My Online Teaching Experience

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1 Introduction

Due to the COVID-19 outbreak, classes in many colleges and universities have been moved online, but unfortunately, many instructors have never had any online teaching experience. I started my online teaching experience almost a decade ago. In the early days, my classes were hybrid, i.e., I taught in a live class, recording my lectures, and then shared the lecture video to online students. A few years ago, when our college offered online degrees, I had to record two of my courses, and also interacted with students in live sessions.

Even though these online courses were not the same, in terms of format and scale, as the ones that we are currently doing due to COVID-19, I was able to smoothly switch to online teaching due to these many years of experience. Actually, I moved my classes online one week before my university made the decision to move classes online. In my past online teaching effort, I have tried many ideas; some worked and some did not. In this article, I would like to share some of my personal experiences. I hope they can help those who are new in online teaching. This article is not intended to be a tutorial on how to teach online. I will only report my own first-hand experiences while acknowledging that many other people may have different or even better practice. I encourage them to share their own experiences.

Disclaimer. In this article, I will name a few products that I have been using. I may seem to promote these products; I do not deny that because they are part of my positive experience. I am not a salesman for these products, and I do not receive any money from their companies. Moreover, opinions expressed in this article are solely my own and do not express the views or opinions of my employer.

2 For Whiteboard Users

There are four primary types of teaching: talking only, using slides, using whiteboard, and using both whiteboard and slides. For the first two types, moving to online teaching is straightforward, but for instructors who use whiteboards, moving to online becomes quite challenging.

I use whiteboards + slides in the early days of my teaching. When I started offering my lectures to online students, I tried the camera approach to capture my writing on the whiteboard, but it did not work well. I was forced to abandon the whiteboard, but I didn’t want to change my teaching style, because I strongly believe in the traditional whiteboard approach. I think that drawing/writing on a whiteboard is a better animation than any of the fancy animation in PowerPoint slides, and it is the most effective way to explain ideas.

That was when I found the Wacom display, so I bought a 13-inch portable display. When you hook this display to your laptop, it becomes the second screen, just like connecting your laptop to any normal screen. What is special about this display is that it comes with a special pen, and you can use it to write on the display. Microsoft PowerPoint and OneNote (and many other software) support pen input, so are many “whiteboard” software. Therefore, you essentially have a whiteboard on your computer, and you can easily write on your slides. Since everything happens on my screen, I can easily record lecture videos. Since then, I have been using this setup for all my classes, online or not online. Five years after I bought my Wacom display, my university equipped most of the classrooms on campus with a large Wacom display.
To this day, I still consider buying this display my best investment in online teaching. It allows me to stick to what I believe to be the more effective way in teaching (I hate to use prepared slides in my class). You can view my sample Udemy lectures here: https://www.handsonsecurity.net/video.html. Figure 1 shows a screenshot of my lecture slides.

**Figure 1: A sample lecture slides**

**Recommended approach.** I recommend the Wacom display approach. It works for both MAC and PCs (you need to install the corresponding driver from the Wacom website). Currently, the price for the 13 inch one is about $700. Instructors who use whiteboards, but do not have grant money to buy one can ask their department and college to purchase one for them. I do believe this is a reasonable request. I sent a request to my own department chair on behalf of other professors (I don’t need one), and I was able to get a positive response.

**Alternative 1.** If you happen to have a computer that already supports pen input, such as Microsoft Surface Pro, you don’t need a Wacom display. However, if you are thinking about whether to invest in a Surface or a Wacom display, here is my suggestion (I faced the same choices before). If you prefer the convenience, buy a Surface Pro, as Wacom display comes with a few wires that you need to connect (not hard, but definitely less convenient). I used to carry my Wacom display to the classroom where I teach, and had to do the setup before each class (it takes about two minutes). If you teach online from your home, the convenience gap between Wacom and Surface Pro disappears, because you don’t need to tear down your setup after each class.

Regardless, I chose to buy a Wacom display, because it lasts much longer than a laptop. For the last six years, I have changed three laptops, but this Wacom display still works, and it can probably last for another six years. Moreover, since the Wacom display is detached from the computer, it can be shared. I let my students attach their computers to the display during their presentation, so they can write on slides.

**Alternative 2.** If you don’t have a Wacom display or a Surface Pro, but you do have a tablet with pen input, such as an iPad or a Samsung Galaxy Note, this also works. I have experimented with this approach...
using Zoom. I signed in to my Zoom meeting from both my laptop and Galaxy Note (Zoom has an app on mobile devices). When I present my slides, I use my laptop; when I need to write on a whiteboard, I let the Galaxy Note share its screen.

**Last resort.** If none of the alternatives above works for you, you can still find a real board in your home, and use it as a whiteboard. Your students can see your writing via your webcam. I saw many instructors use this approach, so it is definitely a viable option.

### 3 Getting Students to Focus and Participate

A significant difference for instructors in online classes is that we are now facing the camera, instead of students; we do not get instant feedback. As a result, we tend to teach faster than usual, resulting in less effective teaching: the faster we teach, the more difficult it is for students to understand the content, and the less likely they will react to us.

We got to slow down, and we got to get students involved. Getting students involved is even more critical in an online class than in a classroom class, because students’ attention span in an online class is much shorter. In this section, I share some of the effective techniques that I have been using in my classes.

#### 3.1 In-Class Discussion

The easiest way to get students involved is to ask them questions. In classroom teaching, this is quite easy. In online classes, it can be quite challenging, especially for a large class. Asking students to turn on their microphones is an invitation for disaster, so I muted everybody’s microphone when they enter the online classroom. They can only “speak” using text.

Most online teaching platforms have a chat and “raise hand” functions, but I found that they are quite inconvenient to use when I am presenting my screen to students, because I have to hide the chat window. Some people use two computers (or a computer plus a mobile device) to join the online meeting room, so they can use a dedicated computer to display the chat window. This works.

Since the second computer is only used for chatting, why not just use a dedicated chatting app, instead of using an inferior chatting function coming with the online meeting platform. That is why I use Slack on my smartphone for chatting. Basically, I use two devices and two platforms, one for teaching and the other for getting feedback.

If students want to ask me questions, they will just type their questions and @ me. I have configured my Slack to only alert me when somebody @ me (you can easily do that in Slack). This is equivalent to the “raise hand” function. Students can also share their opinions in Slack, but my phone will not alert me, so their conversation will not interrupt my lecture. In classroom lectures, if students whisper to each other, I often had to tell them to stop, because it distracts other students and me. Using Slack, they can feel free to whisper. However, since everybody can see what they are talking about, they usually won’t deviate too much from the lecture.

When I ask questions, I also ask students to answer them using Slack. I found that students became more active than in classroom classes, mostly due to two reasons (in my opinions): (1) it seems that this generation of students is more comfortable with texting than speaking. (2) Students do not feel so embarrassed even if their answers are not correct, because they are “hiding” behind their computers. I do see more people getting involved in my online class than in the classroom ones.
3.2 In-Class Quizzes

Many students may still lose their attention because participating in the Slack conversation is voluntary. To solve this problem, I decide to add pop quizzes during my lecture. I add many: in my most recent lecture, I had five pop quizzes, almost one every 15 minutes. All quizzes will be graded (automatically) and counted towards the final grade.

Blackboard has very nice features for making quizzes, and I really like them, but the challenge is that quiz preparation takes a lot of time, and once they are prepared, it is hard to change them during the lecture. I prefer to coming up impromptu quizzes during my lecture, based on students' reactions and spontaneous ideas coming to my mind, instead of using prepared quizzes. This not only saves time, but also gives me the flexibility to react to students. I also enjoy this creative process.

I write quizzes on my slides right in my lecture. For example, after explaining how VPN works using a diagram on my slides, I mark four places on the diagram with A, B, C, and D, and ask students, which one is the path taken by the packet. Before the lecture, I have already prepared several empty quizzes on Blackboard: the question of the quiz simply says “see the lecture slides”, and the four choices say “Choice A”, ..., “Choice D”. While I am explaining the quiz, my TA quickly goes to Blackboard, enables the quiz, and set the close time (typically each quiz only lasts 2 to 3 minutes).

To enable the automatic grading, I have to tell my TA the correct answer, so he can mark one of the answers as the correct one. Since my quiz is developed on the fly, my TA does not even know which one is the correct choice. Before the class, I shared a secret table with my TA, so in the class, I simply yell out the index of the table, so my TA can look up the table and find the right choice, while students learn nothing about the answer. This approach applies to both multiple-choice and true/false questions. It only takes one minute to set up a quiz like this during the lecture with the help from a TA, which is more than enough, because it takes a few minutes for me to explain the quiz to students. My TA will inform me as soon as the quiz is closed, so that I can start explaining the answer. The best part is that the quiz will be immediately graded.

If your questions cannot be turned into the multiple choice or true/false format, you can use the short answer or essay type. Similarly, you can prepare empty quizzes beforehand and enable them during the lecture. You or your TA may need to grade them manually. I do occasionally use this type of question, but I am trying my best to turn my questions into the types that can be graded by machines.

With the quiz and in-class chat methods, I do believe that my students are more engaging in my class than in my classroom lectures.

Update after the Spring'20 semester was over. Because some students could not attend the live session due to their Internet problems, I could not include the quiz score in the final grade, but I still used the quiz approach to get students actively involved. After each quiz was closed, my TA could immediately tell me the result, and that was a very valuable feedback. I also asked students to copy and paste their answers to Slack, so I could ask some of them to briefly explain their answers to us (also using Slack).

Further Improvement (update in July'20). Because the quiz is no longer graded, in my summer teaching, I started using Zoom’s poll feature, instead of doing it in Blackboard, because it is much more convenient. I basically do the same thing by preparing a general poll before the class with an empty question (the actual question is given during the teaching), and five empty choices, A to E. The meaning of these choices are given during the lecture (you don’t need to use all five choices). This becomes my favorite way for measuring students’ understanding, and I use it very frequently.
3.3 How to Handle Cheating?

Students may cheat on quizzes by communicating with one another. This is very hard to defeat. I don’t have a perfect solution for this. I have been facing a similar problem in lab exercises. In my course, 50% of student’s grade comes from the labs. I often observed that some students did almost perfectly in labs, but score very poorly on final exams. Clearly, they did not do their labs, because a significant portion of my final exam questions come directly from the labs. It is very hard to detect cheating in labs.

Based on my grading policy, these students can still get over 60 overall points if they only score 20 points in the final exam (out of 100). I don’t want to let students pass my course with such a poor score, because I don’t believe that they have learned anything. However, neither do I want to reduce the weight on the labs, as hands-on experience is an essential part of my course. I have tried many approaches for more than a decade in order to solve this dilemma. I have settled on one that I am happy with so far, even though it is not perfect. I use a differential weighting scheme, and put the following statement in my syllabus:

The labs and project are supposed to help students enhance and supplement their learnings with hands-on experiences. While many students do benefit from that, for some students, these exercises do not seem to work. They get very good scores in labs and project, but score very low in the final exam. Given that the final exam is the ultimate test to measure how much a student has learned, for students doing poorly on the exam, the hands-on exercises do not seem to serve their intended goal, so their weight needs to be reduced. Here is the formula to calculate the weight on the labs and final project:

\[
\text{Final Exam } \geq 60: \text{ weight } = 50\% \\
\text{Final Exam } < 60: \text{ weight } = (\text{final_exam_score} - 10)/100 \\
\text{Final Exam } \leq 10: \text{ weight } = 0\%
\]

I will be using the same technique to deal with the potential cheating problem in my online quizzes. Obviously, this differential weighting scheme depends on the integrity of the final exam. See my next section on how I ensure the integrity of my final exam.

4 Online Exams

Many instructors may have to change the way on how to do exams after moving the class online, because of the difficulties in preventing cheating. My final exam, a close-book exam, is an essential part of my course, and I do not want to change that after moving my class online. Although proctoring online exams is more difficult, it is doable, and I have been doing that for my online courses in the last few years.

- **How to proctor the exam:** I require students to turn on their cameras during the exam. The camera should show their face and their hands, so I can make sure that their hands are not on keyboards or smartphones, i.e., they can’t look up for answers or chat with others. Make sure in the video, students’ writing is not visible; otherwise, everybody can see their answers. Before the exam, ask students to submit a picture of their setup, so you can tell them whether the setup is acceptable or not.

  Simultaneously monitoring up to 70 - 90 students should not be a problem. If a class has more students, I suggest instructors open multiple online sessions, each with up to 90 students, and ask TAs or helpers to monitor other sessions for them.

- **How students get the exam:** I post the exam 15 minutes before the exam starts, so that students can print out the exam. This is the preferred way. However, occasionally, I do have students who don’t
have access to printers. They need to let me know ahead of time, and I will let them look at the exam on the screen. However, they are not allowed to touch the keyboard; they can only use the mouse, but infrequently.

• **How to submit finished exam:** My exams are written exams, and students write their answers on blank paper. After finishing the exam, I gave them 10 minutes to scan their paper. Many smartphone apps can do the scanning and combine all the pages into a single PDF file. Students then submit the PDF file to Blackboard.

• **How students ask questions:** During the exam, nobody is allowed to ask questions (otherwise, either they would have to touch the keyboard or interrupt others). If they feel some exam questions are not clear, instead of asking me to clarify, they can provide their interpretation, and answer the question based on that. If their interpretation is reasonable, I do give them credits.

• **How I communicate with students:** I require all student’s speakers (or headphone) to be on, so they can hear me, in case I need to make important announcement. To minimize distraction, I mute all students microphones, so they cannot speak to us. If they need to talk (e.g., getting a permission to go to the bathroom or getting a permission to scan their exams if they finish early), they should click the raise-hand button to get my attention. They can then write their messages on a piece of paper and show that to me from the camera. Students can use simple hand gestures.

**Update after the Spring’20 semester was over.** I used this approach during my final exam on May 5th 2020. There were 65 students in total, and the exam went very smoothly. Students followed our rules properly and we did not find any suspicious cheating activities. We only used one Zoom meeting. Zoom can fit 49 participants in one page, so I have two pages in total with 65 students. My TA and I periodically flip between these 2 pages. We did not turn on our camera, so students did not know whether we were day dreaming or monitoring them. Here are some of my experience:

• I did make one mistake. I thought that Zoom will record the participants, so if something goes wrong, I can go back to the video. It turns out that in the recorded video, I can’t see the participants (not sure whether it is my mistake or it is by design). Fortunately, I didn’t need to review the recorded video. Had I known this before hand, I would have turned on another software to record my screen, instead of relying on Zoom to do the recording.

• The majority of the students looked at the exam from the screen. Therefore, being able to see their hands from the video is important, because nobody is allowed to touch the keyboard. They can use mouses to scroll pages.

• All the students were able to scan their exams using their smartphones or scanners. Several students did make some mistakes, but we asked them to stay in the meeting until we have verified their submissions. That took my TA and myself too long for 65 students (45 minutes). We should have asked students to do the verification themselves.

• Occasionally, we lost the videos from some students. I could immediately see that from Zoom, so I immediately told them to enable the video.

• I also paid attention to the total number of participants displayed by Zoom, so I know whether anybody has dropped from the meeting. This did happen, mostly due to the technical problem, but students were able to get back very quickly.