9-2021

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Recommended Citation
Manson and Wadkins. The Biophysicist 2021; 2(2). DOI: 10.35459/tbp.2021.000181

The Biophysicist

What Worked, What Did Not: University Instruction during a Pandemic

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In this report, we discuss the experience of both lecturing and teaching laboratory classes during a pandemic at the University of Mississippi (UM). UM is a relatively rural university with approximately 20 000 students. The instructional approaches that we attempted would be significantly more difficult to implement at universities with larger class sizes, geographically more restricted with regard to climate, or more urban with confined space, yet we observed many failures, even at a rural, spacious campus. Here, we note the various models of instruction that—in our case—could be separated into three approaches: in-person (i.e., traditional face-to-face instruction), online only, and a hybrid model with some component of the two (1). We discuss our experiences of what went right and what went wrong with each approach. Given that similar approaches have been undertaken around the globe, we use this report to relate what we observed as both effective and noneffective for our style of university, with special emphasis on physical biochemical laboratory training of students.

The pandemic caused chaos in higher education

The outbreak of the COVID-19 virus (SARS-CoV-2) in the year 2020 put an enormous strain on the US educational system, which included both research efforts and student instruction. One of us (RMW) saw his research lab shut down in March and not reopen until August, mirroring the negative effect the COVID-19 virus had on US institutions nationwide (2). In-person classes during the spring semester and the summer were unexpectedly moved online with only days of warning to faculty. Many faculty who were not acquainted with teaching online classes were forced to learn unfamiliar software and technology during a very narrow time window. Hybrid classes became an option in the fall semester, but even then, in-person classes required significant adjustments to accommodate the surge of quarantined students. Our discussion of instructional methods should be understood against this background. We label numerically the lessons we drew and suggest some ways that may ameliorate these problems.

In-person instruction

In the fall semester, one of us (NAM) taught in-person for a full course during the COVID-19 outbreak and for half of another course.

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To reduce the risk of exposure to the virus, both classes were taught outdoors whenever possible. Fortuitously, our campus is rural and has a great deal of green space, which may not apply to many reading this report (i.e., what might be practical to teach outdoors in certain states in the fall and spring would be impractical in others). In our case, outdoor seating locations were designated by setting out flag stakes 6 feet (1.8 m) apart. Students sat on their own towels or blankets, one to a flag stake. An easel with a flip chart took the place of a whiteboard. Other instructors who taught outdoors projected their voices with portable public address systems. Students were overwhelmingly supportive of the arrangement. In fact, we were often told by students that these and hybrid classes were the only classes they cared about because the professor was on-site. Although only a handful of colleges and universities nationwide arranged for it (again, impractical in some states), large-scale outdoor teaching is feasible in many parts of the United States, and there are growing calls for more use of it at all educational levels (3).

Lesson 1 learned: Contingency planning nationwide for continuity of instruction failed to account for the possibility that academic buildings become unusable for some period of time.

Suggested solutions: If a situation like the COVID-19 pandemic continues or arises again, decision makers should consider outdoor teaching as an alternative to moving classes online. The practicality of taking this step will depend on a school's geographic location and the time of the year, but in many places it is a live alternative to remote instruction and one to which students responded quite positively.

Another challenge of in-person instruction was students missing significant class time because of quarantine. The difficulties of teaching a class both in-person and remotely at the same time are by now well known. Broadcasting with an audio-only app like Discord (instead of audio-and-video platforms like Zoom) turned out to be highly effective. Both student and instructor need only a smartphone for running the app and headphones with a built-in mic for speaking and listening. Photos, PowerPoint presentations, and text can be posted on Discord's text channel, meaning class material can be preposted, or photos of the whiteboard can be shared with little disruption. Discord requires much less bandwidth than Zoom, making it easier to use for students. Furthermore, many students reported that they were less distracted and they learned more by not having to stare at a computer screen. The instructor, meanwhile, does not need to worry about standing in front of a camera.

Lesson 2 learned: Audio-only instruction is often sufficient for educational purposes. Video instruction is not always necessary.

Suggested solutions: Instructors should familiarize themselves with apps such as Discord. When in-person and remote instruction must be provided simultaneously, Discord can very easily replace Zoom.

Online instruction

Instructors had two options for online courses: synchronous or asynchronous. The different modes faced a common challenge. Our university uses the Blackboard platform for online education. Although it has tools to upload certain types of exam questions, Blackboard was unable to accommodate easily asking questions whose answers were mainly numerical or involved scientific notations. For example, asking students to write down Avogadro's number requires breaking one question into two parts—providing the significand of 6.022 and providing the exponent of 23—which resulted in hours spent tediously constructing and editing exam questions within the confines of the platform. Even then, many standard question formats (e.g., diagrams of chemical bonds) were not possible. Additionally, major issues arose in maintaining the integrity of examinations. Students in online courses could no longer be required to take their exams at the university's on-campus testing center. Instructors had to either employ an online proctoring service (e.g., Proctorio or ProctorU) or resort to administering exams on their own (perhaps with the help of an honor pledge). This limitation to online instruction persisted through the fall semester. Many students tried to take advantage of the situation. For example, online exams were often not taken simultaneously by a whole class (there was no practical way to require this). Some students would share test answers behind the scenes on apps such as GroupMe. Some instructors avoided or eliminated quizzes and exams as a result.

Lesson 3 learned: Online instruction is still at a disadvantage compared with in-person instruction with respect to assessment design and integrity, especially when students' assessments are unproctored.

Suggested solutions: Instructors can stop trying to replicate online the assessment experience of their live courses, instead adapting their assessments to the educational platforms available to them. Educational software developers should meet professors half-way, designing more features in their assessment options that are explicitly for science instruction.

A cluster of other problems combined to make online learning difficult. First, not all students proved to be technologically proficient; some were as uncomfortable navigating Blackboard and Zoom as their most technophobic professors. The idea that all of today's students are digitally savvy and need virtually no technical support appears to be a myth. Second, many students reported simply finding it difficult to concentrate during their synchronous online classes and needing in-person instruction to understand the material. Finally, many students lacked access to fast, reliable internet service. Among the problems students reported were: having no internet access in their household and needing to travel up to an hour away to get on the internet; having to choose between not going to their daytime jobs, breaking curfew to get somewhere with internet access, or both; having only low-bandwidth internet access (one student reported his family still used dial-up internet at home); having to work with a slow computer; sharing a family computer and fighting over computer time or bandwidth; and having to do everything on a cell phone. These limitations made synchronous online classes particularly fraught, because students were required to be on a computer at a specific time on specific days. These limitations also amplified one another. Mental fatigue and social isolation brought about by the move to online classes exacerbated the prior problems some students had with concentrating in synchronous online classes, which also contributed to poor attendance. Before COVID-19, only students for whom the above were not significant obstacles tended to enroll in online classes. These problems with online instruction could thus be sidestepped by those students. However, they could not be avoided by all students during the COVID-19 pandemic.

Lesson 4 learned: If synchronous online classes at colleges and universities are going to reach the largest possible student audience, significant problems with student learning and with equitable access to technology must be addressed.

Suggested solutions: Universities typically have free technology training for employees (e.g., upon getting a new computer). Such courses and modules should be created for and provided to students, as well. At a minimum, students should get a list of pointers ("How To Succeed in Your Hybrid, Remote, or Online Class") and basic troubleshooting tips (e.g., on converting a Word document to a PDF). Modes of remote instruction that require less bandwidth (e.g., audio-only apps like Discord rather than data-hogging apps like Zoom) could be incorporated to reduce, if not entirely eliminate, the bandwidth needs of students. Any form of remote or online instruction should be designed with the thought that some students will have to participate on their cell phones.

Another challenge from early in the crisis was the forced learning curve for professors who were not acquainted with online teaching. Professors who had no prior training in the technology or online teaching pedagogy were given as little as a week to master platforms such as Blackboard and Zoom, as well as video editing software. This environment was particularly problematic for courses taught in a laboratory setting, where the noise from chemical fume hoods could easily drown out the lecturer. Alternative methods of delivering lectures to students had to be radically modified. One colleague who was already an online instructor quipped "this isn't online education; this is triage education." Piled on top of our usual duties (writing papers, grants, advising, etc.), this change made 2020 a particularly unproductive year academically; our administration gave faculty the option to have 2020 not count against their tenure and promotion clock. Within a few weeks of the spring lockdown, UM distributed a "Course Continuity Plan," a template for professors to plan for maintaining instruction in the event of a crisis of any sort.

Lesson 5 learned: A successful midcourse transition from in-person to online instruction requires significant facility on the part of instructional faculty with online teaching technology, but this facility was widely lacking.

Suggested solutions: Training in online instruction needs to be strongly incentivized, if not made mandatory, for all instructional faculty. Course continuity planning, including but not limited to, planning for an abrupt move to online instruction should become standard and needs to be developed at the departmental level, as well as at a University-wide level.

Some things worked out surprisingly well with Zoom classes. For example, one of us (RMW) taught CHEM 393 "Science and Public Policy," which was traditionally a travel class through our StudyUSA program, where the class would travel to the District of Columbia to meet with scientists and public policy makers to discuss the importance of using sound scientific data to make public policy. Because travel was restricted by UM because of the pandemic, instead we had guest lectures via Zoom from local mayors, state officials, federal officials, medical professionals from the United States and Vietnam, staff at the White House Office of Science and Technology Policy, and a very special appearance from Australia by the President-elect of the Biophysical Society (4).

Lesson 6 learned: Travel classes (Study Abroad, Study Away, StudyUSA) required significant alteration to meet COVID-19 restrictions, which was almost always a move to remote teaching and in many cases relied on personal contacts to allow travel students to meet via Zoom with scientists they normally might have been able to meet in person. This example demonstrates a good reason to go to our annual meeting.

Suggested solutions: For courses with a strong public-policy orientation, online classes can be as effective as—if not more effective than—travel classes. Students can have deep discussions with local, state, federal, and international leaders without having to leave their homes. Such instruction modes may also serve as a beneficial supplement to traditional travel courses, especially if it involves meeting with international leaders.

Hybrid instruction

Hybrid turned out to be the most problematic option for instruction during the fall of 2020, particularly in both teaching and research laboratory settings. Normally, our teaching biochemistry laboratory class would contain 20 students per section, but with the lab space confines and social distancing, that number was reduced to five students per section, with the remaining class members watching online. Despite the lessons learned above from online lectures, there was an unexpected benefit of posting recorded prelab lectures and video of the experiments: students could watch them repeatedly. Several students, for example in both logic and biochemistry hybrid classes, agreed that posting lectures online was helpful.

Hands-on training, however, is the purpose of the biochemistry laboratory. What we tried to do was rotate the 20 students per section through the lab such that they would have some semblance of hands-on learning: five would show up one week, then we would rotate to a different five the following week. Unfortunately, noise from the chemical fume hoods coupled with face masks and face shields resulted in almost no student being able to hear the prelab lecture or even the instructions from the instructing teaching assistant. One of us (RMW) began recording the prelab lectures on an iPhone in a quieter room, editing them with Filmora, uploading them to Panopto, and then linking to them in Blackboard. In the end, this worked out to have the same flaws as online instruction. The silver lining was that the students who did attend the live laboratory portion of the class were very happy because it was one of the few times they got to meet their instructors (5). Similar problems were encountered in the research laboratories, but there the biggest obstacle was social distancing, such that students had to synchronize their schedules with other students because of space limitations. Larger research groups found these logistics extremely challenging.

Lesson 7 learned: Hybrid classes are marginally better than online-only classes, but only with students who desire true face-to-face instruction and whose attendance is not thwarted by being quarantined or in isolation or sick as a result of a pandemic. Although certain labs could be done online (particularly bioinformatics-based labs), in the opinion of one of us (RMW), that defeats the purpose of the laboratory class, which is hands-on instruction.

Suggested solutions: The face-to-face instructional components of a hybrid class could be restricted to majors only or to students for whom the course is a degree requirement. Even then, shorter labs might allow more students to rotate through and gain hands-on experience.

Cutting across all of the modes of instruction discussed above, it seems that the "new normal" for university instruction should include some mix of the following ways of supplementing student note taking: (a) Live lectures should routinely be broadcast and recorded; (b) supplementary classroom instructional materials (e.g. PowerPoint slides) should always be made available to students; and (c) photographs of key work done on the blackboard or whiteboard should be taken and distributed to students in the text and chat sections of apps like Zoom and Discord.

Final thoughts

The SARS-CoV-2 outbreak worldwide created significant disruption in teaching and research, especially in science, technology, engineering, and mathematics fields. No teaching methodology was adequate in 2020 compared with nonpandemic years. We are hopeful the vaccination programs currently in effect will significantly reduce the complications, but it seems clear the issues raised in this report will continue throughout 2021 and will necessitate better strategies for delivering instruction. Clearly, academia was unprepared for this level of disruption. Many universities have emergency plans in place for many scenarios, but those plans are unlikely to be adequate if they do not include preparation for pandemics caused by another one of the hundreds of other coronaviruses known to exist.

ACKNOWLEDGMENTS

The authors thank Dr. Laura Antonow (University of Mississippi) for her helpful editing of this manuscript.

REFERENCES

1. University of Mississippi. 2020. Course delivery modes. Accessed xx Month 2020. https://coronavirus.olemiss.edu/academics/#course-delivery-modes.
2. COGR: Council on Governmental Relations. 2020. Research impact under COVID-19: financial crisis and the "pandemic normal." Accessed 3 May 2021. https://www.cogr.edu/sites/default/files/Research_COVID_August2020_COGR_FINAL.pdf.
3. Ayotte-Beaudet, J.-P. Outdoor education at universities can be a positive legacy of COVID-19. *Conversation*. 2021 Jan 3. Accessed 3 May 2021. https://theconversation.com/outdoor-education-at-universities-can-be-a-positive-legacy-of-covid-19-149308.
4. Starling, P. Virtual StudyUSA program helps connect students with industry leaders. *Ole Miss: Univ Miss News*. 2020 Jul 25. Accessed 3 May 2021. https://news.olemiss.edu/virtual-studyusa-program-helps-connect-students-with-industry-leaders/.
5. Meisel, A. Chemistry professors innovate to run labs safely amid pandemic. *Ole Miss: Univ Miss News*. 2020 Nov 27. Accessed 3 May 2021. https://news.olemiss.edu/chemistry-professors-innovate-to-run-labs-safely-amid-pandemic/.