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# Active Learning in an Online Environment

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## Extended Abstract

The importance of active learning is generally embraced by laboratory pedagogical philosophies. Porting those philosophies to labs in an online environment has been challenging to those of us whose experience is primarily with students in person. Despite these challenges, there have been countless successes and lessons learned. The panelists shared some lessons from their experiences with online labs in diverse areas of biology including physiology, ecology, genetics, biochemistry and microbiology and then opened up discussion to the experiences and questions of the attendees. Three main themes emerged from this panel, each described below.

We discussed the definition of active learning. Panel participants took a broad view of this term and considered it to be any type of learning in which the student takes an active role in the process, including performing lab experiments (simulated or in person), analyzing data collected by others, and summarizing information in oral presentations. This broad definition led to a variety of strategies for providing active learning opportunities in a remote environment, many of which are mentioned below. Panelists indicated that they stuck to the same guiding principles for creating active learning opportunities when teaching in person, but slightly modified activities for use in an online environment. For instance, one helpful framework for curricular design is POGIL (Process Oriented Guided Inquiry Learning), a system where students work together to master process skills such as teamwork, critical thinking, and communication. Keeping the learning environment student-centered was also stressed.

In addition to traditional methods of online teaching using simulations, at-home kit experiments, and data analysis without data collection, panelists described other creative ways to teach the process of science without access to traditional lab spaces. For example, students could watch videos about lab techniques and answer questions about them immediately after watching (TedEd has a great free resource for this). Others described asking students to learn about scientists and make short presentations about their work and career paths. Scientists could be selected from the home institution or from the Scientist Spotlight Initiatives (https://scientistspotlights.org), a free resource from San Francisco State that highlights contributions of diverse scientists. Another strategy was to ask students to independently collect

 

data to contribute to citizen science projects like Zooniverse (www.zooniverse.org). This was popular with students and has the added benefit of allowing students to contribute to authentic scientific research.

The panel participants discussed the use of online tools to help to build community to re-create the social atmosphere of in-person labs while teaching remotely. These tools went beyond the traditional discussion board option and allowed students to interact both with course content and with each other outside of class meeting times. For example, Perusall (https://perusall.com/) is a free tool that allows students to work together to annotate assigned readings, including mechanisms to ask and answer questions about the material. Other free tools, such as GroupMe (https://groupme.com), allow students to create text chains to interact and study. CircleIn (https://www.circleinapp.com/) is another choice – this app is not free but offers more features for group work, as does Packback (https://www.packback.co/), a discussion board app that provides points for students who interact well with each other or the course material. One downside to group work outside of the classroom is the potential for cheating on assessments. It was suggested that a student TA join the chat group to monitor for suspicious behavior. It was also suggested that assessments be modified to making cheating more difficult by assigning essays, open ended data analysis questions, oral exams, etc. Some benefits of these online tools included increasing participation from students who may be anxious to speak up in a large group as well as allowing students to work at their own pace and during times that were preferable and/or convenient for their schedule.

Overall, one overarching and well-appreciated part of online teaching was the human aspect of labs and its importance. Students appreciated learning about scientists and their work. Despite being online, they also appreciated the social time of working together on lab problems, especially since many of them were lacking social experiences with their peers at this time. These achieved many often unmentioned yet important goals of lab courses, namely understanding science as a human enterprise, the building of teamwork skills, and the creation of functional social groups for academic and mental-health support. As we move back to traditional in-person environments, it would better serve our mission to utilize some of the tools and lessons from these challenging times.

**Keywords:** active learning, online teaching, community building

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