

Building Authentic Experiences in Online Science Classes

Intent and Plan (from application)-

Even prior to the pandemic there has been an interest in offering more online science classes at Lane Community College. Quality online classes can increase access to higher education. Online classes can make a college education possible for people that it might not have been possible for in the past whether because of location, time, disabilities or other commitments. But a key component to online education is quality. While I don't think any subject lends itself well to just recording a in seat class, sticking it on an online platform, and calling it good, the lab component of science classes makes this not possible. My goal for this sabbatical is to explore through reading education research articles, taking a course on online STEM Lab development, reviewing various online science classes, and meeting with online course developers and online science instructors what works (and just as importantly what doesn't work) in online science class to help students understand and apply scientific topics and how to best develop a sense of a shared community and a sense of belonging in the online setting.

Goals:

- 1) Update my knowledge of best practice in online education particularly as it applies to science classes by taking the Master Online Science Learning – Online Science Lab Class through the Online Learning Consortium (<https://onlinelearningconsortium.org/>)
- 2) Discuss with online course developers and faculty what they have done to successfully establish a sense of community and belonging in online science classes.
- 3) Learn how other faculty have effectively offered authentic online lab experiences (and what hasn't worked).
 - a. Mt Hood Community College - Post-Covid Shut down MHCC is only teaching 100 levels and a few A&P classes online.
 - b. Portland Community College (added) - PCC has continued to offer both 100 level biology class and 200 level 'Majors' biology classes on line. I met a couple of times with their online major's biology instructor, Josephine Pino.
 - c. Oregon State University (OSU) – OSU offers online science classes through their eCampus. Offering online class through a dedicated 'campus' helps ensure that students and faculty in online classes get the resources they need to be successful learning from and teach in the online environment (at least in theory). OSU teaches a lot of 100 level bio classes online but these do not have a lab associated with them. They do teach a 200-level class (for forestry, fisheries, and natural resources majors but not for biology majors).
 - d. Colorado Community College Online Education (CCCOE) - CCCOE is an organization that helps design online classes for all of Colorado's community colleges, across all disciplines. They help faculty with layout, accessibility, and general course design. This ensures that classes meet ADA standard but it also gives some degree of constancy on layout and design, making it easier for students to figure out how to navigate the course from class to class. I spoke with a couple of science class designers from CCCOE, but was unable to talk with any faculty from the Colorado Community College system.
- 4) Establish a regional network of online science faculty to facilitate the sharing of ideas and problem-solving.

What I did and found

For this report I am going to summarize some of the things I learned and found for each of the goals listed above and then give an overall reflection

1) Update my knowledge of best practice in online education particularly as it applies to science classes.

a. Online Learning Consortium

The first thing I did for my sabbatical was take the Master Online Science Learning – Online Science Lab class through the Online Learning Consortium

(<https://onlinelearningconsortium.org/>). During this class we walked through the process of designing an online lab for one of the classes we taught. While I have never used the lab that I developed (I never taught Bi 112 again) the class reinforced many things, taught me a few new things, and connected me with other online instructors from other institutes.

This course stressed the importance of well designed, clear, and detailed objectives. While all classes of all modes benefit from well designed learning objectives these are particularly important for online classes since interaction in the classes between faculty and students are limited (or at least different) making it harder to stress learning outcomes for the class and for labs.

Learning objectives should be designed in such a way that students can use the objectives along with the lab directions to guide their learning. This course also stressed the importance for faculty to look at their learning outcomes and use those to guide them in developing labs. The nature of the classes mode of delivery means that the labs for an online class are not going to be identical to those done in in seat classes. The key is not that the labs are the same but that the learning objectives are met in both modalities. As instructors we often get hung up on making sure things are the same in all modalities (I know I do). Online labs are often going to be different than in seat labs but you can often meet the same outcomes in different creative ways

2) Discuss with online course developers and faculty what they have done to successfully establish a sense of community and belonging in online science classes.

3) Learn how other faculty have effectively offered authentic online lab experiences (and what hasn't worked).

(I am going to combine my discussion of 2 and 3.)

a. Mt Hood Community College –

Sense of belonging has been hard for MHCC. Stopped using forums for the most part because students find them onerous and no evidence that they build a sense of community. They do try and build a sense of scientific belonging by doing some citizen science.

MHCC is currently not having students purchase lab kits or online lab simulation programs (at least in the biology classes). They are carefully looking at learning outcomes and trying to meet them through other types of activities that might not be considered traditional labs. They are having students do a lot of modeling and mini labs with house hold items. The sense of satisfaction from both students and faculty are not very high. The one exception to this is in the handful of classes engaging in citizen science. These classes work very hard to get students to engage with their community around

b. Portland Community College –At PCC I only spoke with 200 level instructors. They require students to participate in synchronous Zoom classes, which they have found to be essential for getting to know students and establishing the sense of community that is often associated a yearlong sequence class. There is also a quarter long lab associated with each term that students design and work on together. Students have a high level of engagement and both students and faculty report high level of satisfaction with the class.

c. Oregon State University eCampus– I only spoke to the OSU faculty about their 200 level biology classes (100 level science classes at OSU are not required to have a lab) and their approach is very similar to PCC's. They require students to participate in synchronous Zoom classes. Students have a high level of engagement and both students and faculty report high level of satisfaction with the class. Students each have lab kits and share data and work together to interpret it. During the ecology portion of the class, they work in groups design experiments and to collect data as well.

d. Colorado Community College Online Education (CCCOE) –Basically say one of the hardest things about online education is building a sense of belonging and community. They encourage faculty to use a combination of forum posts and student review and forming small groups with in a class so students might get to know each other more. When faculty do this, they have found that students reach out to each other more and form study groups. Much like LCC they are designing courses for smaller classes and about 50-70% of any given class is made up of local students so they can meet online or in person.

4) Establish a regional network of online science faculty to facilitate the sharing of ideas and problem-solving

Here's another "sorry I did not get that done". I do have an informal network of colleagues that I routinely talk with about best practices in online education or to brainstorm ideas, I have not established a formal network.

I am a National Institute on Scientific Teaching leader and was part of the organizing team for the Solve My Problem Summer Workshops. These were developed during the COVID shutdown to help bring people together in an online environment to brainstorm ways of moving classes online. Once things were back to some semblance of normal, we continued to offer the workshops. Following my sabbatical, I facilitated a group working on online learning (the workshops had mostly moved back to concentrating on accessibility and DEI in traditional classrooms). While I was not an active participant in the group, just the facilitator, it was interesting to see the same themes I have seen in almost every other aspect of my sabbatical standout: Clear learning outcomes, detailed expectations and instructions for each assignment, frequent personalized feedback (can be small and doesn't have to be personalized for everything), and routine interaction with the instructor preferably via video. They also stressed the importance of letting the instructor's personality show through in the videos. This was not directly in any of the articles I read but it was hinted at in Flower Darby's book where she talks about adding so levity to your correspondence to make it clearer there is a person behind the online class.

5) Common Themes and Reflection

During the time I have been working on this project I was struck by how similar everyone's goals and struggles are. Developing quality online classes in any subject is difficult and requires a lot of time and expertise in both the field of study but also in online delivery. The idea that you can take an in-seat class and just "move it online" is not true. Classes that have a large active learning and hands on component to them, such as science lab classes or art classes, have an even greater challenge. The most success has been found when faculty (and course designers) don't try and give students an identical experience to the in-seat class and instead focus on meeting learning outcomes.

During my sabbatical I was able to observe 5 different online biology courses. Some (most) were well organized and had a consistent structure and expectations from week to week or unit to unit while a couple changed the structure and expectation each week or unit. I experienced first-hand how important clear and organized structure and explicit expectations are to student success. These are two of the key points brought out in a lot of the literature and in the Online Learning Consortium class I took. When online classes are not well organized and expectations are not clear students become less engaged which often leads to a decline in student success.

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Everyone seems struggles with creating a sense of belonging and community in online science classes. The typical form of student to students and student to faculty interaction has been the forum. If these are not done well, with clear structure and guild lines, both students and faculty find them frustrating and not very beneficial. The classes that have had the most success with building community have been those that foster meaningful interactions between students and with the instructor. Most of these have had some required synchronous meeting times and/or have formed small group projects. These classes were also the ones that reported the most engagement and satisfaction for both students and faculty.

Another struggle with online classes that was mentioned by many was an underestimating of the amount of time these classes take. This is an issue at all levels. Students often think that online classes will take a lot less time than in-seat classes because they do not have to attend class. For some students, those with significant previous knowledge of the topic, this might be true but for most it is not. I have been teaching biology online for several years now and it is not uncommon for me to hear from students that are working fulltime and taking a full load of in seat courses. I have also had students who are taking a full load of online classes while taking care of newborn babies (I even had a student who was due to give birth during week 3 of the quarter thought she would be able to make it work if I gave an extension for that week. I did but it did not work). Administration and those who have never taught online often think converting an in-seat class to online is as simple as recording a few lectures and then putting the assignments on line and that once you have done that teaching an online class is a breeze. No one I spoke with has this to be true. It is true that a bulk of the work for an online class is prior to the beginning of the term but there are more emails to answer and more grading to do during the term than in an in-seat class because you are not able to give feedback as quickly and easily as you can in an in-seat course. I feel we need to do a better job of making everybody involved better aware of time commitments and expectations around online education.

I started my sabbatical with the belief that online science with lab classes might be able to be done depending on the subject. After my sabbatical that belief is pretty much the same. What has changed is that I now think they can be done well if faculty and students are given the time and resources needed. This includes training for both faculty and students teaching and learning in the online environment. What constitutes a lab has been a question biology faculty have been asking since I have been here and moving to an online environment just heightens those questions. The classes that I observed that had the most engagement and satisfaction from both students and faculty involved using some sort of lab kit or online simulation program. While there is no data to support this my hypothesis is that students are better able to see the value in these and don't view them as "busy work". Quality online education is the only access some students have to higher education and I feel it should be a part of our planning goals but I also feel we need to focus more on the quality part of 'quality online education'.

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