Using the Lightboard in a Chemistry Class to Deliver Lectures Online
MP4 Video Transcript

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What I'm going to speak about today is what it's like to go from face-to-face to online as an instructor that instructs in a certain style.

And so this is a scene at our community college. And I think if you think about the instructors you know, you could maybe stereotype them into two different categories. You've got folks who are very, very good at engineering learning opportunities. So you might think of classroom management and those types of things. But even broader, there are some instructors who are just extremely adept and skilled at making a situation where a student almost has to learn by the way the assignments are organized, by the way the class runs.

And there's another type of instructor that uses more-- leverages a student-instructor relationship. And often times, that's the sort of approach and technique that they use to reach their students, to motivate their students. And when we as instructors engineer learning opportunities, there's a certain sort of student that that works beautifully for.

So for example, the mature, self-motivated, highly sort of developed student, if you put them in a situation where they need to take the initiative, they'll take it and they'll go with it. There is another type of student that needs what often amounts to extreme support from their instructors. And this is a very, very common student at our community college and I'm sure yours as well.

So the question is if you're one of those instructors who has those relationships with students, develops those relationships, and cashes those chips in when you need the student to work hard, to get through difficult times with your support,

how you go online with that? How do we serve our students? And this is the majority of our students.

So I'm going to talk about just one little thing we might be able to do to make an online student more comfortable in knowing that they have a real instructor, that that instructor is out there to support them. And that's the major challenge, I think, at least in my view as a new online instructor. How do I make those contacts? How do I make sure they know I support them in ways that lead to their success and learning?

So we've had challenges in this regard. And by we, I mean community colleges who go online. So I'm going to first start out on kind of a low note, so I hope you don't want to shoot the messenger. Because I'm here to help in any way I can with this problem. And the problem is illustrated here by data collected by the Community College Research Center at Columbia University-- success rates, failure rates of students online versus face-to-face.

And the data is a little bit dated, but 24,000 students and 23 community colleges in Virginia, it turns out. This is face-to-face versus online failure/withdrawal rates, so very substantially higher online than face-to-face. And there are lots and lots of reasons for that or potential reasons. We don't really know what those reasons are. But as an instructor, when I see these types of data, when I care a lot about my students, it matters to me. What's my role in this as an online instructor? What can I do about this?

Western State turns out to be Washington. Failure/withdrawal rates are about twice as high there. And it's particularly pronounced in gateway courses, for example, chemistry. Introductory chemistry is what I teach. So the problem doesn't go away. When we look at those specific types of courses it's actually a little bit more pronounced.

There's one thing that correlates, or there's one cause that has been teased out by the Community College Research Center. And it's interpersonal interaction. It's no surprise to a face-to-face instructor that-- wait a minute, if you're constantly in touch with your students, if you're able to form a relationship with them, GPA actually correlates extremely well with this one thing. This is the only factor that has sort of been reliably teased out as a potential way to address this problem.

So what I've done is look at, OK, I have to produce a bunch of online lectures. They've got to be viewable asynchronously and even synchronously in certain cases. And there are techniques for doing this that are pretty good. This is the Khan Academy style video, and this is very effective for many students. And I think we all know Khan Academy has experienced a certain degree of success with this approach.

And this is another approach. We like to put the image of the instructor into the video because-- I guess the reason for that would be that we're making a contact. Visual representation of the instructor can be a pretty good thing. But technically speaking, this is a difficult approach. We've shrunk the instructor down to little talking head in the corner.

Often, in education we don't have production values. And these guys here with their lights and their cameras-- they got multiple cameramen. They're paying attention. I got a good mike on me. Production values matter in education as well as they do in other fields. And for some reason we're pretty behind on that. The equipment's cheap now to make great audio, great video of an instructor, put their image into the lesson.

And that's what we've done with this device called a Lightboard that I'll show you briefly. And what it allows-- we want non-verbal communication as part of our online lesson. So there's a reason we spent a whole bunch of money to come here and talk face-to-face. Because it's better than a video. And it's certainly better than a little talking head in a corner-- better in certain circumstances, of course. Your students can't come here. They don't have the money. It's very expensive. We happen to have the resources.

So the question is, is there a way to make a face-to-face lesson the same way I do in my face-to-face classroom and put that online. So the way I teach, I'll have an iPad and it's duct taped onto this thing. So I can go, hey, look, you guys. And I move around a lot. And I try to-- I would never have this classroom where my students are like 80 feet from me and I could barely read-- I did that in the lecture hall when I had 250 people. But now I have 20 or so, and they need my contact. They need an interaction with me.

And I'll use models all the time. I'll pick up a molecular model. And I often have a stylus and a marker in the same hand, so I'll write on the board. And I come over here. I push the button. And I wanted to fold all those things into an online lesson.

Is it possible to do that? Instead of having them as disjointed links that-- if a student has to look at a molecular model, a computer-generated model of a water molecule, they have to click on a link and go somewhere. Could I put it right in there with me so that they can see me interact with the molecule?

And so that's what we've done. We've built a device that does this. But it's not trivial to use. It's pretty easy to use. But the payoff is there are certain students, these mature students that don't need the support, their relationship with the chemistry-- if you put chemistry online for them to absorb the resources and you engineer that situation, they'll be just fine.

But this arrow-- there are many students where it just isn't going to happen for them. They need to go through me. I have a relationship with the chemistry, and I sort of mediate their relationship. And as they develop, they become more independent of me, and they grow as learners. And then they're self-motivated and self-- they have what I call grit. Persistence is what people say. But it's grit. And it's like, OK, I'm going to pound this thing out. Then they have a relationship with the chemistry.

But all three of these things are in the room when I teach face-to-face. And I had my vice president of instructions kind of wag her finger in my face one day and say, are you trying to put your face-to-face class online? Because that's not going to work. And I thought, what do you mean that's not going to work? Do we really know to what extent can we use our usual methods as instructors and get them online?

I'm not sure it won't ever work. And from an instructor's perspective, we have challenges when we have to change modalities three or four different-- and I've had to do this. So I have ITV in one class, and then I have online in another class, and I have face-to-face. And pretty soon, to develop a fluid style and an effective way of communicating with people, you have to shift every time. And it and it becomes-- it's not optimal for the student.

And so even here, this guy told me, you've got to stand in this box. And I basically told him, I'm not going to stand in that box. I can't do that. That's not what I do.

So this-- looking into what's the nature of these arrows. So here's an example of what we've done with a device that allows you to put the chemistry out there to the student. And these are only videos. So it's not like-- anything you can get recorded in video that's helpful to a student. Well, in this format, we can throw some organic chemistry out-- in this case, a steroid.

And the instructor-- a student, if they're walking down the street and they've seen 15 or 20 lessons by this particular instructor, they will say, hey, Jessica, how are you? Oh, man, I really liked your class. Or geez, you're a pain. You just tortured me in this class. But they know who that individual is. And if you look at the little talking head in the corner, they'll probably just walk by and not even notice that that's my instructor.

So there's a human being here, and she's able to gesture. She can put her chemistry out there. And this thing is called a Lightboard. It's not a very complicated device. It wasn't invented by Michael Peshkin at Northwestern, but it was further developed by him in his lab. He's an engineer.

And then we took the device and said, wait a minute. This is a little spendy for community colleges. And there are certain things that are a pain in the neck about how you set it up. And we modified the design in a couple important ways that make it entirely constructable by any community college that has a couple guys and gals around that know how to spin Allen wrenches and a few other things, and position lights correctly, like these guys have these lights positioned.

And what the device allows you to do is overlay computer graphics onto writing, bringing physical objects into the scene and the instructor, all in one scene. So that's all that I use in a real-time lesson, in a face-to-face lesson. Takes a little bit of practice.

It's a different teaching environment. So it's a teaching and hopefully a learning environment that the instructor has to adjust to. You got a super bright bunch of LED lights in your face. You can't see an audience. You can see a camera. And there are certain techniques that you have to develop and hone in order to make it work well.

But it's simple-- four by eight sheet of glass, architectural glass, less than $1,000. There's a big heavy metal aluminum frame that we've already worked with a designer in modifying and making it a package deal that a community college can

more or less order from the manufacturer. Custom design-- but Pueblo Community College, tomorrow I'm going down there to set the same device up for them.

Video camera, PC, iPad, a little bit of software, some practice, and you can synchronize. You can teach from your iPad while the video's rolling. You as the instructor can see the lesson on the iPad. The iPad's image is projected through the PC, essentially, onto the screen so you can show that to the students.

This is the scene. Here is a video camera. This is early on. We kind of had a couple ghetto reflectors set up. And we've since modified it. Julie Wenz, our instructional designer, has made some modifications to the setup so that it seems to function really well now.

But it's simple. It's no big deal. The biggest challenge is probably video editing. The half-life of these videos is hopefully fairly long. So we take time to try to make something that's quality. And when I knew it might be working was when it was all about my inadequacies as an instructor. I would watch the video and think, did I really say that? Did I really-- aw, man. I got to go back and work on that again. Not the equipment-- once the equipment is set up and running, it's no big deal.

She's writing on the back of the glass-- well, the front to her, but the back to the camera. And I've had several people say, how do you learn to write your chemistry backwards? It's like, oh, that's not that hard, you know, if you practice. No, you just push a button in Camtasia or whatever video editor you like, and it flips around.

And if your mom sees these videos, and she knows you're left-handed like I am, and the first thing she'll say is, you know, I like that, but you're not right-handed. That doesn't look right. So it's super easy to just flip this-- so here I have the iPad. And I can see the periodic table. And I can use a pointer.

And you can use AirServer-- I don't have to mention the programs, but you can-- Apple TV, or whatever, to reflect your iPad onto the PC. And just synchronously record all of it, and then overlay them in Camtasia. And it's no big deal.

It allows you-- it approaches as sort of a augmented reality situation, where there is a molecular model, GFP protein, and it's a beta barrel. It's twisted. And I can just give the lesson and sort emulate what I would do. This is exactly what I would do

in the classroom. It would be up here, and see how the twist, the beta sheet. And I can overlay that onto the scene and with a little bit of practice it works extremely well.

We have no idea yet how effective this sort of device or this approach is. We have a lot of anecdotal comments from students saying, yeah, I really like that. I just think it's easier to watch. I enjoy it more. You know, when I'm home alone at night and I'm watching my chemistry there-- purely anecdotal, but students do like-- the face-to-face students who watch the videos, they like the face-to-face more, they tell me. So we know that. But there are a lot of students that simply can't come to the face-to-face lectures.

So we don't know what impact that instructor's image will have on the student. But there's a massive body of evidence that says that representations of instructors, whether they're real people or a certain sort of icons that represent instructors, they make a difference to students. So honestly, we hope it makes a difference, but it's something we're interested in testing. You know, when the whole classroom is wrapped up into one video scene as opposed to clicking around and seeing the molecular models, we hope that it helps the student in a more fluid way experience the lesson.

And we don't know what students look at when they watch these lessons. But I'll show you very quickly a quick eye-tracking experiment that we've done. And we hope to move into this area. Like, wait a minute, when somebody's watching a video like this, what do they look at? And it turns out there are ways to address that question. Will the tool inform instruction? I guarantee you, it already has.

Quite a number of instructors at our college are using it now, and inevitably it's like, oh, boy, I got to change the way I explain that, because watching myself do that, I'm not so sure that's the best way now. So it's a great-- and that applies to any videotaping of instruction at all.

So I'm going to show you-- this is using an eye tracker. So it's an infrared device that mounts below a computer monitor, and it can follow what a person is looking at on the monitor. And these things are fairly heavily used right now in marketing or analysis of the usability of web pages. What are the users looking at when they see a web page? Are they looking at that ad or not? They're just now becoming more commonly used in education.

And there's maybe this number of papers published in chemical education research. How do students learn chemistry? It turns out chemistry is one of those disciplines that-- it's something like music. If you learn music by reading the notes on a piece of paper, the sound has no direct and obvious relationship to these symbols, but the symbols are critical to understanding that. And beginning chemistry students have the same problem. They see numbers and letters on a page, and they can't relate the numbers and letters and notation to the actual objects.

So when we use this eye tracking stuff, we want to know to what extent are the students looking at the model? To what extent are they dwelling on a number or a letter that's in essence an arbitrary letter that doesn't represent the actual object? So this is not a student, but what you'll see is a person-- here is the person up here-- and their eyes are moving around a scene that's an actual lesson.

And there are two types. It turns out your eyes don't just scan smoothly. Your eyes go from one location to another. And the jump is a saccade, and a dwelling on one spot is a fixation. And so in chemical education research, we're trying to start to use these things. Like, wait a minute, an expert learner, they have fixations that are much, much longer than a novice in chemistry. And so they're looking and studying something, and then they'll move to something else.

In these types of video lessons, we want to know, are they looking at the instructor? When do they look at the instructor? How long do they look at the instructor? Why do they look at the instructor? That's a harder problem. But what you'll see is the diameter of the red dot is proportional to the length of the fixation. And these are on the order of hundreds of milliseconds or even 10, 20, 30 milliseconds for the saccade.

So I'll narrate this a little bit because it's jumping. So here I have-- it's hard to see here, but I have a particulate representation of water down there at the bottom of the scene. And I'm sort of thrashing my hand through the water. And when I do this, this individual, they watch me when I'm speaking. When I start to write something, their eye goes right up to the writing. And they look at the instructor's face and watch the instructor's hands.

And so, sure enough, it looks like the instructor's image is at least attracting this viewer's attention. Is that detrimental? For some learners it might be. For some

learners it might be an absolute distraction. For other learners, it might be that this is supporting my learning. And so there I've stopped writing, and they go right to my face. And they watch my sort of nonverbal communication.

This has been a sort of cooperative, collaborative effort at our college. And Emily Jense, who manages a lot of our CHEO efforts and is really a wonderful person who really knows how to get things done, she was extremely instrumental in getting us in a position to build one of these and getting it to happen. Kristen Jones is our former vice president of instruction, and she was very supportive. Maria has been enormously supportive of this effort, and we really appreciate that. And finally Julie Wenz, who's our instructional designer who has really helped us out with this project.

So it would not have happened without CHEO support. So it took me the majority of the summer to figure out how to do this, solve problem after problem, get it done. And when I said earlier yesterday when instructors-- their time is taking up. We pretty much go underground after classes are rolling full-time. And to add on this type of thing to that schedule is really difficult. And so it absolutely would not have happened without CHEO.

So recognizing that, if anyone wants to learn how to make one, if you want to make one at your college, you want to learn more about it, I'm happy to help in any way I possibly can. I'm going down to Pueblo to help them put together one tomorrow. We've posted on our website, which is fvcc.edu, a whole bunch of materials that you can access, like how do we build one of these things? How much does it cost? What are the materials? What's the software? And I'll have cards up here if anybody wants to call me up and say, hey, can you help us put that together? I'd be very happy to do that.