**Remote teaching of introductory physical geology labs during the COVID pandemic**

Vince Cronin, 2:05—2:20 PM, October 10, 2021, OCC B113/B114

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[https://CroninProjects.org/LabsDuringCOVID/index.htm](https://croninprojects.org/LabsDuringCOVID/index.htm)

[https://CroninProjects.org/TeacherPortal/index.htm](https://croninprojects.org/TeacherPortal/index.htm)

I've created a web page containing the raw materials of this presentation, including a link to a "teacher portal" for folks who use the AGI/NAGT lab manual. Those URLs are shown at the bottom of the screen in each slide in this presentation.

Because of time constraints today, there are many stories that are missing from this presentation about how I taught during the pandemic. I'm inclined to think that these stories from *all* of us might need to be preserved in memoirs of teaching *during the pandemic* that should be given space somewhere — online or in print — so that this history and those observations will not be lost.

Between January 2020 and today, I have taught my introductory physical geology course five times, in several different configurations. I am responsible for organizing all of the lab sections every semester, and several semesters there were two separate and independent lecture sections — one taught by Dr. Lyndsay DiPietro and the other by me. In those semesters, the labs functioned as a stand-alone course in parallel with the lecture sections.

What follows is an amalgam of design decisions that seem to have helped to maintain learning.

My students have access to the eText of a good physical-geology textbook, which is coupled with some publisher-supplied online resources. There are several broadly-similar textbooks on the market. The order and general content of most chapters in physical geology lecture textbooks are quite similar.

My students also work with the paper copy of the most current edition of the **AGI/NAGT Laboratory Manual in Physical Geology**, for which I serve as editor and primary revision author. This Lab Manual is designed to work as a stand-alone lab textbook and works well in tandem with any physical geology textbook that might be assigned for the lecture section of an introductory physical geology course.

Before the pandemic, my students had broad reading assignments in the lecture textbook to provide them with background as they attended 150 minutes of lectures on a given topic each week. In parallel with the lecture material, they participated in two hours of laboratory sessions each week during which they worked in small groups to complete 4-5 activities from the Lab Manual. Quizzes for both lecture and lab were all in-person, and several times during the semester they had a pyramid-style quiz that covered several topics. I call this the traditional approach.

As our campus shut-down at the beginning of the pandemic and we moved to remote education, it was immediately clear that a fundamentally different approach was necessary. Students already had access to most (if not all) of the course content through their lecture textbook and Lab Manual, so the principal difference in approach involved what *I* was going to do to facilitate their learning.

The first and most important thing I did was to make myself and the graduate teaching assistants more accessible to students. I held scheduled "office hours" every day of the week via Microsoft Teams, and all of my students had my cellphone number in case of emergency. Fluorishing during this historic shared experience required human interaction. I told my GTAs that the answer to every problem we would encounter with students during this crisis is kindness, and where appropriate add a dash of mercy.

I started with the premise that information that a student encounters by working through an activity is most likely to result in better retention and engagement. So my primary focus was on lab activities — learning by doing — selecting the activities that best serve the flow of information.

The structure and content of the AGI/NAGT Lab Manual were ideal for use in a flipped environment. The first part of every chapter contains the information that a student needs to absorb in order to complete the lab activities, which are arranged at the end of the chapter. There are flags within the introductory text of each chapter that identify the content that is most relevant to each lab activity.

After the activities for a given topic were chosen, it was easy to find the corresponding part(s) of the lecture textbook to assign, along with associated enrichment resources provided by that publisher such as videos, "smart" figures, and so on.

Following the commandment "Thou shall not reinvent the wheel," I looked for freely accessible animations, visualizations, and videos that contain reliable information relevant to the material, and added them to the mix. These resources primarily supported the "lecture" portion of the course because the Lab Manual is largely self-explanatory. Short videos from Dave McConnell, Scott Brande, IRIS, and UNAVCO were really effective and popular with students.

Then I tried to identify gaps in the resources that needed to be filled-in. The most obvious problem was that students would not have access to rock and mineral specimens in the lab, either to examine labeled specimens or to identify unknown specimens. I created dozens of tiny videos that lasted less than 2 minutes each and posted them to a YouTube channel.

In each of these tiny videos, the physical characteristics of an individual unknown specimen were shown in a systematic way so students could use the rock or mineral ID tables in the Lab Manual to identify the specimen. Other tiny videos showed laboratory experiments that would have been difficult or impossible for students to complete in a remote setting. These allowed students to make observations and interpretations so they could complete the assigned activity.

The second issue was that students did not know how to pronounce *some* geologic terms correctly, as they are pronounced in American English. This had *always* been a problem, but it was exacerbated by the pandemic lockdowns. Before the pandemic, students could hear *me* pronounce these terms during lectures, but some of our laboratory TAs did not pronounce some of the terms correctly and that led to confusion.

For each chapter in the Lab Manual that my students studied, I created a video in which each of the terms used in that chapter were shown individually while I pronounced the term on the audio track. *amphibolite* *anthracite* *antigorite* This has become useful to my students and graduate teaching assistants alike.

Finally, there *had* to be a way for students to submit their work electronically. Quizzes were the easy part of the problem, because I could create secure quizzes in our university's learning-management system that students could complete within a specified time window. The lab assignments, which involved a wide range of activities and response types, also turned-out to be easy to accommodate by showing students how to scan and save their work as PDF files and upload the results to our LMS.

Now that all of the puzzle pieces were on the table, I could organize the work I wanted students to do each week into an ordered list that I made available through my website. (I could have done the same thing through the LMS.) This ordered list provided an explicit structure for students to use in this flipped-learning environment.

(I should note here that COVID is still raging in our area, so I am still effectively teaching a remote course. Now, students can choose to attend weekly lectures and lab sections *in-person* or they can choose to participate remotely.)

Here is an example from this past week, when we studied Metamorphic Rocks. First, we click a link on the course homepage to access the Metamorphic Rocks assignment for the *lecture* section of my course. The *lab* assignment is separate.

The lecture assignment has five basic components:

• The first is a list of study questions. The idea is that students should hunt for answers to these questions as they read the assigned texts. The end-of-topic quiz each week is based in large part on these matters.

• The second component is a video from Dave McConnell about metamorphic rocks

• Then there are specific readings in the lecture textbook that were selected to support the assigned lab work.

• Finally, there is an online assignment that is correlated with the lecture textbook, and an end-of-topic quiz that students take online after the lectures and labs for the week are over.

Now, let's go to the laboratory homepage to access the lab assignment for Metamorphic Rocks.

The lab assignment has four basic components:

• A video from Callan Bently that introduces the lab material in the AGI/NAGT Lab Manual

• A video containing the pronunciation guide

• A series of "scan" or "read" and "do" assignments related to each of the four assigned laboratory activities, and an end-of-lab quiz that students take online within six hours of the end of their scheduled lab meeting each week.

Activity 7.4 involves identification of unknown metamorphic rock specimens. Links to the relevant videos are given, so that students can work their way through this activity without being physically present in lab.

This semester, if a given student can come to lab, they have the opportunity to examine similar (or the same) specimens, and the tray for each specimen has a QR code that allows students to use their smartphones to view the corresponding tiny video. They can also preview the procedure using the videos made for the remote labs, before they do the experiment.

Students have expressed a very positive impression of this dual use of direct observation and associated video. So the in-person and remote lab experiences are linked. More importantly, they serve the needs of students who are healthy as well as those who need to participate remotely for whatever reason.

If the student attends the lab, they turn-in their lab-activity-response sheets (torn from the lab manual) by scanning them with a double-sided document scanner. This creates PDF file that the lab teacher uses to grade the work. The paper originals are then left behind in the lab room as a backup record. Students who are unable to attend the lab session can scan their work and submit it as a PDF file to their teacher via email or the LMS.

Because we are all in the same boat together, I have posted a web portal for teachers using the AGI/NAGT Lab Manual that others might also find useful. It contains links to my course webpages and to other online resources I use teaching my introductory lab course in physical geology.