

Online Engineering Labs Discussion

On Friday, May 1, 35 members of the UMN teaching community convened to discuss lab based courses in engineering. Ideas and effective practices generated during that discussion are documented here. Contact cei@umn.edu to suggest an addition to this resource.

Recording

- [May 1 Discussion recording](#)

Facilitator

- [Kris Gorman](#), Center for Educational Innovation

Google Group Email List

- If you are a member of the UMN community and would like to be part of a Google Group email listserv to ask questions or share resources with others teaching or supporting these courses, please request to join the [UMN Engineering Lab Instructors](#) group.

Additional Support

- Email TeachingSupport@umn.edu to connect with academic technologists, teaching specialists and librarians who can assist with designing your online lab.

Considerations

[Consider your learning objectives](#) before deciding how to translate your course to an online format. Some objectives may be expanded (e.g. experimental design, data analysis) while others may need to be scaled back or reconsidered.

Video Recorded Labs

Many spring 2020 lab instructors moved their labs online by video recording lab procedures and then providing data sets to students to analyze. For some, this allowed for additional opportunities for students to develop data analysis skills because they were not spending time making measurements with their own equipment.

Methods instructors used that were most successful include:

- **Students making predictions.** One instructor brought home lab equipment in order to demonstrate taking measurements that were then provided to students. During synchronous lab sessions, TAs showed the procedures in short segments. At each stopping point, the TA asked students questions and engaged them in making predictions.

- **Short videos.** Provide procedures in short (ideally less than 10 minute) segments that students can watch individually.
- **Breakout rooms in Zoom for small teams of students.** [Breakout rooms](#) can be used to put students [pre-assigned](#) groups during synchronous lab sessions.
- **Live element to interactions.** Many instructors cited the importance of maintaining some live elements to the students interactions with the TAs. These were often the opportunities for students to see debugging or explanations of how to resolve difficulty.

Student Designed, Instructor Executed Labs

Some instructors felt that video-recorded labs with provided data limited students' engagement with the labs to only a data analysis exercise. One idea for restructuring future online labs was to focus lab activities on experimental design as a way to engage students with how you conduct certain procedures and use particular equipment to ask and answer experimental questions. Participants proposed this format:

- Students propose an experimental design to meet the specifications or goal as part of an assignment.
- The TA/instructor executes the consensus design, either live or recorded.
- Students then analyze the data provided.

[Prompts for a similar style lab](#) can be found on Is This Going to be on the Exam.

At Home Labs

The Electrical and Computer Engineering department in the Twin Cities have been creating lab kits for students to use in in-person labs that contain equipment like microcontrollers, breadboards and transistors. For the future, they are planning to augment these kits with basic measurement equipment so the labs can be executed from home. Kyle Dukart is willing to talk with other UMN instructors about assistance in creating kits for their labs.

Consider using [Flipgrid](#) or [Voicethread](#) for students to submit short videos or pictures to ensure they have actually set up and completed the labs.

Simulated Labs

For a hydraulic controls lab, Jim Van de Ven (Mechanical Engineering, Twin Cities) used [Matlab Simscape](#) to model physical systems in a virtual lab environment. In Simscape, Jim could drag and drop components to create a block diagram that students could manipulate and generate data from. For example, he created a position control system for a hydraulic actuator. Students had to add sensors to it, take measurements, then build a proportional controller to do position control on the actuator.

Students still “came” to lab during regular lab times in Zoom and worked in their typical 3 person teams in [breakout rooms](#) using the simulations. As in in-person labs, the TA would drop in on groups and respond to requests for help.

Facilitating Groups

Facilitating groupwork online can be challenging, but instructors had some advice:

- **Group check-ins.** For group projects, David Orser (Electrical and Computer Engineering, Twin Cities) found that student groups needed more opportunities to check in in an online environment. He created questionnaires that groups would complete regularly check in and provide updates to the instructional team.
- **Flexibility.** With some students in quarantine and others spread across timezones, one instructor found it best to give flexibility about completing work in groups and allowing the option for work to be completed individually if desired/needed.
- **Leverage Zoom tools.** Jim Van de Ven (Mechanical Engineering, Twin Cities) found using Zoom [breakout rooms](#), [polls](#) and [screen sharing](#), students could continue to engage in small group active learning exercises.