

RESEARCH
BRIEF

A woman with dark, curly hair is wearing a VR headset and adjusting it with both hands. She is in a library or study area, with bookshelves visible in the background. The lighting is bright and natural, suggesting a window nearby.

Immersive Technologies

Moving Past the Hype

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Immersive Technologies: Moving Past the Hype

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Contact CI@chronicle.com with questions or comments.

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INTRODUCTION



Immersive technologies are having a coming-of-age moment. As the tools that put users in digitally simulated environments have matured and gained wider acceptance, they are leaving behind the wild speculation that marred the technologies' early days. The researchers and administrators who are in charge of advancing immersive realities' educational uses are sober-minded, saying they are in a slog, not a sprint. The predominant uses of immersive technologies like virtual reality, they say, will be more akin to laboratory sections of courses, or field trips, than part of everyday teaching.

Jeremy Bailenson is founding director of Stanford University's Virtual Human Interaction Lab and the author of *Experience on Demand: What Virtual Reality Is, How it Works, and What it Can Do*.

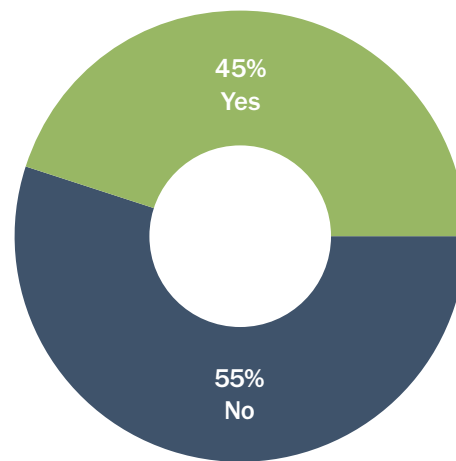
Future students, he writes in his book, will be able "not just to hear any lecture, but to go on the most expensive, rare, dangerous, or even impossible journeys."

Even those who label themselves futurists say that the timeline for widespread adoption of immersive-reality technologies in higher education is extremely hard to predict. But they point to growing evidence that immersive tools are creeping out of laboratories and into classrooms.

As the technologies have changed, the terminology has also shifted. The term "virtual reality" is used to describe situations in which users are completely immersed in a digital environment. In "augmented reality," digital simulation supplements a user's physical world. Together the two technologies and similar ones are known as extended reality, or XR.

In a survey on immersive technologies conducted in July by *The Chronicle of Higher Education* and underwritten by Verizon, 45 percent of those who responded said their college was using immersive technologies for teaching and learning. Among that group, 53 percent described their college's use as "small but growing," while 41 percent described it as "pilot phase or experimental."

Is your college using immersive technologies for teaching and learning?



Source: *Chronicle* survey of 285 college administrators

How would you describe the use of immersive technologies for teaching on your campus?*

Pilot phase/experimental

41%

Small, but growing

53%

Widespread

6%

* Only those at an institution using immersive technologies for teaching and learning were presented this question.
Source: *Chronicle* survey of 285 college administrators

INTRODUCTION

Given that the use of immersive technologies on campuses is still emerging, and that the survey respondents formed a self-selected group, it's unclear how much the study's findings represent higher ed's views and the state of the technology as a whole.

In all, 285 people at two- or four-year higher-education institutions nationally answered the survey, all working in administrative roles that give them broad institutional perspectives.

The survey revealed the bottom-up nature of who is driving the use of immersive technologies, with 48 percent of respondents describing faculty members as the primary drivers, and pedagogical innovation as the primary motivation.

On the corporate side, the companies that make the headsets used in virtual reality shipped 11.2 million of them in 2021, a 92 percent increase from the previous year, according to the International Data Corporation, a market intelligence company.

Many of the people using those headsets are at colleges.

Stanford University bought additional headsets for students in a course on the metaverse — the trendy term for a digital universe with permanent infrastructure and its own economy.

Southern New Hampshire University recently experimented both on its campus and online with using virtual reality to teach students in a biopsychology course

about how brain cells work. For the online course, the university shipped headsets to students around the country to help them

Who is primarily driving the use of immersive technologies at your college?*

Faculty members

48%

College leadership (trustees, president or provost)

12%

Teaching and learning center

12%

Immersive-technology center

5%

Students

4%

CIO and IT staff

2%

Student affairs staff

2%

Other

15%

* Only those at an institution using immersive technologies for teaching and learning were presented this question.
Source: *Chronicle* survey of 285 college administrators

understand two key functions of brain cells — transmission and conduction. By encouraging students to navigate around digital models of cells and control some of the processes driving cell communication, the instructors hope they will better understand the interplay in neural circuits and the ultimate effects on behavior.

University of Maryland Global Campus, which primarily delivers courses in an online or hybrid format to students with an average age of 30, is starting a two-year pilot program with immersive technologies. The program will experiment in 15 courses, across a wide variety of disciplines, with the goal of eventually including immersive content as a routine part of the universities' course planning. In one pilot course, the university will try swapping a virtual dissection laboratory for its usual procedure — shipping cows' hearts to students' homes. In a forensic-science course, students will try to decode evidence laid out for them in a virtual crime scene.

Likewise, the University of Michigan has an XR Initiative across all of its 19 schools

and colleges to try to leverage immersive technologies to strengthen education and create “an interdisciplinary scholarly community of practice.”

In one pilot course, the university will try swapping a virtual dissection laboratory for its usual procedure — shipping cows' hearts to students' homes.

As universities get more strategic in exploring the use of immersive technologies, three main questions emerge: What can drive immersive technologies forward? What are the obstacles to their adoption? And, most importantly, will immersive technologies be more educationally effective than existing teaching methods?



Propelling Immersive Realities' Progress

In the survey and in more than a dozen separate interviews, faculty members were described both as the best advocates for immersive technologies and the chief impediment to their success.

Forty-five percent of administrators said in the survey that faculty members were “somewhat interested” in using immersive technologies for teaching, and 10 percent described them as “very interested” category.

In interviews, though, IT administrators expressed concern about faculty resistance. Joe Way, director of learning environments at the University of Southern California, oversees the design, installation, and support of about

How would you describe the interest among faculty in using immersive technologies for teaching on your campus?

Very interested

10%

Somewhat interested

45%

Not very interested

23%

Not at all interested

5%

Unsure

17%

Source: *Chronicle* survey of 285 college administrators

What is the primary reason your college is adopting or testing immersive technologies?

Pedagogical innovation

47%

Wanting to stay at the forefront of innovation to attract prospective students

32%

Financial support from outside partners/organizations that has made the required technology more accessible

6%

Data proving the educational value of immersive technologies

5%

Other

9%

Source: *Chronicle* survey of 285 college administrators

500 audiovisual spaces on the university's campus. The biggest barrier to adoption of immersive technologies, he says, "will be having faculty change the way they think about teaching. The students are probably ready for it."

Indeed, among those whose institutions use immersive technologies, 32 percent said their primary reason for doing so was to be at "the forefront of innovation to attract prospective students." That reason was surpassed only by a desire for "pedagogical innovation" (47 percent).

When it came to measuring student interest, 27 percent said their students were very interested in immersive technologies, and 40 percent were somewhat interested.

Few administrators or faculty members who were interviewed doubted student interest in immersive technologies. At Southern New Hampshire, Cat Flynn, director of learning science, experimented with virtual reality in biopsychology courses along with a psychology professor. Multiple students, she says, told them the experience was something they would like to repeat so they could look around more inside the neurons and see if they had missed something. Like many similar studies, the Southern New Hampshire experiment demonstrated

How would you describe the interest among students in using immersive technologies for teaching on your campus?

Very interested

27%

Somewhat interested

40%

Not very interested

8%

Not at all interested

1%

Unsure

24%

Source: *Chronicle* survey of 285 college administrators

that using virtual reality sparked students' interest, motivation, and engagement. The researchers surveyed the students after each virtual-reality experience, and 81 percent of them agreed with statements about being motivated to learn the material presented in virtual reality, finding the lesson engaging, and wanting to learn more about neural communication.

While science and engineering courses are often associated with immersive technologies, some academics are exploring their use in the humanities.

At Grinnell College, students and faculty members have worked on a virtual re-creation of a Viking mead hall and a village, with the goal of creating an immersive environment that would allow readers of *Beowulf* to better understand its time period. Some of the students creating the scene have traveled to Iceland to examine Viking settlement sites and individual artifacts, along with reviewing the history of the time and written descriptions. The students are documenting their design decisions as they go. In the end, the hope is that a student will be able to don a headset, step into the scene, and witness a Viking feast.

David Neville, founding director of Grinnell's Immersive Experiences Lab, says such projects may help students to experience other cultures from more of an "inside looking out" perspective than they would get from textbooks. The broader point of using virtual reality in the humanities, he says, is to open students up to other people's lived experiences. Indeed, a virtual-reality project produced at Stanford, the "[1,000 Cut Journey](#)," has users experience life as a Black male.

To achieve vibrant virtual-reality experiences, Neville says, designers will need to create clear opportunities for interactivity. Otherwise, visitors may feel as if they are in an old-fashioned, boring museum. "After a while," he says, "You're like, 'What's my purpose here? What's my role? How do I know I'm making the right decisions?'" It's important to give students immersive stories, he says, that will make them want to keep "turning the page," not to entertain them, but to keep them learning. A lot

To achieve vibrant virtual-reality experiences, designers will need to create clear opportunities for interactivity. Otherwise, visitors may feel as if they are in an old-fashioned, boring museum.

of the learning happens, he says, during discussion and reflection after an actual virtual-reality experience.

A former German-language professor, Neville once created a three-dimensional game to teach students about German household recycling and to learn grammar and the related vocabulary. He used the game with some students but not with others. The game did not help students' grammar, he says, but he noticed that those who had played the game later wrote required narratives "as if they were writing about a real-world experience." Students in the control group wrote their stories in a more stilted, academic way, he says.

Eighty-nine percent of those answering the *Chronicle* survey said that a benefit of immersive learning would be “allowing students to test real-world lessons in low-risk situations.” That was followed on the list of benefits by “visualizing difficult or abstract concepts” (78 percent) and motivating students to learn and imparting technical skills (both at 57 percent).

Faculty members can leverage students’ interest, says Randall Rode, director of campus IT partner relationships and development at Yale University. “A lot of the best work I’ve seen,” he says, “is where we’ve been able to enable students as creators.”

In talking to faculty members, he says, part of his pitch is to tell them that with the right tools and guidance, students can do all of the content creation.

That approach has been used at the University of Washington Reality Lab, which seeks to spur innovation in immersive technologies. In the lab, undergraduates participate in an incubator that allows them to create educational content and digital toolkits that academics at other universities can use to create their own content. A University of Washington doctoral student and his colleagues at the lab created a virtual-reality tour of a geological site, with informational pop-ups at various locations and tools that allow students to measure rock surfaces and the angles of those surfaces. They can then conduct computations to understand larger principles, such as plate

tectonics. Along with building that model, the lab created digital tools for creating other models, and has held workshops at geology conferences to teach others how to build field experiences for students.

Researchers often mention the health-care professions as an area where virtual reality could make an important contribution — by offering simulated interactions

What do you consider the benefits of immersive learning? (Select all that apply)

Allowing students to test real-world lessons in low-risk situations (e.g. medical courses that use VR)

89%

Visualizing difficult or abstract concepts

78%

Motivating students to learn

57%

Imparting technical skills

57%

Encouraging creativity

51%

Offering more personalized learning

38%

Other

7%

* Only those at an institution using immersive technologies for teaching and learning were presented this question.
Source: *Chronicle* survey of 285 college administrators

with patients such as practicing bedside manners or inserting chest tubes. While three-dimensional anatomy lessons have advanced, virtual interaction with actual patients appears limited. “We haven’t seen a lot of mature instructional resources yet,” says Frank Barber, assistant dean of technology, learning, and innovation at the University of Washington’s nursing school.

Little use of full-fledged immersive technologies appears to exist in campus functions outside of classrooms, although administrators say the technologies have potential in that capacity.

“We’re here to make those investments,” says Barber. “We just haven’t seen something that’s convinced us that we’re going to introduce it to our whole cohort of student nurses.”

Little use of full-fledged immersive technologies appears to exist in campus functions outside of classrooms, although administrators say the technologies have potential in that capacity. A report on an [Educause poll](#) conducted in November 2021 concluded, “Ancillary uses for XR may not

take hold in higher education ... yet.” Some institutions are plunging into 360-degree video and more advanced virtual-reality techniques to reach out to potential students and their parents and to entice them to enroll or visit the physical campus.

There is some other experimentation as well. Southern New Hampshire University began trying to get more of its graduates to participate online in its spring and fall commencements in 2019, before the Covid-19 pandemic arrived. Out of the university’s approximately 30,000 graduates each year, only about 900 study on the university’s Manchester campus. The rest are online learners from around the world.

Beginning in fall of 2021, when more of an in-person experience was possible at commencements, Southern New Hampshire hired a virtual-reality company to film the ceremonies in 360-degree video. Now online learners and their families can attend graduations and navigate around the streaming video with a mouse or touchpad — hearing the bagpipe band, looking behind themselves at fellow graduates, hearing their name read at the same time their photo and their personalized message to their families or professors is displayed.

The online users view the ceremony on flat screens and do not get the full virtual-reality experience, but the work points toward future possibilities.

“We get a lot of feedback from parents saying, I wish I could enjoy all graduations from the comfort of my couch and not have to sit out in a hot stadium for hours,” says Deanna Zanella, assistant vice president for ceremonies and events at Southern New Hampshire.



The Barriers to Immersive Technologies

Any developing technology needs money, and immersive technologies have not had a clear, consistent source of funding. They do not appear to have a champion in a federal government agency, so researchers who want to develop the technologies have to wedge their ambitions inside grant applications to such agencies as the National Endowment for the Humanities or the National Science Foundation. Researchers and IT administrators say private foundations have not taken a strong interest in developing immersive technologies for education. Some virtual-reality companies are willing to donate or discount equipment, but professors have mixed feelings about working with corporations.

Some are only willing to take no-strings-attached gifts, while others openly embrace more extensive university-industry collaboration.

As a result, academics interested in working with immersive technologies need to compete for often scarce internal funds.

At the University of Missouri at Columbia, Flower Darby, associate director of the Teaching for Learning Center, sees immersive technologies as one of the many educational technologies that have great potential but that need more leadership and investment. Emphasizing that she is speaking as an individual and not for her institution, she says that investment should include more wraparound support, such as additional staff members who could help professors and students. She sees a “big disconnect between available technology and higher ed’s uptake of it. For me, immersive technology falls into that category.”

Darby says that even though the latest pandemic, the war in Ukraine, and the growing number of natural disasters and extreme-weather events are showing that students and faculty members are having more difficulty getting to campuses, she sees little progress toward the ability to work well virtually, including with immersive technologies.

In the *Chronicle* survey, when those who said their college wasn’t using immersive technology were asked why, the leading cause, at 62 percent, was that it was “cost prohibitive.” Forty percent said the major barrier was a lack of interest among faculty, and 34 percent said that another technology had a higher priority.

Why isn’t your college using immersive technologies?* (Select all that apply)

Cost prohibitive



Lack of interest among faculty



Different technology is a higher priority



Lack of interest among administrative



Too difficult to use



Lack of interest among students



Improving teaching isn’t a priority



Other



Source: *Chronicle* survey of 285 college administrators

The *Chronicle* survey also asked directly what academics see as barriers to using immersive technology for teaching. The leading cause cited, at 80 percent, was the need for faculty training. The causes that came after that were the need for adapting course content to a new teaching environment, and the cost of devices, such as headsets.

IT administrators say the price tag for virtual reality has dropped from an investment in the millions to a sum in the thousands for occasional classroom use. And while a dedicated engineer may no longer be necessary, quite a bit of time is still required from tech-support staff. At \$300 to \$400 for basic VR headsets, they are not much more expensive than a chemistry textbook. But the perception of high cost and big bandwidth demands may prevent many institutions from making the leap into trying the technology. In addition, as researchers point out, textbooks and lab kits are regarded as being essential for teaching, and virtual reality is not.

Colleen Bielitz is associate vice president for strategic initiatives and outreach at Southern Connecticut State University, in New Haven. She is a co-chair of an XR

community group within Educause, co-chair of the education committee of the VR/AR Association and active in a group called XR Women. She has helped develop content for immersive technologies. But whether she is searching for content or trying to make

What do you see as barriers to using immersive technology for teaching? (Select all that apply)

Need for faculty training in how to use it

80%

Course content must be adapted for AR/VR

73%

Cost of headsets and related devices

69%

Lack of adequate IT infrastructure

59%

Lack of interest by faculty

50%

Need for student training in how to use it

40%

Lack of interest by administrators

30%

Concerns relating to data privacy and security

26%

Lack of interest by students

9%

Other

8%

Source: *Chronicle* survey of 285 college administrators

sure what she develops gets used elsewhere, she is often frustrated. “There’s no central repository,” she says. “There’s no ‘app store’ that I go to where I could get apps just geared toward education.”

Those institutions that are able to make the jump to experimenting with virtual reality face limitations and ethical concerns. Wearing a headset for an extended period can give some students fatigue, dizziness, and headaches, sometimes collectively known as “cybersickness.” Tolerance of headset use varies. Some instructors say 20 minutes is as long as they can take, others say an hour and a half is fine.

At Stanford, Bailenson says his laboratory limits students to a half-hour at a time.

“After 30 minutes,” he says, professors encourage students to “take their headset off, touch a wall, drink some water, go talk to another person.”

Privacy advocates find one particular aspect of headset use disturbing. The devices can collect highly individual data on their wearers. In a Stanford study of 511 participants watching 360-degree virtual-reality video, the system being used could identify 95 percent of users after collecting data — such as users’ head motion and controller angle — for less than five minutes. The researchers concluded it’s important for the public to realize that nonverbal data can be personally identifying data.

Academics working with headsets are trying to pool student information into developer accounts without student names or get permission to use fake emails when setting up headset accounts.

[A Chronicle analysis in June](#) of the vendor contracts that five universities signed in the process of joining a pilot project to create

metaversities — digital replicas of existing institutions — found that the contracts varied greatly in how much they protected student privacy.

Another ethical concern of those working in immersive technologies is a fear that as the technologies converge with artificial intelligence, and as more senses, such as hearing and touch, are added into virtual realities, the notion of reality itself may be blurred. “Imagine if you actually experience

Those institutions that are able to make the jump to experimenting with virtual reality face limitations and ethical concerns.

something and you see it, and it’s completely real to you, why would you question it?” asks Maya Georgieva, director of the XReality Center, at the New School, who has shipped headsets around the world for her course in immersive storytelling.

Many technological barriers stand in the way of even getting to such ethical conundrums. Stanford’s Bailenson says there’s a lot of difficulty, drama even, in getting headsets to students, getting the right software installed, setting up working accounts for each student, teaching students to use the headset, and coping with the fatigue that sometimes comes with wearing them. A common saying in his lab is “VR is hard.” He doesn’t see virtual reality “becoming a staple for biology or chemistry or history this year — not yet.”



The Million-Dollar Question: Educational Effectiveness

Bailenson has just guest edited, with a Stanford colleague, a special issue of the journal *Technology, Mind and Behavior* focused on the topic of virtual reality and learning. “There’s a fairly strong and consistent narrative emerging,” he says, “that for procedural stuff — if you’re learning different steps — or spatial stuff, if you’re learning how molecules fit together or understanding wayfinding on a map, that VR is an epic win.”

He believes virtual reality can help doctors learn to use surgical tools and help quarterbacks master plays.

The other win is what he calls “social presence.” Virtual reality can give conversations a much more personal and “live” feel than a video call, increasing engagement. Imagine the average video call, with a grid of people on the computer screen. If someone appears to be looking sideways at the person next to them, they are actually looking away from the conversation, at a distraction in the room they are actually in. But in virtual reality, someone swinging their head around is

Despite the stream of evidence supporting some educational aspects of immersive realities, some say it is not strong enough.

a sign that they are shifting their visual attention. In that context, he says, virtual reality is “a really nice tool to bring people together.” In a class he teaches on the metaverse, any element of it resembling a lecture won’t be in virtual reality: “You don’t need to wear goggles to see a talking head.” But small-group student discussions will take place in virtual reality, to strengthen social connections.

In addition, he sees some untapped potential in teachers’ using avatars to make their behavior less threatening and more engaging for students. Instructors can

choose to display different versions of their avatar to different students to personalize how they engage with each student. If for example, a student feels that their professor is looking directly at them, they are more likely to pay attention.

In [one published paper](#), Bailenson and his colleagues found that female students were less apt to learn math when male avatar teachers in a virtual classroom displayed certain behaviors, such as spreading their legs wide and leaning forward, than they learned from a male teacher who crossed his legs and leaned back.

While such results can of course be applied in a physical classroom, they are also evidence that it might improve learning if gestures and postures were individually adjusted for each student in virtual reality, a feat not possible in a bricks-and-mortar room.

Despite the stream of evidence supporting some educational aspects of immersive realities, some say it is not strong enough. Satisfaction ratings by students who use the technology are often high. Proof-of-concept experiments usually work.

But “what it comes down to,” says Wray at USC, “is can you show me that my students are better off doing this than if they don’t? And where’s the cost benefit? To be honest, you can’t show it. We’re too early.”

Champions, though, say that the technology is worth pursuing. “Instead of telling the story, you can immerse the students in the story,” says Bielitz, at Southern Connecticut State.

CONCLUSION

In the *Chronicle* survey, 66 percent of administrators either strongly agreed or somewhat agreed that immersive technologies will become widespread in improving the campus experience of students in the next five years. When it comes more specifically to teaching college courses, 63 percent either agreed or strongly agreed that immersive technologies will become widespread in the next five years.

Virtual reality is already fairly common in some technical education, such as underwater welding, where it can simulate what would otherwise be very expensive training. Health-care professions and those science disciplines that require spatial understanding, such as chemistry, geology, and biology, are also viewed as likely early adopters.

TO WHAT EXTENT DO YOU AGREE WITH THE FOLLOWING STATEMENTS:

■ Strongly agree ■ Somewhat agree ■ Neither ■ Somewhat disagree ■ Strongly disagree

“Using immersive technologies will become widespread in teaching college courses in the next five years.”



“Using immersive technologies will become widespread in improving the campus experience for students in the next five years.”



Source: *Chronicle* survey of 285 college administrators

Those answering the survey seemed to reflect those priorities: Vocational education, such as courses on manufacturing and nursing, tied with the natural sciences for the disciplines that administrators believe lend themselves best to the use of teaching with immersive technologies, with 78 percent each. Sixty-five percent said applied sciences, such as engineering, would lend themselves to using immersive technology.

But even in the fields considered ripe for immersive technologies, many academics are left running thought experiments while waiting for more mature technology. “We geek out about it,” says Barber, at the University of Washington’s nursing school. “We really want to make something happen.”

Many academics believe student demand will drive the adoption of immersive technologies. One researcher said his teenage son, who was interested in nuclear physics, was building a digital

replica of the Chernobyl reactor with some of his like-minded friends. Bielitz says children and teenagers are already in the metaverse playing games and building imaginary and replica worlds. “Generation Alpha,” says Bielitz, will arrive at higher education’s door in seven years expecting their education to reflect their experience with immersive technologies.

In the end, immersive realities cannot be understood by reading text or watching videos. Bailenson, at Stanford, tends to be very measured in talking about virtual reality’s future. But he and others urge those who have not experienced virtual reality to don a headset and step into a new digital landscape with some friends, whether the trip is inside a neuron, a tree, or on the surface of Mars. There, students of all ages can experience the feeling of being with others in new places. “It is really special when everything’s firing on all cylinders,” says Bailenson. “It’s truly magic.”

METHODOLOGY

In July 2022, *The Chronicle* emailed surveys to 8,500 administrators, and 285 responded.

Directors made up the largest portion of respondents (38 percent), followed by deans, including associate and assistant deans (27 percent), provosts, including associate, assistant, and vice provosts (9 percent), and vice presidents (8 percent). Smaller numbers of presidents, technology officers, department heads, and other administrators answered the survey.

Forty-two percent of respondents work at public four-year institutions, 34 percent at private four-years, and 24 percent at public two-year colleges.

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