Emerging Classroom Technologies

Scenario
Emerging technologies for learning spaces are being tested at Brundage University. In one engineering classroom, a tablet lets anyone in class write on the room’s whiteboard, freeing instructors from standing at the front of the room while enabling students to contribute to notes drawn on the whiteboard. “The technology makes learning more collaborative, engages students more actively in learning, and draws introverted students more actively into the discussion,” notes professor Mary Flavin. Software mitigates the need to snap photos of whiteboard content: Those images can be captured digitally for future use and forwarded to other devices, including students’ phones. Knowing they can access the whiteboard notes later, “students can concentrate on the discussion rather than on taking notes,” Flavin says.

In the business school, learning spaces are designed to facilitate discussion taking place simultaneously in two locations. Through the use of floor-to-ceiling projection screens and large LED monitors in learning spaces in different states, an instructor at one site can appear virtually life-size on the screen in the other site. For the instructor, the configuration makes it appear that students at the remote site are seated directly behind learners at the instructor’s home site.

Elsewhere on campus, computer scientists are experimenting with a “virtual teaching assistant.” Linked to robust databases, the VTA can answer many routine questions that learners have—freeing instructors for higher-level learning—and also helps students dig more deeply into specific questions. The university’s IT staff are working to make a new wave of virtual reality products, including lighter wireless headsets, available to learners and instructors in many disciplines. Game designers love them, of course, but so do instructors, who use VR headsets to learn about different student learning styles.

In the School of Education, students are using Internet of Things technologies to study the pedagogical impact of physical elements such as desks, chairs, and IT equipment. There’s a debate about whether using technology to track student and instructor movement constitutes an invasion of privacy. In yet another learning space, acoustics are the focus. Depending on pedagogical needs, instructors can adjust the acoustics to support presentations from the front of the room or small-group discussions. With the latter, participants can hear what is being said around a table while noise beyond that sphere is attenuated.

What is it?
As technology becomes more advanced and our understanding of how to use these tools becomes more sophisticated, potentially important new technologies are emerging for use in teaching and learning spaces. Going beyond the expected evolution of ubiquitous tools like digital projectors and flat-screen displays, institutions are experimenting with the development of a wide range of emerging technologies that can open doors to rich and vivid active learning experiences. Encompassing physical tools, software for teaching and learning, technologies that support immersive learning experiences, and new applications for environmental design, a wide range of technologies that today are on the vanguard or in pilot phases could soon become common tools for learning in physical spaces.

How does it work?
Progress is evident on a number of fronts. Advances in artificial intelligence have helped create virtual teaching assistants. Significant improvements in AV design are greatly improving the experiences of students at remote sites; one example is a realistic, life-size projection of the instructor at the remote location. Innovations in wireless projection facilitate the ways learners and instructors exchange information from multiple devices, enhancing collaboration. Emerging commercial products now permit instant translation of writing on physical whiteboards into digital form. Emerging technologies for tracking movement and activity in learning spaces are beginning to inform research on learning and pedagogy. Universities are exploring how emerging technologies can produce better acoustics and lighting that can help improve teaching and learning.

Who’s doing it?
Georgia Tech has several semesters of experience testing Jill Watson, a virtual teaching assistant. In the Reality Lab at Indiana University, students use virtual reality to “walk” through buildings they have designed and study up-close the technique of a virtuoso musician. Learners and instructors at King’s College send information wirelessly to a main classroom display—sharing applications, graphics, video, and audio from multiple devices and essentially turning a classroom into a collaboration lab. At NC State University, faculty and graduate students can use the Visualization Studio, a collaborative environment with 12 projectors that display content in 360 degrees across four walls. In
Emerging Classroom Technologies

Special Education 801, a course at Penn State World Campus, 360-degree videos help future teachers learn how to respond to challenging student behaviors. Another application helps graduate-level nursing students identify potentially unsafe living spaces for elderly people. A learning space at Stanford University, Lathrop 282, offers a synthetic acoustics system that supports both small-group work and large-group discussion for up to 140 students. At the University of British Columbia, a lecturer in game law delivers a course via VR, with data that capture his gestures and voice mapped to an avatar pictured in a room resembling a lecture hall. At the Wharton School at the University of Pennsylvania, the Cisco Connected Classroom enables students in Philadelphia and San Francisco to conduct synchronous case-based learning and feel as though they are interacting in the same place. Instructors at multiple universities use AI tools from the company NVIDIA to develop learning kits for students in such disciplines as deep learning, accelerated computing, and robotics.

Why is it significant?
Emerging technologies for teaching and learning spaces are significant in three broad ways. First, they nurture further movement away from a “sage on the stage” model to one of collaboration and deeper student engagement in learning. Software that converts writing on whiteboards to digital form, for example, encourages learners to be co-creators of content and enables better interaction in group work. Second, they facilitate new, more vivid learning experiences, such as those that can be created using AR and VR and that enable students to experience places they could not otherwise visit. Third, their potential to improve cognition and engagement can enhance learning. We are learning more, for example, about how “human centric” lighting, which reflects research into circadian rhythms, can have an impact on cognition. Similarly, “zone” acoustics helps ensure that all learners can fully participate in a class, enhancing the way a physical space supports learning.

What are the downsides?
The rise of more sophisticated, more widely applied wireless technologies, such as those that can track student participation in courses or other campus activities, exacerbates concerns about the privacy of collected data, especially if such tracking ties usage to specific individuals. New policies may be needed to govern such use of data. The emerging technologies may be expensive to obtain, maintain, and scale across campus learning spaces. As with other learning technologies, the pedagogical benefits need to be clarified and embraced by instructors in order to gain widespread adoption. Another potential downside is that the learning curve for using emerging technologies may be steep, discouraging adoption.

Where is it going?
Emerging technologies in teaching spaces show great promise for engaging students in more active and personalized learning and deeper participation in collaboration. By fostering innovation in pedagogy, these technologies have the potential to enable and stimulate new developments in learning designs. Voice activation and facial recognition software will speed routine tasks such as configuring technology and taking attendance.

What are the implications for teaching and learning?
By facilitating deeper student engagement in learning, emerging technologies can support current trends in learning design, including improving the way we assess how students learn and what they are learning. Simultaneously, these technologies have the capacity to draw students into wholly new and richly vivid learning experiences, such as those made possible by new generations of technologies like 3D visualizations, 360-degree video, VR and AR. Powerful displays and visualizations can deepen the understanding of content and research findings. In these ways, emerging technologies constitute compelling platforms for students to use in constructing and co-creating learning experiences of the future. These technologies will help institutions enhance the quality of interactions in learning spaces, including improving the connections between learners at different sites and broadening the capacity for solving of complex problems. Emerging technologies that document how teaching spaces are used could enrich research to improve pedagogy.