



# Lab-based Learning in the Remote Classroom

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## Value of Remote Lab Experience

There is some content that students can attain equally well from remote labs. We need to take a good look at our learning objectives to figure out what those are. Remote labs drastically increase student engagement in the context of a remote course and improve how your students feel about the remote/online course. If we are deliberate about it, these experiences can also help them see the value in what they are learning during this time and beyond.

## What are the LOs for your labs?

How are the LO's in your syllabus currently described? Are there any learning goals that are not actually tied to being physically in a lab? Is there another way that you can expose your student to that learning opportunity?

## Setting student expectations

In order to guide our students to success, we need to help them understand the time commitment. This might come in the form of reminding them how many hours they would normally have been spending in lab, so that they plan appropriately. We also need to be clear about deliverables – will there be reports, or in the case of a simulation, will there be embedded questions? It is also possible to incorporate group work into these experiences, so we will need to let them know that upfront. It is important to make the grading philosophy clear as well, for example, will we take the score for the first attempt or best attempt if multiple attempts are permitted?

## Begin by figuring out what it is you would like your students to learn.

We often have learning objectives that are not necessarily tied to being at a lab bench. They could be things like hypothesis development, experimental design, techniques, record taking and data management, predicting results, etc. Let's get to the root of our goals to help us figure out if an experience can be translated to a remote environment.

## Options for remote lab-based learning

There are many options available, so after reassessing our learning goals, we can choose the one(s) that will accomplish those goals well. Options include **lab kits** or **at home labs** (sometimes called kitchen science), which involve the student doing hands on work. We can also use **videos** of ourselves or TAs completing the lab and ask questions as appropriate. It is also possible to work with **data sets** from previously run labs or purchased from a provider and have the students work through those. For dissection work, there are many **virtual dissection tools** and there are also **image libraries** that can be used. It is also possible to expose students to the content through **lab simulations** and **case studies**.

## Hands on labs and kits

This is a way to add hands on activities. It might be possible to modify a lab so that it can be done at home. **Benefits:** Even though students are remote they get to get out of their chair and do something. You have more control over these experiences, and they may better meet your learning goals. In some cases students get to involve their family and friends in their learning. There is exposure to a wider variety of experiences than with simulations alone. **Concerns:** Kits and even at home 'kitchen' labs can sometimes be costly. Students sometimes need guidance so that they properly manage their time. Helping students when they are stuck somewhere in the process becomes a challenge, because invariably, you will not be online when the students are doing the activity. Another concern is that grading these labs can be time consuming for the instructor. You will not be able to incorporate group work into the 'working' part of the lab, but you can have them work together on analysis and deliverables in some cases. **Best Practice:** For 'kitchen' labs, make the supply list very easy to find. Show the students the value of the labs and overemphasize safety. Some instructors also have students submit a photo of the work.

## Case Study Labs

**Benefits:** Hands on without minds on isn't helpful. Case studies allow you to throw your students in the deep end before they are ready. They can be used to scaffold learning and are low stakes. **Concerns:** If students don't take it seriously, there can be submission quality issues. You will need to guard against plagiarism and cheating and some case study data bases charge a fee, so there can be cost concerns. **Best Practice:** Choose wisely. If possible, make your students become part of your case study and get your students in on the act.

### Extension activity that can be incorporated accompany most experiences

For each lab you will need to submit the following

Purpose: what was the goal of the activity.

Background information: 3 - 4 sentences on what you needed to know in order to be able to do this well.

Data: Describe the kinds of data you collected during the lab.

Analysis: Answer the questions that are included in the lab.

Conclusion: 2-3 sentences about how the activity and information can be applied to the world around you. Why is it important? How can you apply the knowledge.

## Labster as a Tool – Drexel has Institution License

<https://www.labster.com/simulations/>

Add the simulations you'd like to your course. No limit on how many simulations you can use. Students navigate through a lab experience and answer questions. Proper lab protocol has to be followed. Based on mastery. Grades flow through to Learn. **Best Practices:** Contact [itg@drexel.edu](mailto:itg@drexel.edu) to get simulations loaded to course shell. Use TA support for primer videos that get students ready for any hiccups they may come across in the simulation. Determine whether submission times are important to your teaching philosophy for these activities and set up adaptive release and dates appropriately because Labster due dates do not actually restrict student access. There is a Labster Dashboard that will give all information about a students' progress through the simulation. Drexel's global settings will cause the grade for the first attempt to flow through to Learn and changing Labster Dashboard settings will have no effect on Drexel global settings. Encourage students to use Labster support if issues arise.

## Lab Simulations

Lab simulations can shorten the learning curve and allow students to apply what they are learning. They can allow students to experience equipment that might be too expensive to acquire or to allow a novice to use. They also do not present the safety hazards of an actual lab. Simulations also allow students to jump to the good stuff because, there is no need to wait for incubation periods, for example. They are always available and are more accessible for some with physical challenges. Simulations allow students to test predictions and there is reality adaptation because designers can highlight important features or de-emphasize those that are less important. Students have more chances. In a true lab setting, mistakes can sometimes be impossible to recover from because of cost or time lost. That is not the case with simulations. **Concerns:** It can be difficult to help students understand that you are replacing a 2hr lab for example and therefore, they need to allot that amount of time to go through the exercise. There are many free options, but many of the better simulations can be expensive. There is also a technological concern as one has to be sure that students have adequate internet speed for example to run these activities. You also have to be sure that selected simulations do not rely on software that is being retired e.g. FLASH **Best Practices:** Focus on content not technology, don't just pick the 'shiniest' presentation. Be sure to give your students something to do before, during and after the simulation. Connect the simulation to the rest of the course content

### Resources:

Zeynep Tatli, & Alipasa Ayas. (2013). Effect of a Virtual Chemistry Laboratory on Students' Achievement. *Journal of Educational Technology & Society*, 16(1), 159-170.

Liu, D., Valdiviezo, P., Riofrio, G., Sun, Y., Barba, R. (2015) Integration of Virtual Labs into Science E-learning. *Procedia Computer Science*, Vol 75, 95-102

<https://drexel.edu/facultyaffairs/teaching-learning/remote-teaching/>

<https://drexel.edu/castle/resources/faculty-fellow/>

<https://drexel.edu/graduatecollege/resources/remote-course-facilitators/>

**Remember! The world is your buffet!  
You can mix and match delivery  
methods across your course!**