

## Explainer

# Augmented and Mixed Reality in Higher Education

### What is augmented reality?

Augmented reality refers to an interactive experience in which technology infuses digital information into a user's perception of the real world. That input — usually visual or auditory — appears essentially seamless to the user. Access to this world can be via head-mounted or hand-held equipment designed specifically for AR, or through a computer monitor, special eyeglasses, gaming devices, or even a smartphone. A simple example of AR might be the projection of numerical data via Google Glass to inform a surgeon of a patient's vital signs during a procedure.

### What is mixed reality?

"Mixed reality" takes this technology further, blending real and virtual worlds in ways through which the physical and digital worlds can interact. One way to think about this difference is that while AR essentially creates a virtual overlay on top of the real world, MR does more to integrate virtual objects and input into the physical world. Thus, MR takes the user deeper into immersive learning. An

example of MR might be the opportunity for an architect to "test drive" a building that has yet to be constructed, using MR technology to "walk" through its rooms and even take a "tour" of its HVAC system.

A close cousin of MR, virtual reality (VR), can be defined as immersing a user in an entirely simulated environment. AR, MR, and VR are sometimes grouped under the umbrella term XR, or eXtended reality.

### How are colleges using augmented reality and mixed reality for teaching and learning?

While applications of AR and MR are still in their infancy, colleges are finding more ways to use these tools to support teaching and learning. In a medical school, for example, an AR projection of a rare surgical procedure can remind a surgical student of some of the nuances of that operation. Similarly, AR can show medical students what is under the skin, so to speak, as they examine patients and can offer a rich lode of information — such as test results — to help future medical professionals diagnose and treat

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maladies. Researchers at Case Western Reserve University have been developing an AR tool that enables medical students to watch and study the way blood moves through the heart, arteries, and veins.

**Through immersive experiences using MR, students can “visit” the solar system, go deep under the sea to explore the effects of pollution on oceans, or take a 360-degree tour of an ancient Roman town or Egyptian pyramid.**

For students studying art objects and historic relics, technologies like AR can superimpose encyclopedic collections of facts on the item being studied. At the University of British Columbia, for example, Siobhán McPhee, a professor of geography, developed an AR-enriched, smartphone-accessible tour focused on how development of the Canadian Pacific Railway in the late 19th century created social and economic changes that helped shape Vancouver’s historic Chinatown and downtown Eastside neighborhoods. A similar app at Pennsylvania State University helps students study the construction of the university’s iconic Obelisk, a 53.4-ton stone tower originally built in 1896 to showcase regional rocks and minerals.

Through immersive experiences using MR, students can “visit” the solar system, go deep under the sea to explore the effects of pollution on oceans, or take a 360-degree tour of an ancient Roman town or Egyptian pyramid. Also helpful for students in trade schools, AR and MR

can help a would-be electrician learn how to work safely but without the risk of making a fatal mistake in real life. Similarly, simulated lessons supported by AR and MR can help future firefighters and air traffic controllers learn how to do their jobs in safe environments.

Another application for AR and MR might be in online education, where emerging technology has the potential, some say, to help students feel more connected with other learners even when students are located physically in many different sites. Related technology is already being used to improve the experiences of students in satellite classrooms, such as refining realistic projections of images of professors from one facility to another.

AR and MR also create learning opportunities for students. At Rice University, for example, engineering students developed an AR app that incorporates visual, auditory, and vibration cues to help patients with Parkinson’s disease overcome a symptom known as “freezing,” when legs temporarily fail to follow the brain’s command to walk. Students at the University of Illinois developed an app that adds an AR experience for users exploring menu items at local restaurants.

### **Are there applications of augmented and mixed reality for administrative purposes?**

Some colleges are starting to use AR and MR technologies in their marketing. Savannah College of Art and Design sent Google Cardboard headsets to 30,000 accepted students who could then take VR tours of SCAD’s multiple campuses. The college also embellished its course catalog with AR features like videos and animations. At American University, visitors who point their phones at certain

posters on campus open AR applications that let them explore student life, “visit” a class, or even watch a basketball game. California State Polytechnic University at Pomona developed an AR campus tour that highlights the institution’s history.

In addition, colleges may one day take a page from the playbook of charities that are using MR to enhance their reports to donors on the impact of their contributions, with immersive experiences that deepen the emotional impact of the story being told.

### **What concerns do augmented and mixed reality raise in higher education?**

Like any new technology, AR and MR require staff time for the exploration of what possibilities the tools offer, after which staff need training to learn how to use the technologies. While prices are starting to fall, some tools for using AR and MR can be expensive to purchase, house, maintain, and keep secure. Facilities may need to be renovated to accommodate the use of AR and MR. Faculty may be reluctant to adopt AR and MR in their pedagogy. Research on the effectiveness of AR and MR for learners is only beginning to be developed and industry standards are inconsistent. As with many technologies, AR and MR raise issues about whether the data they might generate or store could threaten student privacy and their rights to have personal data kept secure.

Concerns have also been raised that some AR and MR experiences may be so intensely emotional or disturbing that

they raise ethical questions about the responsibilities of those who provide the experiences.

### **What might the future bring?**

As AR and MR technology gets more sophisticated, as the hardware becomes less cumbersome and costs come down, and as more users become acculturated to their use, applications for AR and MR will presumably proliferate in higher education. AR and MR will likely move from their current status as something of a novelty to become integrated more fully — and broadly — across academic programs. While some skeptics question whether AR and MR will live up to their hype, other experts are more sanguine; one education-research company projects that some 60 percent of colleges will be using VR in some capacity by 2021.

The use of AR and MR will likely also expand in college administration. Beyond use in marketing and recruitment, institutions are beginning to explore potential applications of these technologies to help donors, legislators, and potential corporate partners gain a better sense of an institution’s activities and goals. MR could show a potential donor what a new building might look like with much greater detail than an architectural rendering. Similarly, AR and MR may become indispensable for facilities planning and development. These technologies may one day become common in many campus business offices, perhaps in applications that have yet to be invented.

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