provided an opportunity to ensure that students gain a sufficient understanding of the virus in order to make informed decisions and respond to public health crises. An unexpected outcome of the pandemic was the ability to enhance student understanding of public health through discussion of the novel coronavirus in the classroom.

Course-based undergraduate research experiences (CURE) provide students with authentic research experiences in the framework of an undergraduate course. CUREs benefit students by engaging undergraduates in scientific inquiry and the process of science. Preparing biology undergraduates for graduate/professional schools or careers in STEM requires students to be proficient in hands-on research skills. Successful students also need to be scientifically literate in order to critically evaluate scientific and health challenges facing society. As the coronavirus spread in 2020 and universities moved to remote learning, the need to pivot from physical to virtual research became clear (Corson et al., 2020). To make this switch, traditional research practices were adapted to create meaningful remote undergraduate research experiences (Fuse et al., 2020).

This work describes integrating COVID-19 into the curriculum of a Parasitology Research course to make the connection between parasitology and the pandemic. The CURE included curriculum focused on testing for parasites, but also how it relates to diagnosing COVID-19 with the aim of helping undergraduates become scientifically prepared citizens.

Objectives

1. Train biology students in research methodology using parasite diagnostic tests
2. Acclimate students to the primary scientific literature
3. Engage students in virtual scientific communication by presenting posters
4. Infuse COVID-19 into the curriculum to show the connection between diagnosing parasites and COVID-19

Process

Participants: Four junior or senior biology majors from Johnson C. Smith University (JCSU), a historically Black college in Charlotte, NC, were enrolled in the course entitled, Special Topics in Parasitology Research, during the Spring 2021 semester.

Research Course: This was a CURE course created in Spring 2018 with the original goal of improving basic research skills among biology majors. Early iterations of the course emphasized benchtop research skills and critical evaluation of the primary scientific literature. In March 2020, JCSU moved all classes online to minimize COVID infections and in person laboratory work was suspended for the remainder of the semester. While no longer able to conduct original, lab-based experiments, the course was revised to develop other essential scientific research skills such as data analysis, experimental design, and scientific communication. The 2020-2021 academic year at JCSU remained entirely online and the parasitology research course was further reconfigured in 2021 as an online CURE to include curriculum focused on parasite diagnostics, but also its relevance to the pandemic. Different types of testing (antibody, antigen, and molecular) for COVID-19 were discussed, including how serological tests demonstrate a previous infection, but antigen tests indicate an active infection. Students learned the rationale for the different types of diagnostic tests specifically for parasites, but they also learned that the basis is the same for coronavirus testing. The course was taught remotely until 2022.

Assessment: At the end of the semester, student learning was assessed by a retrospective pre-post self assessment of students' knowledge of research. Students also responded to anonymous, open-ended questions regarding their experience in the course and understanding of COVID-19 research diagnostics.

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Student Responses

"Diagnostic tests are used not only for parasites, but also for other pathogens, including coronavirus. Did this course improve your understanding of COVID-19 testing during the pandemic? If so, how?"

"Yes, it helped me understand COVID-19, when they started to test for the virus I had knowledge on the types of test they were using. Once knowing the test they [were] using I knew how long it would take to analyze and get results to patients with symptoms."

"Yes, not only did it explain the difference in which test to use when it comes to molecular and serological it also went into depth [on] which diagnostic to use for long term and short term as well."

"Yes. I am considering a career using diagnostic tests because I want to help investigate infectious diseases and save lives one day."

Figure 1. Anonymous student responses to open-ended questions posed at the end of the semester

Outcomes

After completion of the Parasitology Research course, students indicated that they gained a better understanding of the COVID-19 pandemic. Student responses from the retrospective assessment showed gains in their understanding of the various types of COVID tests. The average score was 4.67 on a scale of 1-5 for the item: "After taking this course, I understand the difference between the types of COVID-19 diagnostic tests". Prior to taking the Parasitology Research course, students averaged 3.0 for understanding the different COVID tests. Students answered open-ended questions including: "Diagnostic tests are used not only for parasites, but also for other pathogens, including coronavirus. Did this course improve your understanding of COVID-19 testing during the pandemic? If so, how?" The students' responses also indicated that they gained a better understanding of the course's relevance to the pandemic (Figure 1).

Next Steps

Many scientists have used pandemic to enhance student understanding of public health through research. Undergraduate research is considered a highly impactful exercise due to its value in student success and engagement (Kuh, 2008). The original purpose of the Parasitology Research course was for students to engage in research to diagnose parasitic infections. COVID-19 diagnostics, however, were infused into the course with the goal of improving scientific literacy surrounding the pandemic. Results from this study may serve as a framework for incorporating COVID-19 into the biology curriculum to improve student knowledge of the global pandemic. Continued development of this course may contribute to curriculum reform and faculty discussion of best practices in undergraduate research and its relationship to the pandemic.

References

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