

Supplemental Material

CBE—Life Sciences Education

Durham *et al.*

Supplementary Materials 1. Interviewee explanations for changes in Active Learning practices

Percent of time active- decrease

Reasons provided	Example quotes from interviews
<p>Limitations of asynchronous approach:</p> <ul style="list-style-type: none"> -provided pre-recorded lecture videos with no interactive aspects -challenging to be active when operating in asynchronous format -dropped all student-student interactions in asynchronous format, including team-based learning exercises -used discussion boards for what would have been in-class discussions 	<p>Interviewee 8: "I did voice over PowerPoints and as I started developing them, I realized wow, I cannot ask my questions like I did before. I would constantly be asking them questions for review and I couldn't do that because there's nobody to respond back to me so I had to adjust my lecturing style."</p> <p>Interviewee 13: "I do use a PowerPoint to work my way through a typical lecture but I build in lots of pause points to do minute papers or pair-share type of activities that heavily involve students working in groups... but with the switch to online instruction at the drop of a hat, I made the executive decision to switch to an asynchronous format and so there wasn't going to be a classroom full of Zoom students that could then be put into breakout groups every couple of minutes and so the way that I tried to sort of simulate that activity was every once in a while during my recorded lectures that I would post, I would have like a broad question saying like alright, this is a good place to pause and think about what we were talking about and here's like a prompt thing to think about in your head but I couldn't do as much of a follow up directly with the lecture and so I instead switched to using discussion boards to try and get that sort of communication aspect."</p>
<p>Students were not responsive in synchronous sessions</p>	<p>Interviewee 10: "When I'm teaching the class in person... it is a discussion-based, activity-based class... The problem when we switched to completely online, we had some issues with technical issues on their end. We had some issues with kids expressing early on a desire for asynchronous learning, they wanted on demand courses. That flipped though, that turned 180 as the semester went on. And then the kids would... they'd log in and walk away... So, I would try and do those things and just get no responsiveness or we'd have the activities I had planned initially, just you can't do them in a virtual environment. I can't provide that kind of feedback and such, so that's why we switched."</p>

Percent of time active- same

Reasons provided	Example quotes from interviews
<ul style="list-style-type: none"> - Asynchronous: student prompts provided in pre-recorded lecture videos but students not held accountable for responses - Synchronous: continued live lecture sessions with occasional check-in questions - Wanted to ensure consistency to help reduce feelings of shock among students 	<p>Interviewee 2: "[In person] I give students questions or prompts that they would discuss in pairs or in small groups and then return and report on what they had talked about. The problem though is when we switched to online, I opted to go for an asynchronous approach because I knew a lot of students would have other commitments during the day, you know, jobs or whatever else and so everybody couldn't show up to a synchronous meeting and so when we were meeting online, I still gave them those prompts. I still asked them to please pause and consider how they would respond to these things to go through notes and whatever else. They weren't working with another person anymore; it was still individual and there was no way of knowing if they were actually doing that."</p> <p>Interviewee 4: "When I did the online component because of the transition from face-to-face to online was so sudden, I tried to keep it as similar as possible for students, so they didn't have any shock so to speak. So, I would do a synchronous lecture where I would have students log in at the same time... and I would go through the PowerPoint slide shows just as I would if I was in a classroom."</p>
<ul style="list-style-type: none"> - Had reliable student participators for in-class questions in both modalities 	<p>Interviewee 5: "Typically I will ask questions, wait for responses, things like that. That particular course, I've got a group of students that are willing to ask questions and interact... I still have those students that were willing to raise their hand on the computer and I would still stop and ask questions the same way that I normally would."</p>

Percent of time active- increase

Reasons provided	Example quotes from interviews
<p>Removed or reduced lecture time:</p> <ul style="list-style-type: none"> - Did not think students listened to lectures online, so pre-recorded videos were kept shorter than in- 	<p>Interviewee 6: "Most of the materials that they were dealing with regularly were worksheets or some other kind of activity that I was providing for them other than listening to a lecture and basically I just chose to do that because thrown into this suddenly, I didn't think that I could handle synchronous classes very well and when it</p>

<p>person lectures would have been or removed lecture entirely</p> <ul style="list-style-type: none"> - Most or all course activities required students to engage with the material or turn in something <p>Online resources that were made free allowed greater access to higher quality materials</p> <p>Artifact of survey design: most activity in face-to-face was completed in lab portion of the course, so those activities were not included in survey</p> <p>Synchronous: during live sessions, lectures were reduced or eliminated and students went straight to breakout rooms</p>	<p>first happened, I read an opinion piece that said don't try to do that."</p> <p>Interviewee 7: "Basically since they weren't meeting in class anymore, there were no lectures per se. I didn't record any of my own lectures. Instead I had found little snippets of videos online, and then I would have them answer questions based on those snippets. I also found case studies from the NSF case study website and then I would have the students work on that. So there really wasn't like lecturing per se, from me, just like little videos or case studies or questions that they would have to answer."</p> <p>Interviewee 1: "What I chose to do was to make my PowerPoints available to students asynchronously and then to create a shared Google document for students with questions and answers. And then I held open office hours via Zoom. So, there was much less of me lecturing, essentially none. They had time to read through my lectures and then post questions to me in the Google doc or email me questions. So, it became a much more student responsibility type format."</p> <p>Interviewee 3: "I had this wonderful access through the University of Colorado vet school. They made it free and their online dissection resources free and they were beautiful dissections. Like you could really look at the images quite well so I was able to use it. The Cornell ornithological lab, they actually made some resources free as well which was wonderful, because we didn't have the budget to just buy a whole bunch of stuff and I'm just kind of philosophically against making students buy anything. So, having those resources provided for free because of this emergency was amazing and I was able to take advantage of that."</p> <p>Interviewee 12: "My class had a lab section that was equal in length to the time spent in lecture, but I sort of ignored that when I was answering the questions, because otherwise we would be more than 50% doing all the other stuff besides lecturing, if you included the lab time."</p> <p>Interviewee 14: "I think the main thing became on the online, I don't really lecture in the beginning... if a student asks me a question and it took me you know, five minutes, maybe even 10 minutes and drawing things on the board and basically doing mini lectures to answer questions, I sort of counted it as a lecture because that's really all I do for lecture so that decreases online because it's just harder to launch into lectures and keep going with it when you're sitting in front of the computer with the students on Zoom."</p>
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Percent of time in groups-decrease

Reasons provided	Example quotes from interviews
<p>Logistical concerns/issues:</p> <ul style="list-style-type: none"> - Thought group work was not compatible with asynchronous approaches -Did not know how to facilitate groups within learning management system or video conferencing program -Did not have time to figure out logistics of group work - Wanted to make it easier on students and/or self - Students were not responsive in breakout rooms or shared asynchronous documents - Technical difficulties: tried breakout rooms but had technical difficulties so 	<p>Interviewee 2: "It's the challenge of teaching the asynchronous class and trying to give students the freedom to be able to set the schedule for the class in a way that best worked for them. So rather than try to get everybody into the same schedule, I tried to set it up so they could work on it individually. I didn't want to force students into a schedule that may not work for everybody."</p> <p>Interviewee 1: "Typically when I teach every few slides of my lecture I have a question where the students are asked to turn and talk with a partner and discuss, and then report back to the large group. Being in an asynchronous situation, they still had those questions in the slides but there was no requirement. I mean, I did encourage them via emails to talk with classmates, meet with classmates via zoom, but there was no accountability for that."</p> <p>Interviewee 14: "I did have to cut one entire group independent project because it just did not seem feasible to do that entirely virtually. Especially because it's supposed to be a group experiment or group work and that's a lot of work and to make them do that individually in the middle of the pandemic at home with all the other things going on. It just didn't really seem fair."</p> <p>Interviewee 13: "I like to have periodic points where students can reflect with one another and discuss the material without going into using up the whole rest of the lecture on that discussion... With asynchronous delivery, it was very difficult to do that</p>

abandoned group work altogether

- Administrative pressure to use asynchronous approaches

Sensitivity and fairness regarding students' home/personal situations:

- Unknown student internet access

-Time zones vary among group members

-Unknown personal home situations

- Various work schedules among students

so the only sort of group discussion that I could really push was with some of our lab activities. I had them working in groups so they would have Zoom conferences and work together on some stuff and a couple of discussion board type activities where they could talk back and forth, but it wasn't quite the same."

Interviewee 8: "So because I had to very quickly incorporate and create new content, make the voiceover PowerPoints and the extra quizzes, figure out how to get my exams online, I did not have time to figure out how to do online groups, so the whole team-based learning, we had two more to do in the semester and I just canceled them."

Interviewee 10: "Some kids were having technical problems and a lot of kids would log in to make it seem like they're there but they weren't actually there. The system we've got is Blackboard Collaborate Ultra, which does allow me to break the kids into subgroups, but when we were first making the transition... only two were willing to use their microphone and talk on there... In our normal classroom I have them in groups of four and we switch groups every week and I can see who is participating and who isn't and there's no hiding in the classroom and it just didn't work online or at least I haven't figured out how to do it online."

Interviewee 5: "With being transitioned into it rapidly, we didn't have a way of breaking out groups. I know that there are ways within the Collaborate to break out groups but we have not been trained in that yet you know, it's the learning curve."

Interviewee 6: "Because I wasn't doing anything synchronous where I could have students together and force or persuade them, encourage them to be in groups and I still think it would have been useful... I even said that to students for one assignment that if we were doing this in class, you would be in groups and so why don't you put it in a Google doc or something and work on it together and just turn in one document. But nobody did that and so I kind of took that as them not being interested or it not being worth it to them to bother with whatever logistics they were dealing with for group work and I didn't pursue it any further."

Interviewee 4: "When I worked in the classroom, there are times when it's easy to do activities, like think-pair-share or group activities, sometimes in lieu of lecture. I ran into technical issues when it came with the programs I was using. So, either with Zoom or with Big Blue Button, they have certain proxies for how you can do the group activities. You can have breakout sessions and send students into small breakout rooms and you can monitor what they were doing. But the first time I tried that it was a disaster. I lost a lot of students.... So at that point in time, I decided I'd go away from the group activities for the rest of the semester and just focus on what I could achieve with the programs that I had at my disposal."

Interviewee 14: "I felt like I was sort of forced into it [an asynchronous format]... originally we were asked to do as much asynchronous work as possible because we couldn't know what sort of internet the students had available or did they have to take care of family members or work or whatever it was. So, I think I sort of took that into account and from the beginning I sort of transitioned some of my group work activities more towards discussion boards that they could do asynchronously which of course does not ask them to work in groups then. I didn't like that approach and I ended up probably moving away from that more towards the end because I didn't find the students were as engaged with them and getting as much out of it."

Interviewee 9: "We had students from all over the United States and so I couldn't guarantee that they would be in the same time zone and then I couldn't guarantee internet connectivity. Those were the two biggest and for me I'm all about fairness in my class and so I can't place a demand on one student and assume that they have really good internet connections or something so I have to hold them to the minimum standard."

Interviewee 3: "Because the students were scattered all over the country, I had them from coast to coast in multiple time zones. Some of them had to get full time jobs and

others were in quarantine... and then I had other students who had to go home to pretty unideal circumstances. And then I had another student who doesn't really like children, but was all of a sudden responsible for all the childcare for her entire family."

Percent of time in groups- increase

Reasons provided	Example quotes from interviews
-To maintain sense of community (asynchronous format) -Replaced group work on labs with group work on course activities	Interviewee 7: "Most of the time when my students would do group work in class, they would be in groups and so I wanted to keep that up since they weren't seeing each other anymore. I thought that since the community was still important, I made groups in Canvas for them, which is our learning management system and then pretty much anything that they did for the class I had them work on in those groups, you know, trying to simulate how it would have been in the classroom and still trying to foster that community."

Supplementary Materials 2. Interviewee explanations for changes in Learning Goals and Feedback practices

Learning goal specificity- decrease

Reasons provided	Example quotes from interviews
Time limitation	Interviewee 13: "For most of the lectures that I would post ahead of time there would be a slide at the beginning and the end of the lecture that would sort of have three or four broad learning objectives for okay, this is what we're going to be covering in this particular class period and then one or two slides at the end of the lecture sort of saying if you followed along with what we're getting at, these questions should be doable for you. So, I'd been sort of revamping those into my face-to-face instruction. With the upheaval with COVID I found that sometimes I was just rushing to get a lecture recorded and either had reduced the amount of those objectives posted at the beginning or the end, or would simply forget to post them because I was like a day behind getting my lectures up and didn't get around to it."

Learning goal content broader

Reasons provided	Example quotes from interviews
-Streamlined material for students	Interviewee 13: "I wanted to try and make this as streamlined as possible for students so I'm not going to try and delve into some of the more detailed, deeper concepts to the level that we normally would have done instead I'm going to try and make this transition as seamless as possible while maintaining the academic rigor that I'm hoping for, but trying to keep it a little bit more streamlined for them."
-Sacrificed depth for breadth	Interviewee 5: "In terms of overall goals it's kind of well we're not going to get this covered and we're not going to get that covered. You know, how can I streamline the material so that I can hit more topics but maybe less in depth?" Interviewee 1: "We did delete a little bit of content from the last unit but it didn't affect learning goals. It was more depth than breadth."

Learning goal specificity- same

Reasons provided	Example quotes from interviews
Practical reasons: -Learning goals already established -To allow students to prep for exams -Did not have enough preparation time to change learning goals	Interviewee 12: "I've taught this class several times. I knew what each subject kind of covered. So, I knew... what the main points for each topic were ahead of time. I was able to maintain that with the subjects because, you know, stuff changes, we get newer and better information, but it's paleontology. It's very rare to completely upend everything in paleontology and totally change stuff." Interviewee 4: "We had set learning goals, which matched the program learning outcomes for the bio department at our university"
Personal value: -Having consistent learning goals are part of teaching philosophy -Wanted to maintain consistency with what students signed up for -Perceived lack of student concern	Interviewee 3: "That's actually something that's really important to me. For me, students need to know why I'm having them to do things and for me to justify what I have them do I need to see it tied to both the overarching university learning outcomes for their entire degree and the overarching learning outcomes at the department level for a degree in biology, and then I have my learning goals for my class that are divvied up by objectives." Interviewee 4: "When I transitioned from face to face to online, I decided to just leave it as is and not change the learning goals; just make sure that everything that I impart to students stays consistent as if it was a face-to-face... I tried to keep it as similar to the original idea as possible, just so that in case we came back or we had to modify something, that what the students had signed up for was not being changed on them." Interviewee 11: "When I switched to online, I thought, okay, it's not like I'm trying to redesign the whole course, because we were pretty much in the last 5 weeks or so of the semester. We were about two thirds of the way through our semester when we had switched. So, in order to abruptly transition, I did not want to go ahead and change anything in terms of what the overall goals were... so I just left it as it is... I just didn't think that in a situation in which we were suddenly switching that this would even matter to my students, and no one asked."

Learning goal specificity- increase

Reasons provided	Example quotes from interviews
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- Justification for why students were being asked to do the activity/work
- Provide more structure and specific points of focus for students

Interviewee 7: "My learning goals were always stated in my syllabi, and... if we were doing some sort of in-class activity I didn't specifically have it stated on like the piece of paper or on the case study, like why they were doing that case study. I might verbally tell them but I didn't have it explicitly as part of the assignment itself. And when we went to online, they didn't have me there anymore explaining why they were doing the assignment or how it was related to anything else. So, I felt like I had to be more explicit so they weren't trying to guess or I guess part of it was also justifying why I was having them do these things. I put it in as part of the instructions that they would get for why they would need to do this case study or whatever they were doing."

Interviewee 10: "The anxiety [among students] was high, there were a lot of questions so what I found was very helpful to calm them psychologically and give them some structure was, and I never did this when we were in the real class because they just kind of knew what the vibe of the class was, but here I would give them every single day, this is what's going to happen."

Percent of feedback provided on in-class activities, exams, or projects- decrease

Reasons provided	Example quotes from interviews
<p>Time constraints and stress level barriers:</p> <ul style="list-style-type: none"> -Not have enough time -Felt overwhelmed -Wound up operating in survival mode 	<p>Interviewee 6: "The amount of feedback decreased largely because I was just so overwhelmed with the amount of material that was coming in. Instead of an in-class discussion where they might've just gotten participation points for being there and speaking up and that kind of thing, all of a sudden, they're having to type something up and send it to me and I'm trying to read all of this and grade all of this and I couldn't handle it. Especially early on in the transition I think I tried to do too much and so a lot of it I ended up just having to say okay, they did it. That's fine. They got credit for doing it and I didn't provide feedback and by no means do I think that was ideal but it was the only way I could survive."</p>
<p>Remote modality limitations:</p> <ul style="list-style-type: none"> -Difficult to accomplish in real time with synchronous sessions -Difficult/ not possible in asynchronous format 	<p>Interviewee 10: "In this [remote] format if I do anything on those assignments I'm getting back, I have to write back to them and I'm not a fast typer. So, what I ended up doing was I would read everything, I read every word of everything, but I would only respond back in relation to the assignment to a fraction of the kids because I just couldn't do it for all of them, it was too much."</p> <p>Asynchronous difficult: Interviewee 12: "Since I wasn't having them have class discussions, obviously, I wasn't discussing anything with them."</p>
<p>Logistics barriers:</p> <ul style="list-style-type: none"> -Not used to LMS grading system -LMS user interface is clunky/slow -Cannot monitor breakout rooms well without disrupting student workflow 	<p>Interviewee 8: "I felt like it really got reduced because I didn't have that in-class asking of questions, providing feedback to the answers to those questions... I did respond to students' questions when they had them but not many students emailed me with questions... Part of that too was I got rid of that team-based learning stuff and that's where a lot of that feedback came from where we would go through the answers to the questions."</p>
<p>Format of questions/assignments changed with remote transition:</p> <ul style="list-style-type: none"> -Switched question format to multiple choice for easier/automated grading -Made exams harder to take, so more time consuming to grade 	<p>Synchronous difficult: Interviewee 14: "They would normally write an answer on the whiteboard in class and then we would go around and talk about them or maybe they would write it out on a note card and hand it in to me, one per group and I'd look it over and give them feedback for the next class. So, it was not that I didn't want to see what they were doing or give them that feedback. I just struggled with the best technology to do that without having it be a ton more work for them and for me. I didn't want them to have to format a new word document and type it all up when really, I just wanted a quick sketch on the whiteboard in Zoom or whatever. So, some of that is just I wasn't able to know how to get the feedback for the in-class stuff."</p>
<p>Artifact of course timing: Instructor expectations of students already established</p>	<p>Interviewee 10- "When I have them all in these pods of six groups of four, I'm constantly circulating around the room and my job is more listener or coach during class than it is, you know spewing stuff at them... I couldn't break them into those groups [in the remote format], which means I wasn't circulating. So, the only responses I was getting in the synchronous learning was from the small minority that wanted to participate back."</p>

Interviewee 5: "Rather than getting a stack of assignments that come in during class and so you've got everything there and you can go through them, now they're coming into Blackboard and to process them through the Blackboard, to me is much more awkward. And so that slowed down the rate of feedback and probably did a little less feedback with that."

Interviewee 1: "They had fewer quizzes and feedback on them was limited because I didn't grade them and turn them back immediately as I would have in the face to face. And the summative course exam, we usually would do those on paper and there would be some multiple choice and short answer, and short answer questions in general get feedback written comments from me. Transitioning to remote, the learning management system was very clunky and caused some real delays. You know, it took five clicks to see an answer for a question so by the time grading was done, there wasn't much time for feedback."

Interviewee 14: "Mostly that came from the change of format for the exams. In class before we transitioned, the exams were all essay sorts of questions or drawing out experiments and data or interpreting data and writing out paragraphs of answer. And I did have them try one exam like that when we transitioned, and it had to become open book, open internet of course, which meant the questions had to become much, much, much, much more challenging... It was harder for me to grade and give them feedback on that though because they turned it in electronically... I let them choose for the next exam which they wanted and by far the majority wanted the multiple choice... Those they could see the right answer but I didn't give any feedback on it because it was multiple choice and sometimes, they would ask and we would talk about them in class the next time but most of the time, we didn't as much so there were fewer opportunities, I guess."

Interviewee 11: "We didn't have that much left that was anything sort of new. ... early on in the semester, I give lots of individual feedback as this is what you need to do in order to do better and so on. But by the time we got to where we went online, I had already discussed these sorts of things with the students. So, they knew what the expectations were. They understood what was necessary in order to do well."

Percent of feedback provided on in-class activities, exams, or projects- same

Online course shell already set up

Interviewee 4: I have been using Canvas as a way of having students complete and submit their assignments and receive feedback from me. So, I've gone away completely from having any paper submissions. So, my option actually, it made it slightly easier to work, transitioning to the online format because I already had all of these assignments, submissions, everything done online.

Interviewee 12: "I was trying to give them feedback to push to do a better job on that for the cumulative experience."

Percent of feedback provided on in-class activities, exams, or projects- increase

Personal value:
-Thought students needed to know specifics of grading; wanted to be clear why points were taken off

Interviewee 6: "Because we weren't in class together where I can say "okay, in general, there were problems with number four, what I was looking for was this and a lot of you missed that but don't forget blah, blah, blah" I felt I needed to write that out and, in many cases, I literally copied and pasted the same comments on every student's, or you know many students' exam papers but I at least was giving them feedback on it. I thought they needed as much as possible specifics not just that it was wrong, but why it was wrong, what they missed, in some cases go back to this lecture or this was included in such and such material we looked at."

Logistics:
-Had more time at home compared to on-campus obligations
-Had less groupwork remotely, so more feedback for individuals
-No chance to chat in person and knew that all students would receive were feedback comments

Interviewee 7: "All my exams are short answer, and so when I would grade them in person, I would take off points but I would tell the students I will certainly go over any exam questions or anything you want to learn more about like, why did I take off points? What was the correct answer? What was you know, incorrect thinking they might have had and I would rely on the students to come to my office hours for that... and I just wasn't able to do that once we went online because the students' lives changed so much everything that I was trying to do was asynchronous and I didn't want to disadvantage students by requiring them to come to an office hour at a particular time when maybe it just wasn't possible for them with whatever was happening in their lives and so I didn't have that one-on-one kind of meetings with the

students and so when I was grading their things rather than just taking off points I was actually trying to be again, just really explicit. What would have been a more complete answer or what were they incorrect about?"

Interviewee 3: "It was easier with the formative stuff in the online setting because it was something they handed in and frankly I was sitting at my computer a lot... In class it would be more of a discussion. I guess that's still feedback but it's not directly from me... when I'm working at the University there are students always in my office or lab or there's some problem with the animal labs. So frankly my grading was pretty slow... and at home even though it was slower I was able to address things more methodically."

Interviewee 9: "I do a lot of teamwork and I moved to individuals so I didn't have any teamwork after the switch."

Interviewee 7: "Whenever we did things in class the students would usually be working in groups and then I wouldn't necessarily address each group individually but we would usually have a go over the answers, or different groups would provide the answers for different questions in class and so I never really addressed any one student's misconceptions or anything of that nature. But when it went online, they never had any circulating in the class or I never went over a question with the right and wrong answers in class anymore. All they got really was what they saw and so I was just trying to make it very clear to them why I was taking off points and what they missed or whatever those misconceptions might have been."

Supplementary Materials 3. Interviewee explanations for changes in Inclusivity practices

Diverse examples and analogies- decrease

Reasons provided	Example quotes from interviews
- Uncomfortable or awkward: Felt that discussion of controversial or uncomfortable topics is more amenable to conversation rather than asynchronous approaches	Interviewee 13: There were a lot of opportunities to bring that up with the ecological topics that we covered in my course and it would involve a lot of then back and forth discussion about these different perspectives. But when we switched to the online modality again, I had a couple of examples here and there but there wasn't that opportunity for back and forth as much."
-Artifact of semester timing: relevant topics occurred before the shift	Interviewee 9: "If I'm going to do recorded lectures then it's harder to get into controversial topics but when I'm in the class I can bring up and have more of a dialogue with my class and that includes talking about people in science. So, I'd rather have a discussion about someone's contributions to science rather than just tell them what happened."
-Resorted to the basics of textbook when remote, and textbook contains very little diverse representation	Interviewee 11: "When in person, I can somewhat agree that this was addressed. When we went to the online format, you know, my goal sort of became, oh, survive this, you know, try to get these students to understand these scientific concepts, and do as best as they can to remain engaged through the end of this. And so, I kind of blocked out any other, any other extraneous things to include."

Diverse examples and analogies- same

Reasons provided	Example quotes from interviews
Personal value: -Thinks calling out misinformation about people is important -Wants to ensure underrepresented friends and students see themselves represented in the course	Interviewee 3: "Oh, for me that's very, very, very important. ...I have friends who work in my field who are amazing Black women or Black men and they are not represented fairly in a lot of different ways. So, to me that's very important. I have students of color. I want them to see themselves in what I do."
Major component of course design/ course topics lend themselves well to diverse representation	Interviewee 4: "While they were still on campus, I had talked about how they needed to think about different aspects of all the topics that they're discussing, not simply from an American-centric point of view, but also from a world-centric point of view. So, what might be acceptable to an American lifestyle is not necessarily the most accepted way of doing something say in Africa or Asia....This course lends itself really well to talking about diversity or differences in all these different components and it didn't matter whether it was face to face or online, I kept up the same process."

Supplementary Materials 4. Interviewee explanations for changes in Responsiveness to Students practices

Aware of non-understanding and followed up- decrease

Reasons provided	Example quotes from interviews
Course and breakout room logistics: -concerns about overburdening students -Fewer types of follow-up resources available -Difficult to screenshare videos or other materials while synchronous -Not enough time to check on all break out rooms -Jumping in breakout rooms disruptive -difficult to do asynchronously -weekly modules led to time lag in grading/feedback, so no time to adjust to student misunderstanding	<p>Interviewee 14: "When I did the in-group or in-class group activities on Zoom, we would do breakout rooms and I would jump into the different rooms and they would ask me questions so I could kind of figure out if they understood it or not. But I think I struggled a lot more because it takes a lot more time to jump into the room. You have to listen a bit longer because you didn't hear any of the conversations when you weren't actually in the room. They often would have processes, which is good, but then I'm answering questions a bunch and then the activity ends up taking a lot longer because it's more difficult to just say, "Oh guys, everyone needs to remember X, Y, Z. Okay. Go back to your group." I'd have to call them all back from the room and that takes at least a minute and then tell them that thing and then send them back."</p> <p>Interviewee 11: "I didn't really think that was necessarily possible in this format. Now, if we have a format in which we could be more synchronous, or we could have an expectation for more students to show up to Zoom meetings, then perhaps that would be more possible. But you know, our goal here was to get through this semester."</p> <p>Interviewee 12: "If you've recorded something and they watch it, you have no idea what's going on when they're actually watching it. It's not until you see their response on the exam that you see whether or not they got something. And at that point it's kind of too late to have addressed it."</p> <p>Interviewee 5: "Because of the class size and for bandwidth concerns and so on the students would have their video off so I'm not seeing them... then you also do not get the facial expressions and there's a little bit of a feeling at the end of the day, how many of them turned on the recorder, turned on the presentation and were off doing something else while they were listening to it. So, it really felt like my ability to see them and to perceive their questions really was relying on about three of the more vocal engaged students to kind of do the work for the class as a whole."</p> <p>Interviewee 3: "This is my least favorite thing about teaching online. Because I don't have that visual input of what's going on in my class. I don't have the ability to walk beside them... both physically and you know as an analogy I don't have that ability and I'm sure some online instructors can do that like rock stars, I'm just not one of them."</p> <p>Interviewee 3: "Sometimes flat out asking them, they're not going to tell you, so I really relied on those chats. So, you ask but sometimes they don't even know enough, like they're so overwhelmed they just say, "Yes" to make the conversation go away, or they don't respond."</p> <p>Interviewee 3: "You can ask and you can reach out personally but in this particular class I had two seniors who were supposed to graduate in May. They totally checked out. Totally. And I reached out to them. I texted them. I had their football coach text them. It was when the coach texted them that they contacted me."</p> <p>Interviewee 2: "I did initially have once a week, a, question sessions where they could come and meet in a meeting and go over whatever they want. That started as once a week and then about halfway through the quarantine that transitioned to twice a week, but not many students even came to that... so I got a really good feel for what those few students were struggling with. The class as a whole, because I wasn't interacting with them, I didn't have any idea."</p> <p>Interviewee 7: "When it's in person, you get a feel for the classroom. You get a feel for either students staring at you blankly or you know, the brave type of students that might start asking questions that kind of leads you to get an idea that, hey, the students aren't understanding it right now. When it was online, because I wasn't with them, I couldn't feel how they were feeling, kind of like in the room when they were all confused or anything. [In the remote modality], I never knew that they were confused until they would turn in an assignment for points."</p>
Lack of student cues available: -students kept cameras off (synchronous) -no real-time interaction with students (asynchronous) -students not responsive -students falsely indicate understanding -students did not ask questions	

Aware of non-understanding and followed up- same

Reasons provided	Example quotes from interviews
<p>Students more likely to email for help when remote</p> <p>Course activities fostered back-and-forth between students and instructor to follow up on misunderstandings (running Google Doc)</p> <p>personal value: -thinks following up is most important part of teaching -has no issue slowing down to help students keep up</p>	<p>Interviewee 6: "I think a lot of times students are afraid to or embarrassed to say anything in front of their peers, so I'm pretty sure that I didn't know or they weren't admitting that there were difficulties when we were still face to face and then when we went remote there were in some cases, just tons of emails "Can you explain this again?", "I didn't get this", "Are you referring to that?" just you know, some students who were contacting me a lot, some who almost never contacted me and so I felt like I was getting a pretty good feel."</p> <p>Interviewee 1: "In open office hours via Zoom students brought questions, we discussed, I could follow up on whether or not they understood, et cetera. And then in the Google doc, that was a chance for the students to type out their question and then I can respond and then go back and forth several times. So, it wasn't just an okay, I told you this now you're done, you get it but they could respond again as they needed to."</p> <p>Interviewee 14: "Because that's the most important thing, right? You can't figure out if students don't know something and then not work to try to fix it...I guess I was able to maintain it because I think it was the most important part of teaching."</p>

Supplementary Materials 5. Interviewee explanations for changes in Experimental Design and Communication practices

Make predictions and design experiments- decrease

Reasons provided	Example quotes from interviews
	Interviewee 6: "It's not something that our students seem to be very adept at, especially at this, it's just that I'm teaching most of them as second semester freshmen and so they really need a lot of prodding and hints and I think that would just be really hard to do remotely."
- Students lacked skills for independent work in this practice (some due to class level)	Interviewee 14: "I did have to cut one entire group independent project because it just did not seem feasible to do that entirely virtually. Especially because it's supposed to be a group experiment or group work and that's a lot of work and to make them do that individually in the middle of the pandemic at home with all the other things going on. It just didn't really seem fair."
- Practice was dropped or reduced along with group work because students would work in teams during these practices	Interviewee 9: "I didn't have team-based exercises any more so we lost that whole thing. I do a lot of stuff in class as teams so they had their group of four is their little team and that goes through the entire course, and so they couldn't meet anymore and so they didn't get to form hypotheses together."
- Simplifying course material to get through the semester: "survival mode"	Interviewee 11: "I guess the best way to describe what happened here would be that I went down the ladder on Bloom's, you know, I was looking for, you know, things like remembering, understanding and applying more so than analyzing, evaluating, and creating to finish off the rest of the year... It was less of a let's analyze and think about what's going on here and come up with hypotheses and more so like, okay, here's the system that we're looking at. Here are the basics that I want you to know. Here are some ideas that I want you to think about. Here's a video to reinforce that, and here's a time that I'm available for us to discuss that ahead of the test."
Logistics artifacts: - Amount of time was same but took longer for students to work through them remotely - Artifact of course timing: more were originally scheduled for first half of semester - Method of adjustment limited ability to use one or more of these practices	Interviewee 13: "When it came to the online modality, we switched to using a lot of datasets collected from previous semesters and so I would give students an experiment that was built by students last year and all the data and ask them to think about what's a question you could ask within this very constrained set of data? And so, a little bit of the creativity was lost there because the students didn't get as many opportunities to really come up with it themselves, they just had to work within like okay, I've got these five treatments, there's only two questions I can really ask with it. So, they got to do some experimental design, but not to the same degree."

Make predictions and design experiments- same

Reasons provided	Example quotes from interviews
	Interviewee 4: (applies to all Experimental Design and Data Analysis questions): "I already have labs and other activities designed to be done on an iPad while the students were in class. And that did not change whether I was doing it face to face or remotely. And so, I utilize that feature in my labs. I already have labs and other activities designed to be done on an iPad while the students were in class. And that did not change whether I was doing it face to face or remotely" (Institution provides iPads to all students)
- Necessary resources provided to students prior to remote transition	Interviewee 2: "When we cut off, we were just getting into human anatomy and physiology and I do a lot of case studies there. So again, in that case they were looking at artificial data and then drawing conclusions from those data, and then trying to find an application. So that's how I was doing those things and those are the exact same things I would do in a normal class but again now it's okay, do this on your own. How often students were actually doing that I'm not sure but I was creating the opportunities for them."
- Opportunities were provided, but students were not held accountable	Interviewee 7: "One of the things that the students do in this class is they are supposed to design and implement their own experiment and so part of that is having an observation and then having a hypothesis and then making predictions and that's what I would have done if we had been in person and I did part of that online in the fact that I still had them you know, do the first half of the scientific method without actually doing the experiment. And so, I still think that that's pretty important and so I would still have them do that even when it was in the online format so they didn't do the second half of it. They didn't actually carry out the experiment and necessarily
- Practice was part of ongoing projects that continued after the transition	

make conclusions on their results but I was still at least trying to do the first half of that where they would have observations, make hypotheses, and then come up with some sort of experiment that they would use to test it. And then if hypothesis one was correct that this is what the results would be. If hypothesis two was correct, this is what the results would be. Even if they didn't do the experiment themselves."

Scientific literature or media articles- decrease

Reasons provided	Example quotes from interviews
Access: -Didn't think students had access to articles off campus or unknown internet access - Artifacts: -Lost with face-to-face lab -Course timing: more were originally scheduled for first half of semester	"In the class there was one big semester project where they had to find a recent news article and read it and then present on it, and that presentation just happened to occur late in the semester when we went to online. So, it never happened in the first part of the class but it did happen in the second part."

Scientific literature or media articles- same

Reasons provided	Example quotes from interviews
-Low frequency throughout semester in original plan -Substantial part of course structure/goals -Institutional support: all students are given an iPad so all had access to papers since semester start	Interviewee 14: "They do really just actual scientific full papers to interpret and try to really wrap their heads around, just a few times and so that ended up being about the same just where they were already spaced in the class. It didn't change."

Scientific literature or media articles- increase

Reasons provided	Example quotes from interviews
Part of personal value/teaching philosophy or part of normal approach to teaching	Interviewee 7: I think I was trying to have them do as much kind of analysis on their own as I could have them do because I feel like that's just sort of a skill you need to have as a biologist and certainly I teach an upper level biology course and so I just wanted to make sure that even if you know, maybe some of the content was changing, sort of the skills portion of it, they were still getting and I, I just sort of feel like being able to critique and interpret you know, what you see in the literature versus what you see you know, in popular media. I just feel like that's a critical skill that people should be able to um, you know, should be able to do. Interviewee 9: "That's just how my lectures work, we always reference literature and media and videos and stuff like that so my lectures honestly didn't really change that much."

Supplementary Materials 6. Interviewee explanations for changes in Data Analysis and Interpretation practices

Make or interpret graphs- decrease

Reasons provided	Example quotes from interviews
- Make course more manageable for students	Interviewee 3: "For me it was just making things more manageable... piecing together what my colleagues said at various faculty meetings and what multiple students whether it was my advisees or students in this class, some of their classes kind of tended towards overloading with busy work as opposed to fair assessments."
- Not enough time	Interviewee 10: "Because we didn't have the group work element and for the non-science majors, I mean their science literacy is not always the best and they get frustrated very quickly. So, it was a battle I wasn't interested in fighting."
- Casualty of dropping labs	Interviewee 7: "That was certainly something I struggled with was the virtual labs because I'd never taught online before. I'd never really explored virtual lab options. And so, without the in person face-to-face, without the lab component to it, they just weren't as exposed to as much data."

Make or interpret graphs- same

Reasons provided	Example quotes from interviews
Materials, training, or support provided or established at the beginning of the semester: - Basic skills training already established - Continued use with ongoing course projects - Materials (paper lab manual) already developed and distributed to students at start of semester - Institutional support- all students provided iPads at start of college, so technology or apps readily available	Interviewee 13: "Because I had that front-end focus on analysis, practical interpretation, and graph building, they were able to actually apply that stuff with me not directly in the room, which actually worked out pretty well as a way to see whether or not it actually clicked with them or not because they could reach me during office hours, but they didn't have as much face-to-face contact. By and large it worked out pretty well on that front." Interviewee 7: "We were just getting to the end of those experiments when we went online and so they were gathering that data and then hadn't yet wrote their formal lab reports for that but I gave them the rest of the data and then they were still generating the graphs from the data that we would have done if we had stayed in person." Interviewee 4: "I already have labs and other activities designed to be done on an iPad while the students were in class." (all students provided iPad by the institution)

Make or interpret graphs- increase

Reasons provided	Example quotes from interviews
Artifact of course timing: relevant topics fall at end of semester	Interviewee 6: "They would make graphs and tables, especially graphs, a lot in the lab and the reason that we ended up doing it during the remote portion was largely because of the content that we were doing."

Supplementary Materials 7. Interviewee explanations for changes in Cognitive Skills practices

Percent of time active- decrease

Reasons provided	Example quotes from interviews
- Harder to facilitate online and/or with breakout rooms	Interviewee 14: "Those were a little harder to administer online I felt like. Especially because those are the ones that students often need my help with more as they're working in a group, and those work better if I have a way to sort of more easily monitor how the group work is going which is more challenging in the Zoom breakout room"
- Activities took longer to work through remotely so there were fewer in each class	Interviewee 10: "The amount of time we spent on those sorts of things did not change. What changed was how many we were able to get through. So, like when we do this stuff online, I've got my video rolling so they can see me. I might pose out a question and, in the classroom, hands go up or people just start talking as the semester goes on because they get comfortable with each other and it's like a log rolling down a hill they just carry it from there. Here [in the remote modality], I would pitch out the question and there was this ridiculous lag time. Fewer people responding and the log would only roll for a little bit and then it would stop. So, for us to cover the territory for those discussion questions that I thought was the depth we needed was a lot more prodding on my part, had a lot more of that lag time, had a lot more awkward silence, things like that. The amount of time was the same, but the number of different things we hit was different. It was a lot less."
- Casualty of dropping group activities in remote format	Interviewee 6: "I think that would have happened anyway if we hadn't transitioned to remote. I had planned to do a couple of case studies earlier in the semester and only one case study later in the semester"
- Artifact of course timing: only planned for these during the first half of the semester	

Percent of time active- same

Reasons provided	Example quotes from interviews
- Important skill for course level or content	Interviewee 11: "I suppose it's inevitable in Anatomy, especially in Anatomy 2, that that is part of the learning process"
- Part of personal/teaching philosophy	Interviewee 14: "It's a 400-level class and this is kind of what I'm trying to push them to do all of the time.... I kind of just expect them at this level to be able to learn that from those PowerPoints and know it. And then we spend the class time doing those higher-level things with it. So that didn't change a lot because that's sort of always the way I've felt like the class should be and that's why I flipped it [in the first place] so that I could give them more help with that higher-level work."
- Set the tone early in semester then continued after transition	Interviewee 6: "Well I'm just always trying to do that as much as I can. I don't see a lot of point in asking students to just memorize stuff. I mean, they obviously have to know facts to be able to use the facts and apply them and analyze them and so on but I would much rather them be able to work at a little bit higher level."
	Interviewee 12: "So I tried to maintain the same level of rigor in the questions that I used on the mini exams as what I would have had on the in-class exam."
	Interviewee 1: "So this is in the questions that I asked during my lecture where I asked students to turn and discuss with a partner [in person]. Those are primarily application type questions and not recall questions. If the students were continuing to do them as instructed, those were maintained, those questions still were there. Some of those then I did see students bring back to office hours or to the [shared] Google doc. So, I know that the students who were fully engaging were making use of that time to check their understanding on that application."

Percent of time in groups- increase

Reasons provided	Example quotes from interviews
Academic honesty: wanted to make sure students could not Google their answers	Interviewee 7: "I think I had made the decision that I wasn't going to fight the internet. They can look up any question and you can find an answer on the internet and so I was trying to come up with all of my own resources and I would Google any kind of question I would have them answer. I was Googling all of that myself. Like when I would write the question and I would put it into Google and see what kind of answer I would come up with because I didn't want them to just be able to Google the answer and find something really straightforward online. I was really trying to tailor my questions, not so much like rote memorization questions, but really to understand a particular process. The easiest way to do that I thought, and not fight the internet was

to really kind of come up with these more deep-probing sorts of questions or you know, you learned about it in this situation and then if we change the situation, how might things change or what might be affected."

Supplementary Materials 8. Interviewee explanations for changes in Course and Self Reflection practices**Students provide feedback on course structure- decrease**

Reasons provided	Example quotes from interviews
Did not solicit feedback directly but was open to it	Interviewee 12: "The way I had it set up, I just wasn't sending out emails requesting feedback, but I was getting many of the students contacting me directly with their own feedback."

Students provide feedback on course structure- same

Reasons provided	Example quotes from interviews
Part of personal teaching philosophy	Interviewee 13: "I am a big proponent of course adjustment based on what's working and what's not working ... I feel like it's sort of my duty as an instructor to be able to sort of read the pulse of the classroom, actually listen to feedback and be humble enough to say okay this is working, this is not working, let me find a way for this to work for you and I thought that that was especially important given that none of them signed up for this kind of online transition"

Students provide feedback on course structure- increase

Reasons provided	Example quotes from interviews
	Interviewee 8: "I was just trying new things and I wanted to make sure that the efforts that I was putting in to create new content was being used by the students and they preferred to have that, if they found them useful or not."
- Inexperience: new to online teaching	Interviewee 14: "I've refined things enough over the years that I guess I was pretty confident that was the way I wanted to run the course and that it was working pretty well. Of course, after the transition then it was all brand new. ...I just felt like I needed a lot more feedback for my own learning on teaching in this format."
- Wanted to find out what was working for students	Interviewee 5: "Our students are really good at catching you in the hallway, catching you in the cafeteria, things like that. Well now when we are going online where everyone's scattered felt like it was now that burden of "Are you understanding this?" shifts more back to me as opposed to students being responsible for their own learning. We really were very much concerned and we were continually reminded of trying to reach out to the students and not letting them hide behind the distance."
- Keep students connected to course	
- Personal value/teaching philosophy	Interviewee 14: "If you're going to ask them for feedback on the course... you have to be willing to change something... Learning is a cooperative process and if they're not involved in how they're learning... I don't know. Why would you ever ask for feedback if you're not going to use it?"

Students reflect on study habit and problem-solving strategies- decrease

Reasons provided	Example quotes from interviews
Not compatible with asynchronous design: -course videos were recorded ahead of time -instructor only sees product, not progress towards product -instructor does these practices informally during class discussions -casualty of dropping semester-long project	Interviewee 2: "When we're meeting in person, I'm wandering around the room and I'm listening into conversations. I'm kind of reading over their shoulders as they're writing out answers and I'll jump in a lot and I'll ask them, "Okay, tell me what you're thinking right here. Why do you think this is the case? What led you to this conclusion?". In that sense, I was giving them an opportunity to stop and think about what they're doing and why they're doing it. And I would probably particularly do that when I saw people kind of going off on the wrong track. But once we started meeting online, there wasn't an opportunity for me to see the students work through the process. All I ever saw was the product, so I wasn't able to jump in while they were formulating their responses and to get them to think about how they're going about doing it."
Artifact of course timing: -occurs often at semester start, less frequently as students adjust to course -expectations and guidelines already established by this point in semester or year	Interviewee 13: "With introductory biology students, a lot of them are still just learning how to college in general and so they might be coming from a background where just regurgitating the textbook will get them an A in the sciences. So, I take time throughout my course to highlight different kinds of study habits, whether it's small group work, teaching the materials to other students, building concept maps, effective note taking... I didn't have a chance to really do that in the way that I normally do in person." Interviewee 11: "This is a two-semester course, so the majority of them were in there for A and P 1 and A and P 2. The last four weeks or so of the semester, which was online, they're really at the tail end, in a pair of courses that sort of follows the same sort of pattern that we go through repeatedly."

Students reflect on study habit and problem-solving strategies- same

Reasons provided	Example quotes from interviews
Practice implemented at low frequency	Interviewee 5: "Whether it was online or face to face, there's not a lot of strategy towards solving a problem because it's more learning primary basic information."

Students reflect on study habit and problem-solving strategies- increase

Reasons provided	Example quotes from interviews
Keep students connected to course	Interviewee 1: "So after transitioning to remote, partly we just missed the students, partly we wanted to maintain connection and let them know we were still on the other end of the email. We would send regular emails to them at least once a week, usually twice a week, just reminding them that this transition to remote is going to require different study strategies and ask them to think about who are you connecting with? How are you studying at home? Are you setting aside time? Are you thinking about if you really understand the concept because if you're not talking with me in the classroom, you need to be self-aware of those things you don't understand and come back to me with those questions electronically. So, we tried to just keep reminding the students of that via email so that they didn't feel like they were adrift at sea and also just to keep our course content on their radar."

Supplementary Materials 9: Semi-Structured Interview Guide Script

Adapting to a crisis: Documenting change in scientific teaching approaches in response to abrupt adoption of online and remote teaching among faculty in primarily-undergraduate institutions

SEMI-STRUCTURED INTERVIEW GUIDE PRIMARY UNDERGRADUATE INSTITUTION FACULTY

Location: Remote

Time & Date:

Participant:

Overall Notes on Interviewee:

[note: outlines and headings in blue are included as landmarks, not to read during the interview]

WELCOME/ PROCESS & PURPOSE

Moderator reads: Hello [Participant's Name]. Thank you for taking time to provide your insights to our research today. My name is [Interviewer Name] from the [Interviewing Group]. I will be conducting the interview with you today that will build upon the survey you already completed and explore a bit more about your experience abruptly transitioning your course to the remote modality as a result of Covid-19.

We appreciate your interest and willingness to complete this interview. During the interview, please focus on your [course name] course and the experience of transitioning it from a face-to-face learning format to an online or remote learning format.

My role here is to ask questions and listen. We welcome all opinions and will keep them confidential, so please feel free to say what you think. This session will be recorded so that we are better able to review your comments later. For the sake of clarity, please be sure to speak loudly and clearly so that our recorders can pick up your comments. We will be on a first-name basis during our interview, but in our later reports there will not be any real names or identifying institutional information attached to comments. We will use pseudonyms in later reports. You may be assured of confidentiality.

If at any time you wish not to answer a question, remove yourself from the interview, or drop out of the study, you may do so. To compensate you for your time today you will receive a [monetary value].

Our session will last about an hour. Do you have any questions before we begin?

Introduction (2 minutes)

- Briefly, tell us a little about yourself and your typical teaching style.

Objective 1: Determine changes in teaching practices as a result of abrupt modality transition as represented by MIST subcategories (15 minutes) [not in script]

For this first set of questions in the interview, I will ask about some of your specific survey responses. I will provide your responses for you, but you may want to have your survey results document handy as a reference, and I will refer to question numbers on the table to help get you oriented.

Active Learning Strategies:

- In question #1 on your survey you answered that the approximate percent of class time students were asked to answer questions, solve problems, or complete activities other than listening to a lecture [increased from X to X, decreased from X to X, stayed the same at X] after the course modality transitioned to online learning. Please describe what you did differently and why you chose that approach.
- In question #13, you answered that the average percent of class time during which students were asked to work in groups [increased, decreased, stayed the same from X to X] after the course modality was transitioned online. Please describe why you chose that approach.
 - If the interviewee mentions barriers/challenges to facilitating group work, ask what kinds of barriers or challenges were you aware of among your students that led to your decisions to change the amount of group work used in your course?

Learning Goal Use and Feedback:

- You noted in Question 2 that learning goals were provided for [insert analysis from survey Q2 related to how learning goals were used and distributed to students]. Please describe why you chose that approach and how you were able to keep the same strategy for both modalities.
 - How did the content of your learning goals change as a result of the modality transition?
 - How did you decide which learning goals to drop, keep, or add? [Alternate questions if no changes: how did you make the decision to retain all of your learning goals? Was it easy or difficult to facilitate your unchanged learning goals?]
- You answered a couple of questions in the survey about the amount of feedback beyond correct or incorrect answers you provided for students on different activities. Specifically, in question #8, you indicated that in the face-to-face format you provided students with feedback on [get from survey results table] percent of in-class activities, but that [increased/decreased/stayed the same] to [get from survey results table] percent in the remote modality. You also indicated in question 11 that your amount of feedback on summative assessment questions or components [increased/decreased/stayed the same] from [get from survey results table] percent in person to [get from survey results table] percent in the remote format. Please describe why you chose that approach.

Inclusivity (13 of 15 candidates):

- In Question #20, you indicated that in the face-to-face format you [insert survey response] that the examples or analogies used in your course included a diversity of people and cultures, and your

agreement with that statement [increased/decreased/stayed the same] to [insert survey response] when the course transitioned to the remote format. Please describe why you chose that approach.

Responsiveness to Students (14 of 15 candidates):

- In Question #26, you indicated that in the face-to-face format, you were [get frequency data from survey response] aware of instances when students were not understanding a concept, but in the remote modality that [increased/decreased/stayed the same] to [get frequency data from survey response]. Please describe how you knew students were not understanding and [why you chose that approach/why you were able to maintain this awareness in both modalities.]
- You also indicated in question #27 that when it became clear that students did not understand a concept, you [get frequency data from survey response] provided follow-up discussion, activities, or resources during the face-to-face format but that [increased/decreased/stayed the same] to [get frequency data from survey response] in the remote format. Please describe [how you were able to maintain this practice across modalities and] why you chose that approach.

Experimental Design and Communication (14 of 15 candidates):

- In Questions [28 and 30], you indicated that the frequency at which students were asked to formulate or identify hypotheses and to design experiments [increased/decreased/stayed the same], when you transitioned the course from the face-to-face format to the remote format. Please describe why you chose that approach.
- [6 interviewees (2 increased, 4 decreased)] In Question #36, you indicated that the frequency at which students were asked to interpret or critique scientific literature or media articles related to science [increased/decreased/stayed the same] from [get from survey] in the face-to-face format to [get from survey] in the remote format. Please describe why you chose that approach.

Data Analysis and Interpretation (15 of 15 candidates):

- In Question #32 and #33 you indicated that the frequency at which students were asked to make graphs or tables and to interpret data in graphs or tables [increased/decreased/stayed the same], when you transitioned the course from the face-to-face format to the remote format. Please describe why you chose that approach.

Cognitive Skills (15 of 15 candidates):

- On question #42, you indicated that the frequency of activities that required students to use higher-level thought processes during the face-to-face format [increased/decreased/stayed the

[same] when the course was transitioned to the remote format. Please describe why you chose that approach.

- On question 43, you indicated that students were asked to participate in open-ended exercises such as case studies or questions with multiple possible correct answers [get from survey results table] during the face-to-face format and that [increased/decreased/stayed the same] to [get from survey results table] in the remote format. Please describe why you chose that approach.

Course and Self-Reflection (12 of 15 candidates):

- On question #23, you indicated that students were asked to provide feedback on course activities or content [get survey results] times during the face-to-face modality, but that frequency [increased/decreased/stayed the same] to [get survey results] times during the remote modality. Please describe why you asked students for this type of feedback [more/fewer/the same number of] times in the face-to-face modality compared to the remote modality.
 - You also indicated that you [did not make adjustments to the course after receiving feedback/made adjustments to the course some of the time feedback was collected/made adjustments to the course every time that feedback was collected] in the face-to-face format, and that [increased to/decreased to/stayed at] [not making adjustments/making adjustments some of the time/making adjustments every time] after collecting feedback during the remote modality. Please describe why you chose that approach.
- On questions 44 and 45, you indicated that the number of times students were asked to reflect on their study habits or problem-solving strategies [increased/decreased/stayed the same] from the face-to-face modality compared to the remote modality. Please describe why you chose that approach.

CONCLUDING DISCUSSION (5 minutes)

As we've talked today about your experience with your course and COVID-19 disruption:

- Have you thought of anything else you'd like to say that we have not discussed?

I am now going to try to summarize the main points from today's discussion (key messages and big ideas that developed from the discussion). The main topics were

- Is this an adequate summary?

As was explained at the beginning of the session, the purpose of this interview was to further explore your experience abruptly transitioning your course to online learning. Your comments today will be useful in documenting historic disruption in higher education and will serve to develop more effective support structures to improve teaching and learning given unforeseen and similar events in the future.

- Have we missed anything or are there any other comments at this time?

Thank you for taking time out of your day to share your opinions. Your participation is greatly appreciated and has provided valuable insight into this topic.