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## TEACHING AND TECHNOLOGY

by Andrew Low

### Four Technologies That Are Transforming Distance Learning

Higher education institutions are faced with a gargantuan task of teaching advanced course material to a tech-savvy audience that has been raised on a diet of professionally-produced media. Naturally, they expect educational content to be available on-demand with the same quality whether they're consuming it in the classroom, the dorm room, or the living room.

The COVID pandemic forced many schools to provide classes online, and now they're transitioning to a hybrid model that allows students to attend virtually every class in-person or remotely. While allowing an instructor to teach online (especially from home) can be relatively simple, providing complete coverage of an entire on-campus classroom is a larger undertaking. Replicating a fully interactive distance learning setup in many rooms across a campus is a substantial undertaking, technically and financially. But four advances in AV technology have made distance learning better sounding, easier to install, more scalable, and even greener than ever.

#### Microphones For A New Millennium

The biggest technical hurdle in building distance learning classrooms has always been capturing high-quality audio from the students in the room. Doing so is important to make sure that students listening remotely or to a recording are able to hear questions being asked and answered, and in some cases to enable students at one side of a lecture hall to hear remarks made by students across the room.

Originally, classrooms were strung with overhead microphones hanging down over the seats, which necessitated careful aiming and laborious wiring above the ceiling. But newer array microphones (that look like a vent or soundbar) can generate multiple pickup

lobes that can be aimed in different directions and capture speech from greater distances. The coverage can be adjusted electronically from a laptop, eliminating the need for a technician to climb a ladder to make final tweaks. Three or four array mics mounted in the ceiling can do a better job than a dozen hanging mics ever could.

Array mics also do a much better job of discriminating between speech and the room noise or reverberation that is present in many buildings. In smaller classrooms, one array microphone on the ceiling can often be configured to pick up both the students and the instructor for a completely touch-free audio solution.

### Digital Signal Processing Polishes The Sound

The microphones in the room convert sound waves into audio signals that can be transmitted, amplified, or recorded. But these raw streams need some post-production that polishes and refines each microphone signal and combines them all into a balanced, harmonious mix.

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This balance is accomplished by a digital signal processor (or 'DSP') that can be a standalone hardware appliance or an application that runs on a PC in the room. The DSP needs to be powerful in order to accommodate the challenges of a large, acoustically-complex space like a lecture hall.

Like a good sound engineer, the DSP turns quiet talkers up a bit, and turns loud talkers down a bit to ensure consistent volume. It also activates the nearest mic when someone speaks and turns off unneeded microphones to avoid

that bottom-of-a-barrel sound. A distance learning class with live interaction can also experience an annoying echo when a remote speaker's voice coming out of the loudspeakers is picked up by a microphone and re-transmitted back to the far site. The DSP includes an Acoustic Echo Canceller (AEC) that prevents such reverberations.

Most classrooms include some underlying background noise from computers, projectors, HVAC systems, or just building rumble. People

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in the room may not notice these background noises, but microphones pick them up. A good DSP includes Electronic Noise Reduction that can digitally remove ambient noise to an amazing degree.

### Getting Around, Digitally

One of the things that has made distance learning classrooms an expensive undertaking was running audio and power cables through walls and ceilings. Digital audio networking protocols allow one Ethernet cable to carry hundreds of audio channels plus control signals and power for microphones, loudspeakers, and DSP units. These components can run on a dedicated AV network, but they take so little bandwidth that they can share the same network used for data and building functions. Digital audio networking also makes it easy to route audio and video between rooms or across campus, connecting to a central media recording facility or AV management office. Best of all, system status can be remotely monitored and managed by the institution's IT staff, using most of the same tools and protocols they're already familiar with. Technicians can

receive notification alerts when an issue needs attention and address it quickly without the hassle of constantly checking on rooms that are operating without problems.

### Rechargeability

Wireless microphones have long been one of the most popular tools for presenters and instructors. But the need to constantly replace batteries has been a huge headache for AV technicians, who must err on the side of caution and throw away batteries that may still have considerable use left. Many large universities dispose of thousands of alkaline batteries every year. Smart lithium-ion rechargeable batteries for wireless mics provide performance that equals or exceeds the older alkalines, but can cost about one-fourth as much per operating hour. Instructors only need to drop the microphone or bodypack into a charging dock at the end of a class to be sure that it will be ready to go when needed. Best of all, rechargeable batteries support the university's environmental awareness goals by preventing alkaline batteries from being disposed of in landfills.

### Ready for the New Educational Landscape

Capturing the voices of people in one room and reproducing them clearly at another location seems like it shouldn't be that hard. With just one speaker at the front of the room, the task is easy; with one hundred or more students spread throughout an auditorium, it's a technical challenge. If the audio isn't clear and vibrant, attention suffers, and students struggle to keep up. Fortunately, technical advances in audio equipment have made the large-scale deployment of distance learning classrooms more effective than ever.



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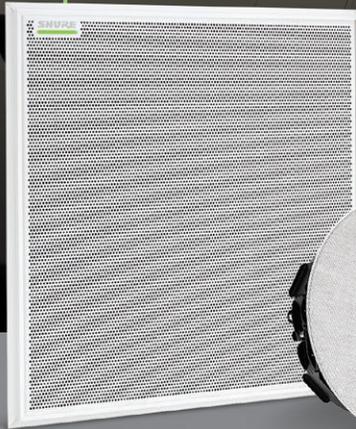
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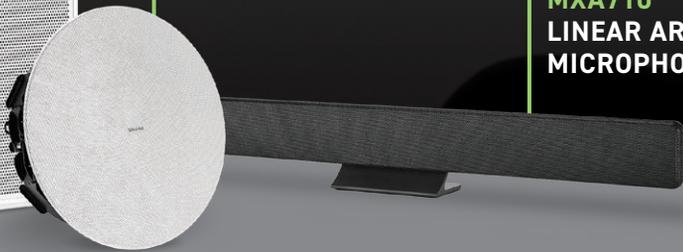
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