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EDUCAUSE Live! - XR for Teaching and Learning
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Welcome to EDUCAUSE live, everybody. This is Christopher Brooks, Director of Research at EDUCAUSE, and I'll be your moderator for today's ELive webinar. We'd like to thank Quest for their sponsorship of the 2019 EDUCAUSE Live! Webinars. Quest is the go-to solution that helps universities and schools better move, manage, and secure their Microsoft infrastructure. We hope you'll join us in making this session interactive. If you're tweeting, please use #EDULIVE. Use the chat window on the left side of the screen to submit questions and to share resources and comments. We will pause throughout the presentation for Q&A, so we encourage you to type your questions into the chat throughout the webinar. If you have any audio issues, click on the link in the lower left-hand corner of the screen. And, at any time you can direct a private message to Technical Help by clicking in the top-right corner of the Chat window. A drop-down menu will appear where you can select Start Chat with and Hosts. The session recording and slides will be archived later today on the EDUCAUSE Live! website. Our webinar today is XR for Teaching and Learning. EDUCAUSE recently published the eXtended Reality (XR) for Teaching and Learning, year two, which focuses on the research question, what factors influence the effectiveness of XR technologies for achieving various learning goals? In this session, we will explore the main findings of this study, that be enabling the creation of realistic and high-fidelity simulations, XR expands the range of topics that can be learned as skills. And that even where its pedagogical benefits are clear, XR must still fit into existing instructional practices. These findings will also be illustrated with examples of XR use cases for teaching and learning in fields as diverse as physics, nursing, and dance. We are delighted to be joined by Dr. Jeffrey Pomerantz, Associate Professor of Practice and the Coordinator of Online Education for the School of Library and Information Science at Simmons University in Boston. Previously, Jeffrey was a senior researcher for the EDUCAUSE Center for Analysis and Research, or ECAR, where he served as principal investigator on a number of projects, including the annual undergraduate student and information study, and the IT workforce and higher education study. He is the author of the book Metadata, part of the MIT Press Essential Knowledge series, and an Associate Editor of the Open Access Directory, a project of the Berkman Center's Harvard Open Access Project. Pomerantz earned his Ph.D. from the School of Information Studies at Syracuse University, and his MS (LIS) from Simmons College. Thanks to Jeffrey Pomerantz for joining us here today, and with that, let's begin. Take it away, Jeffrey.

JEFFREY POMERANTZ: Thank you, Christopher, and thank you all of you for joining us today. And, as Christopher said, this will be an overview of the report "XR for Teaching and Learning" that was just recently published by EDUCAUSE, and a bit of a sneak peek at the next report that is also on XR and the HP campus of the future project, but I will save that little teaser for the tail end of this presentation. So, first, hang on, I'm trying to forward the slides, and having a, of course, technical difficulty. I'm not able to put the slide forward.
CHRISTOPHER BROOKS: Would you like me to do that for you?

JEFFREY POMERANTZ: Nope, got it. Just overshot. Sorry about that, folks. Always a technical problem right at the beginning of these things. First, we have a poll question for all of you. This is similar to a question that we will be presenting some data on a little later on in this ELive! The question is, what is your sense of the importance of XR to the future of higher ed? And I know a couple of you out there are in the K-12 arena, and please answer for your particular context. Like I said, this is data that we’re going to present later on. And let me, while you are working on that, let me move to the next slide, which I would ask you to type your answers briefly into the chat. Do you have some XR, virtual reality, augmented reality, mixed reality, projects going on at your institutions? And if you do, please tell us a little bit about them. I think that would add a nice depth to the research findings that I’ll be presenting on sort of at a high level, and will be very interesting to hear about the actual project that you all have going on. So while you think about all of that, let me say a few words, while you, you know, tune me out for the next two minutes, while you’re answering all of these questions. First, and very importantly, I would like to thank HP and EDUCAUSE. EDUCAUSE, of course, because they have been publishing these reports on XR use in higher ed, and HP, because they are sponsoring the "campus of the future" project. This is an initiative of HP to get XR technologies of all stripes out into educational institutions, and HP has been very generous with their time and resources and have brought EDUCAUSE in to do the research on how this technology is being used and what it is being used for. So, this entire project comes out of this very fruitful collaboration between HP and EDUCAUSE. So, thank you both. Personally, this has been a very fun project for me to work on. Now, as Christopher said a moment ago, EDUCAUSE just recently, about a month ago, published the "XR for Teaching and Learning" report. That is the second report out of this project, and I will talk about that a little bit further into our time here. That will look at how campuses and institutions develop XR learning. So going out of the
classroom into the institution as a whole. And I will, like I say, talk about that in a little bit. So, there were 17 institutions that participated in this project, the second phase of Campus of the Future. Some of them are holdovers from the first year. Dartmouth, Yale, all of these logos of institutions you are probably familiar with. The one in Hebrew is Yale. The first phase of the Campus of the Future project was very much early adopters, institutions that already had some VR/AR uses going on, on campus, which, of course, is how they came to the attention of HP and EDUCAUSE in the first place as sites to study. So, I will say right off the bat, that institutions are not necessarily a good representative sample of institutions of higher ed in the United States as a whole. These are early adopters. Kind of inevitably.

Now, for this second phase of the study, we have a bunch of new institutions, a much more diverse group, which was very cool. Again, some of these institutions are pretty often, because their name’s right on it, but what’s interesting is the first phase was a little research university heavy, and in the second phase we have a much wider and more diverse set of institutions. Morgan State University is an HBCU. Barnard is one of the Seven Sisters institutions. We have two community colleges, Foothill, and the one that looks like a torch in the bottom right, that’s Wake Tech, for those of you in the Raleigh area, I noticed in the chat. Right? So we have a wider set of types of institutions. Oh, I forgot to mention, North Carolina School of Science and Math is high school. So it was really great to have this wider variety of types of institutions, because, let’s face it, diversity matters here. The number of types of use cases that came out of these different institutions was much wider because we had such a wide set of types of institutions. So this study was a multiple-case study. We looked at institutions and their particular use cases in the classroom, talked to instructors, talked to CIOs, to try to collect as much information as we could about how XR was being used in courses that were actually being taught while the research was going on. So this is one of these interesting studies where the thing that we were studying was literally changing as we were looking at it. Which is always fun for a social scientist. Okay, what do we mean by "XR"? Very briefly, I assume that all of you know the answer to this, or you probably wouldn't be here. That said, there’s some really interesting research going back to the mid-‘90s about what’s called the virtuality continuum, which proposes this sort of spectrum from, at one extreme the physical world, and at the other extreme, basically, the Matrix, right, completely simulated. And everything that we think of as XR is somewhere in that spectrum in between. Virtual reality is closer to the entirely simulated end of the spectrum. Augmented reality, mixed reality, are somewhere in the middle, where you get with augmented reality overlays over the real world, and you can still see the real world. Mixed reality is similar, except that the overlays could potentially be interactive. Like I said, I'm here in Boston, and in Boston, we have the Rose Kennedy Greenway, which is the site of where a raised highway used to be and was taken down and turned into a park, and it’s really lovely. And we have an AR exhibit literally on the greenway, where if you've got the right app on your phone, you can hold it up and look at old pictures taken from the Boston Public Library archives of what buildings used to be at that site 100 years ago. And I'm sure you've seen exhibits in museums and other city tours like this probably. Augmented reality is getting to the point now, where it’s supported on a smartphone, as is VR with, you know, Google cardboard goggles or what not. So this is something that will come up later, that cost of these technologies is dropping considerably as more and more of this functionality goes to smartphones. But I'm getting slightly ahead of myself. Before we move into the actual findings of the "XR for Teaching and Learning" report, questions so far?
>> CHRISTOPHER BROOKS: Jeffrey, I haven't seen a lot of questions come through, but a lot of people have been sharing their individual projects with us.

>> JEFFREY POMERantz: Fantastic, thank you.

>> CHRISTOPHER BROOKS: But I think mostly -- we have one now from Justin, who is asking, did the XR project survey use immersive audio in any way? Immersive audio, excuse me.

>> JEFFREY POMERantz: Yeah, that's an interesting question. So in the "XR for Teaching and Learning," the second-phase study, the answer is no, but that's because we were looking at just the uses that were happening in the institutions we were looking at. In the first-phase study, we worked with Gallaudet University, which, as you may know, is a school for the deaf. And so what -- they had a whole set of use cases around how to -- how to create VR content for accessibility, right, they were working with immersive soundscapes and creating simulations for people who could see, but were deaf, so we had an interesting set of use cases from Gallaudet that were accessibility-related, but Gallaudet was actually not a part of the second wave, so we don't have a lot more information about immersive audio. My understanding is that there are some projects going on with immersive audio at Yale and Syracuse University, that I'll be doing some digging into. Some soundscape data for language learning, for example. Plop somebody into the center of a language community so that they can hear what it sounds like for everyone around them to be speaking in their target language. But we don't have a lot on immersive audio yet, although I think that's a very interesting use or direction for a lot of this. The visual side of VR, to be fair, is better developed than the audio side. An aspect of the tool that needs some development, in my opinion.

>> CHRISTOPHER BROOKS: I'm not seeing any other questions, Jeffrey, so if you want to go ahead with the next section.

>> JEFFREY POMERantz: Will do. Okay. So, like I said, the research question for the "XR for Teaching and Learning" project was what factors influence the effectiveness for XR for achieving learning goals? Right, the idea being that there are -- what we found in the first year's study was that XR is useful across a wide range of fields, for a variety of uses, and we wanted to drill down into specific fields to find out what XR was useful for and why. And what we found was that there were five major factors that affect the effectiveness for "XR for Teaching and Learning." And the first one is this. Fidelity of realism, which is really two things, but they are very closely related, so we lumped them together into one category. This is a photo from an XR app -- excuse me, a photo of an XR app for nursing. And this poor mannequin, if you notice, has a knife in its chest, right? It's a nursing simulation, and one of the interesting things about the field of nursing is that it has a long history of using simulations, but those simulations are mannequins or human actors, patient actors. Now, a mannequin is relatively authentic in the sense that you can do all of the things that you can do to a human to a mannequin, right, do the compressions if you're doing CPR and whatnot, right? But it's not particularly realistic. It doesn't look like a real person. There is a need in person for high-fidelity realistic simulations. One of the folks I spoke to at Morgan State University actually said something that I thought was quite insightful, which was that you simply
cannot do the kind of fine motor skills that are required of a nurse, you can't practice those in a simulation, in a VR simulation, because the handheld controllers in VR don't allow it. You cannot practice intubating somebody, or giving them an injection with a handheld VR controller, when all you have is a single finger or two-finger clicker, right? So it is not a high-fidelity simulation yet. So they are working on developing better tools to allow nurses to practice nursing skills in VR. Realism is an interesting question, as well, right? Because in order for a simulation to be a useful learning environment, the more authentic it is, the more useful it is as a teaching environment. You don't want to practice giving a real person an ingestion hundreds of times, but in a simulation, that's perfectly fine. You can practice anything you want as many times as you need. Another example of a field that wasn't part of this particular study was pilot training. Right? You can practice any dangerous maneuver in an airplane that you want, in a flight simulator, as many times as you want. The more realistic it is, the better. You don't want to be practicing that in the real world. The more realistic simulation is the more valuable it is as a learning environment. Now, great. Nursing and flight simulation, the real world is pretty well defined, but that's not necessarily always going to be the case. Right, and what we have here is a still from a project called a lift or static playground, which was developed for the MIT physics department to allow students to manipulate charged particles to teach electromagnetism. So what does authentic mean in an environment like that, when this is, literally, outside the realm of any human experience? So there's some interesting discussions going on about what authenticity means for a simulation, when a simulation is not something that humans can ordinarily experience, like manipulating protons and electrons, right? And what has to happen is, it has to feel realistic, right? I've used this simulation myself, and the protons and electrons feel like they are kind of bouncing off of each other with the handheld controllers. So it feels like you're manipulating bouncy balls, but at the same time, it has to stick to best -- the best known science in the field. So the question of authenticity is an interesting one in this case. But this is also an example of our second factor, right, what makes XR effective for teaching and learning is the novelty of it. You have to -- the XR tool has to provide the ability to learn something that you simply can't do in any other way, right? To be fair, electromagnetism, you could learn that through videos. There are lots of, you know, textbooks out there on the subject. You may remember from high school or college physics, the right-hand rule and what not about charged particles. Lots of ways of teaching this particular topic, but to be able to manipulate charged particles is something that you simply can't get somewhere else. So the novelty value is a really important piece of the effectiveness. It is providing a new way to learn. Which brings me to -- XR tools increase time on task, right? And probably all of us here know perfectly well that time on task for students, generally, means improved learning performance, right, the more time students spend with content, engaging with material, generally, that means the better they are going to learn that material. So this is a still of a project called Cell Verse, which is also out of MIT, but a different group, the Teacher Education Program. This is a two-player VR game, where the fella who's standing is inside a simulation of the cell, literally, moving around inside of the cell like that old -- like that old movie -- now I'm blanking on the name of the movie, where a submarine shrinks down and goes around through somebody's body. Fantastic Voyage, something like that. "Interspace," yes, thank you all of you, "The Magic School Bus," that's exactly right. The one who's sitting, she is the navigator, she is basically mission control, looking for information about cellular biology, and the two of them have to communicate in order to fix a genetic defect in this simulated cell. The folks who created Cell Verse refer to it, basically, as an educational version of the party game, if you've ever played this game, keep talking
and nobody explodes, right? You have to communicate in order to diffuse a bomb in Cell Verse to fix the cell, right, and the idea is communication is a must. The two players have to talk to each other, they have to collaboratively problem solve, or they cannot fix the problem with the cell. That framing, learning about cellular biology as a two-player game, increases the amount of time that these students spend engaging with the material. Of course, this also has a novelty value to it, right? This is a way of interacting with cellular biology material that isn't available in any other way. But framing this as a two-player game increases the amount of time and the depth of engagement that students have with molecular biology materials. And so you have students who are unable to solve the problem of fixing the cell on their first iteration of the game and go back to it, so that they can work on it later, right? It is quite a different mode of doing your homework, but apparently quite effective, and the MIT team has been doing interesting research using this tool in various high schools around the local area. Now, another factor that makes XR effective, ease of use. And this is probably true for all technologies, to be sure, but the technology has to be easy enough to use, or instructors won't use it. And I say this as a faculty member myself, right, we all know how faculty are. They are very busy. Some are hesitant to learn new tools, right, so the tools of XR have to be easy enough to use to kind of get over that initial hump of is this worth the instructor's time to devote to learning to use it? Plus, on the student side, we know from previous EDUCAUSE studies of students that students really want technology in the classroom, but they also want it to be clear how that technology is tied to the learning objectives. And if students are spending too much time learning to use the technology, they are not engaged with figuring out how it connects to the lesson at hand, it seems like technology for technology's sake, which is never a winning strategy. This particular photo is from a project out of Harvard University, where the team has built a simple electromagnet and Dixie cup speaker, which is a fairly standard electronics project to that, you know, I understand -- physics is not my field, fairly common one for physics students to work on. But the VR overlay, you can see the electromagnetic fields around the electromagnet, and as you change the distance of the cup from the electromagnet, you see the electromagnetic fields change. So it's a very easy-to-use interface, because you're eliminating physical objects, and what ends up happening, you see the overlay, the AR overlay change. So very simple to use, but very effective for enabling students to see something they would otherwise not be able to see. And, finally, a spirit of experimentation. The everyone involved in XR really kind of needs to go into it with this idea that we're still pushing the boundaries of both the technology of XR and what it's capable of doing in the classroom, right, we're still learning about the tools, even as they are evolving fairly rapidly. Right, this particular photo is from Yale University, and a faculty member there, Justin Barry, had a project that he gave to his students to design a new model of handheld controller, and so the students' assignment was to basically design a prototype of something completely new. Now, I mean, those of you who have taught in the classroom know it can be very difficult to assess an assignment, where the assignment literally is go do something completely new and innovate. How do you assess something like that? So there's a certain amount of buy-in to the experimental nature of using XR in the classroom in the first place that you have to be okay with to do this, but at the same time, this is how we're going to figure out what the use cases are, right? As technology evolves, we're pushing the boundaries of what's possible with the technology, and, at the same time, pushing the boundaries of how we teach in our particular fields. So that is our five factors. What makes a particular XR technology or tool an effective teaching tool, right, we have five factors, realism and novelty are kind of characteristics of XR that contribute to making it an effective teaching
tool. Right? The fact it increases time on task is an effect of using it as a teaching tool. And then we have the two prerequisites for using XR effectively, it has to be easy to use, and you need to go into it with a spirit of experimentation as the instructor and as the student, as well, frankly. So, let me pause there and ask if you have questions about that. And I haven’t been keeping close track of the chat. Hard for me to read and talk at the same time, but I see that it’s been very active, so thank you all for the active conversation.

>> CHRISTOPHER BROOKS: It is very active, and by no means should you be expected to keep track of it while you’re presenting. That's on me. I don’t know that we've had any other questions emerge through there, despite the active conversation, but one topic that has appeared in a couple of places throughout is related to really sort of high-quality haptic feedback gloves for VR, and I was wondering if you might have run across anybody using such a device in some of their work, or maybe discussing the development of such things as a way of perhaps increasing the realism and that sort of authentic experience that you highlighted.

>> JEFFREY POMERANTZ: So there's sort of two pieces to an answer to that question. So the first, in no particular order, the first is that there's a distinction to be made here between consumer-grade VR and AR tools and hardware and commercial grade, right? Consumer-grade stuff is what you can go to Best Buy or whatever and come home with a headset, right, your PS2 or your HTC Vive, or the Oculus, consumer grade designed for home use, basically. And then there is a whole other arena of XR hardware development for commercial uses in the sense of like warehouses and, you know, use by firefighters for training, and, of course, military is a huge arena for this, right? And those are two very different tracks of hardware development. Haptics is being developed much more on the commercial side of things and much less on the consumer side, right? There really aren’t any that I know of affordable haptic gloves for consumers. Any haptic glove that I’m aware of are quite expensive and used for pairing with commercial-grade headsets. So most of the technology that we’re seeing used in higher ed is consumer-grade stuff. And mostly that's because it's less expensive. The other side of the equation, too, is what you’re seeing on the commercial side is, instead of haptics, you see something like Magic Leap, where what you've got is a device that can do hand tracking in the air. So instead of getting forced feedback on your skin, you have the ability to manipulate your hands in the air realistically, but you don’t get the feeling of manipulating things. But you can do all of the fine motor skills, or at least that's the goal. But I would say watch the space, right, for the development of Magic Leap and Magic Leap-style technologies, because that seems to be where the commercial -- sorry, the consumer-grade side of the hardware is going. So all of that was a long answer to say there isn't really anything, sorry.

>> CHRISTOPHER BROOKS: I want to be mindful of the time. We had a couple of other questions come through. I'm going to offer one up now that I think you might be able to answer pretty quickly and save the others for time at the end. Are some of the projects from MIT and Harvard available to other institutions or commercially yet?

>> JEFFREY POMERANTZ: The Cell Verse project is. The others are not yet. They are still under development. But the Cell Verse project, the one that's a collaborative game that you're walking around
a cell, that has been deployed in some high school classrooms around Massachusetts, and they are starting to roll that out as a research project a little more widely. Now, this is a question I get all the time, is there a repository of VR or AR simulations? And there isn’t one. Right, there are lots of educational apps in the, you know, steam repository and the Oculus repository and whatnot, but there is no central repository for VR simulations for educational use the way there is for, like, open educational resources, like the Merlot Repository or something. There should be. If anyone wants to build one, you know, the community will owe you big.

>> CHRISTOPHER BROOKS: All right, Jeffrey. Let’s keep an eye on the time and maybe go on into the next section here.

>> JEFFREY POMERANTZ: Okay. So all right, before XR can get adopted by an instructor, before XR can be used in a classroom, you have to adopt it first, yes? So one of the things we were looking at, too, is what factors weigh into adopting XR for instruction in the first place, and there are two, and I’m sure you recognize this curve in the background. This is from the Defusions of Innovation framework, and a lot of the findings in our study feel like they walked straight out of Everett Rogers’ work on Diffusion of Innovation. First, in order for XR or any new technology to get adopted, it has to fit into what your existing teaching practices are in the first place, and partly that’s because a lot of fields have existing curricula, accreditation standards, et cetera, that any new thing has to fit in with, and then over time, existing curricula change, but at the outset, XR has to kind of slot into, well, this is something that we can use XR for in our existing course load, et cetera. And the other piece is the hardware and software can’t cost more, significantly more, than the existing alternatives. And for some of these things, like, you know, electromagnetism, or cellular biology, there are good videos, good animations, good textbooks on these topics, so the cost isn’t necessarily just monetary cost, but also the time of the instructor and the students to learn how to use this stuff, the -- you probably remember maybe two years back there was this entertaining article in "inside Higher Ed," they were not comfortable using it in front of a room full of students, right, that’s a cost. So in order for something to be adopted, has to fit into what instructors are already doing and expectations of their field, and have a reasonable cost of adoption. Partly, that’s an ease of use issue. At this point, I’m going to hand it over to Christopher to talk about some research EDUCAUSE has been doing simultaneous with this XR research, because my argument would be that while XR and new technologies have to fit into existing practices, this change is coming down the pike, more or less, whether we like it or not. So let me hand this over to Christopher to talk through the next couple of slides.

>> CHRISTOPHER BROOKS: Okay, thank you, Jeffrey. So, everyone, this slide depicts a graphic from the 2018 EDUCAUSE study of undergraduate students and information technology. And it reflects accommodation of a couple of questions from our survey. The first of those was, that we posed, was whether or not students had access to different technologies, and all those are listed here. And these are the black dots that you see on the horizontal axis. And just to give you a frame of reference, the ones on the right-hand side of the figure are the workhorse technologies of laptops and smartphones, to which nearly all students have access. But if you look to the left-hand side of the figure, this is where 3D printers and AR/VR headsets reside. The way you can interpret the black dots is only 3% of students had
access to 3D printers and 4% to AR/VR headsets. In 2019, those numbers are pretty much the same. The second question we posed, and this is where we get into the balloons that are attached to those black dots. The second question is, how is it that students have access to those technologies? Do they own them themselves outright? Do they borrow them from friends or family, or does their institution provide them for them? Well, for 3D printers, for example, a plurality of students reported their access is via their institutions. And that's reflected in sort of that lavender or purple balloon that you see beneath the 3D printer label. For AR/VR headsets, a majority of students, however, reported they actually own their AR/VR headsets outright, and that's kind of the greenish-yellow bubble that you see there. We should offer a little bit of a caveat here, because enlisting AR/VR headsets as a way of explaining them, we did list more low-tech and less expensive versions of these technologies, such as Google Cardboard, and those might have inflated the ownership numbers a little bit within that. And just to kind of update this 2018 figure with the 2019 data, it pretty much looks exactly the same. This particular slide, excuse me, depicts student device use, as well as the ratings of its importance to their academic success. So in the same survey, we asked students the extent to which they use the various devices to which they have access in their courses. These are only students reporting out who actually have access to them, and that is on the X axis there, and how important those devices are to their academic success is depicted on the Y axis. We only have two years of data for the AR/VR headsets, but as you can see with the big red arrow there, that's pointing you to where the combination of the coordinates place it. For 2018, only 7% of students said that they used AR/VR headsets for at least one course. But 24% told us that they were very to extremely important for their academic success. So we don't quite have a 1:1 ratio of usage to importance quite yet. For 2019, also have similar numbers. It's the same percentage of students reporting that they use them for at least one course, and a slight decrease, down to 21%, who said they were very to extremely useful, but I don't think we can say anything about that 3% loss, because it doesn't really reflect a trend. It's only two data points so far. Last slide that I'm going to speak about, and then we'll hand it, I think, back to questions, is this one, which comes from a short survey that we put out last December to higher education IT employees, whose focus is on teaching and learning. And we were asking about extended reality technologies, as well as digital transformation. One of the two questions that's related to what you are observing here is how innovative did the respondents think that their institution is, and a majority, 65% of respondents, told us that they actually considered their institution to be pretty innovative, and this was true across all Carnegie classifications. So that's pretty impressive. Majority of folks saying, yes, my institution is, in fact, pretty innovative. Then we also asked respondents to tell us how important each of the XR technologies listed here are to the future of higher education. The numbers that are actually reported in this table are, basically, a cross tab of those who told us that their institutions are innovative with the number of folks who told us that these technologies were very to extremely important for the future of higher education. And the correlation of those cross tabs comes out with the respective significances that you see attached to them there. Clearly, what we have is AR, which might be more versatile than a fully immersive program virtual reality environment, augmented reality is on the top, virtual reality is closely behind in second place, and roughly two-thirds telling us 3D printing and scanning are also important. Smart glasses fall to the lower end of things, but I have heard from several folks across the Atlantic that they actually believe smart glasses may very well be on the ascent in terms of making a comeback. So while the push for XR adoption and use may come from students, I think we also have some evidence that instructors,
academic technologists, and perhaps even campus leadership might very well be thinking about how to bring XR to campus. And so with that, we'll move to another round of questions here, which I think -- I need to look at the pending questions.

>> JEFFREY POMERANTZ: Fair. So at Jamie's suggestion, I'm going to blow past the questions, in the interest of time, save questions for the end.

>> CHRISTOPHER BROOKS: Sure.

>> JEFFREY POMERANTZ: That's only a few minutes down the road. So I wanted to give you now a sneak peek of the next report that is currently in progress in year two of this project. So the report that just came out a month ago or so is about XR use in the classroom, what is it good for, for meeting learning objectives. This next one is about the institution itself. How is XR being integrated into the institution and being deployed across campuses. I have no idea if this is going to be the cover image for that particular report. I just had to pick a nice image. The research question is this, right, another "what factors" question. What factors influence institutional adoption and deployment? And what we're seeing at this point, very briefly, is that there are three, and these are pretty standard stuff in higher ed, I think. The -- for all of you who have worked in higher ed for any length of time, the special technology initiative should be familiar. You've probably seen it many times, right? It is very much kind of a top-down initiative driven by campus leadership, the CIO, the dean, what have you, with some resources attached to it. The reports out of Yale's project, they have three years' worth of reports that are well worth reading, if you click on that link. This is a set of projects that is driven by a group with ownership over the XR initiative on campus. Second model is trying to integrate XR more broadly into the current service offerings on campus, and Florida International University here has a facility called the Miami Beach Urban Studio, which I think is a super interesting example of this. It is, essentially, a gigantic makers' space. It's a building size facility that allows the entire campus community to use a variety of types of hardware. Everything from 3D printers, to, you know, band saws. So all kinds of hardware, and XR hardware and software has been integrated into the offerings of the Miami Beach Urban Studio. So instead of having a separate initiative, which is separate from all the other academic units on campus, XR is being integrated into existing service offerings. And then the third is this sort of bottom-up, grassroots approach, and, actually, the folks at Syracuse University have a really interesting model of this that they have several faculty members from different units across campus collaborating, and some are getting grants, some are doing research on XR, and over time, they've sort of built up this community of interest on campus, and a couple months back, they had this big launch, where they showed off what they've been working on to the CIO and other campus leadership to try to start getting some campus resources behind what has, up to this point, just been this informal collaboration. So we have these deployment models of a variety of types and, of course, they are not mutually exclusive. And, very briefly, infrastructure and culture are critical. Who has ownership of this? Is it the library, because that's often where makers' spaces are? Is it the IT unit? And organizational culture is critical, and this is the last thing I will say. By organizational culture, I mean, honestly, campus leadership, right? A risk-averse CIO can kill a technology initiative very effectively, but a risk-taking, whatever the opposite of risk-averse is, can really give some wind in the sails of a campus technology initiative. So getting buy-
in from institutional leadership is critical for gaining traction with use of this technology across campus. And the last thing I would say is EDUCAUSE has launched a community group for XR, and it is a pretty active group. I would encourage you to take a look at their List Serve and archives. They run events at the annual conference. And in the interests of time, I'm sorry, we're cutting it a little close, but please stick around if you have questions. We're happy to stick around for a few minutes, and thank you all very much.

>> CHRISTOPHER BROOKS: Okay, so on behalf of EDUCAUSE and Dr. Pomerantz, I want to thank all of you for joining us today for an engaging session and conversation. Before you sign off today, please click on the Session Evaluation link, which you will find in the chat window. Your comments are very important to us. The session's recording and presentation slides will be posted to the EDUCAUSE Live website. Feel free to share it with your colleagues. And, finally, please join us for the next Elive! Webinar, Diversity, Equity, and Inclusion: Moving from talk to Action on November 18th at 1:00 p.m. On behalf of EDUCAUSE, this is Christopher Brooks. Thanks for joining us today for EDUCAUSE Live!

>> JEFFREY POMERANTZ: For those still here, I will stick around for a few minutes. I have some questions that Christopher and Jamie have pulled out of the chat, which I’m happy to address. So one here that's an important one, I think, is what tools are available for creating XR content? And at this point, what I am seeing is that by and large, things are being developed in unity and steam, though there are other platforms out there that get less use, but a lot of the same development platforms that exist for game development are, at the moment, what's being used to develop educational content. It's an interesting question, whether that's the most appropriate platform for developing educational content, but it seems like that's -- that's what there is at the moment. I'm not aware of any open-source tools for developing XR applications. A lot of the software is tied to particular hardware platforms. Let's see. We have a question here, how are people getting XR hardware into their institution? That's an excellent question. Part of the difficulty of answering that question, of course, is we're working with HP, which is driving a lot of this, but outside of the institutions that have been participating in this particular project, a lot of it is very informal. New technologies tend to come to campus kind of under the radar often, you know, individual faculty members buying something for their own use or writing it into a grant. And so often that's how this stuff comes to campus in the first place. The next part of that question is how do we convince the upper administration that it's worth the price tag? And I think the Syracuse model that I was talking about a little while ago is the way to do that. You have to, at the institution, kind of build a certain amount of capacity. It's very difficult to go to your CIO and say I want $5,000 to experiment with XR technology in my classroom, right, that would not go over particularly well at any institution I've been at, right? The grassroots model of build some things, make some proof of concept, and then share that with administration, that will get a lot better reaction, because at least then your CIO or whoever can see the potential of it. But I don't have a good answer for that particular question. It's a hard sell. Let's see. Do I know of any XR software that records answers to questions within the simulation and then connects to Canvas? Short answer, no. I have not seen any XR app that connects with any LMS that's not an impossible ask. There's plenty of APIs that Canvas can full data out of a simulation from, or push data into Canvas. So that's perfectly possible, technically, but I simply haven't seen that done yet. I think we, as educators, just need to start asking simulation developers for the functionality that we
want. What is the most effective and resource-efficient way of grassroots engagement for XR? That's an excellent question. Building things, developing a technology, developing proof of concept projects.

Again, Syracuse, I suppose they are on my mind, because I spoke to some folks at Syracuse just recently. But they have -- for faculty and students for building for specific courses. In the New House School of Communication, for example, demonstrating how to use the technology in the context of the news field, right, so they are building something that is a proof of concept for how the technology can be used in a particular course, for a particular discipline. And then you can showcase that on campus to institutional leadership and what not. And once you have something to show for it, that really helps to overcome people's lack of imagination, right, it's hard to see what a new technology can be used for until you see what it can be used for, and then it kind of sparks ideas.

>> CHRISTOPHER BROOKS: Jeffrey, if I could, just as a last segue out, piggyback on your last reply there, and suggest that I think one of the things that we need the most right now with these nascent technologies being used in classrooms and labs is evidence of their impact on learning outcomes. I think we really need folks that are in this space and that are working with them to think about how their interventions with XR technologies can be measured, and that includes things like thinking about baseline measures of student learning and post testing that out and then following up. That, of course, would kind of be the gold standard, if you could pull that off in a quasi-experimental design, but evidence of impact, I really think, is one of the things that can serve as something that convinces not only faculty to embrace it, but also for administrators and others to invest in it on campus.

>> Agreed. All right. Well, for those of you who are still sticking around, thank you. And I think that brings us to the end, yes, Christopher?

>> CHRISTOPHER BROOKS: I believe so. Thanks, everybody. Really appreciate you being here today.

>> JEFFREY POMERANTZ: Thank you all very much. And there's my e-mail address. Please, anybody, get in touch. I'm on LinkedIn and every other thing, so any questions, any insights, please get in touch. Love talking about this stuff.

[End of Session]