

Technology and the Classroom—The Users' Perspective

New research shows schools are embracing improved tech-enabled pedagogy and better collaboration at every level.



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Introduction

New research from NewBay's *AV Technology* and *Tech & Learning* magazines—from a poll of more than 200 users of educational technology in K–12 and higher education—shows how technology leads to increased engagement and more use of online resources, thereby improving educational outcomes. Although the survey showed that many higher education and K–12 schools remain at a crossroads in terms of making a full transition to technology, the vast majority of those who responded are excited about what they're accomplishing today and are equally excited about moving quickly to implement better ways of teaching with online curriculum and to take advantage of online avenues for research, better displays, video conferencing, and more. While there's still a technology gap in many schools, it's a gap that up-to-date projectors, large displays, better networking/connectivity solutions, and better teaching software can fill. The survey results offer a roadmap showing what technology and tech-based pedagogical methods are working for schools today, as well as what's to come.

— By Brian Nadel

Technology in Education

Trends Common to K–12 and Higher Education

In education today, the classroom is at a transition point. The school built around overhead projectors, chalk, and white boards is on the way out. But what is replacing it—interactive displays and devices for students and teachers as well as online curriculum—has not fully arrived in the educational landscape. The change will bring a profound evolution to schools and teaching. It will not happen overnight, nor will it be easy for schools to manage.

To make this transition properly requires a complex matrix of equipment, services, and curriculum. In addition to the actual projectors and displays, schools that want to fully digitize will need to establish the necessary communications links and pick the best curriculum and services. All of this will have to happen in an era of limited budgets.

The results of our poll of 201 educational technology users and buyers in primary, secondary, and higher education shows a snapshot of current uses, wants, and needs in addition to what these educators are looking forward to in the near future to enhance education.

Less than half of those polled (45%) use collaborative displays in their schools or classrooms. These displays can be used for everything from working through a college calculus problem to showing third graders how to form letters. The bonus is that, at any time, students can come up to the screen and show how they'd solve the problem with the teacher and class looking on. In fact, the current technology allows two students (or a teacher and a student) to independently or cooperatively work through a problem on an interactive digital screen and then save the material for analysis or distribution to the class.

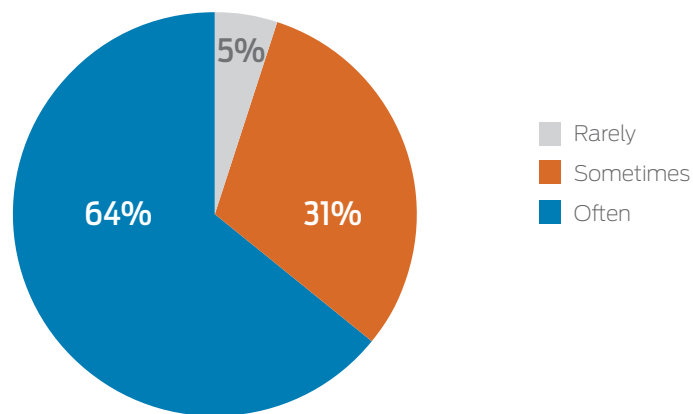
Although it's encouraging that so many are using this technology, the majority, 55% of respondents, don't use this valuable pedagogical technique. Among those who don't, the biggest stated constraint isn't lack of educational materials or lack of training, but rather the lack of funds to buy and install the equipment.

Impediments to Technology Adoption

When asked whether budget constraints are impeding the incorporation of advanced technology like interactive screens into daily classwork, 64% responded that it happens often, while 31 percent said it occurs sometimes. That adds up to a total of 95% who say that lack of money is holding back technology in schools. Only 5% of respondents said that budget constraints block the use of technology only rarely.

Figure 1

Budget Constraints Impede Technology Adoption

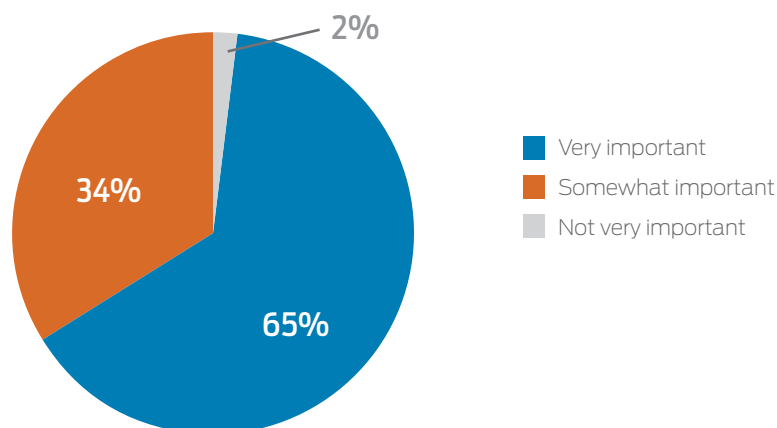


The Current Benefits of Technology Use

When respondents use collaborative display technology, they say, it helps to enhance education by bringing in resources that could only have been dreamed of by teachers a generation ago. When technology works, the result is a dynamic classroom experience with teachers able to switch easily, and on the fly, from showing an online resource—like the University of Colorado's PHET science and math animated simulations—to local software showing a data analysis or a student's screen with the answer to the problem. A total of 97% of respondents think this is somewhat or very important. Only 3% said that the ability to change quickly what's projected onto a projector or large screen classroom display is not very important.

How is this technology used to the best advantage in classrooms? When it comes to sharing a student screen with the class, consider a sixth-grade student writing a subjunctive sentence on the digital board, with another student marking up her work, and you get an idea of its potential. Whenever students teach themselves or each other, half the battle has been won.

Figure 2

Importance of Being Able to Switch on the Fly

Over the past decade, the biggest change in sourcing teaching materials has been the Web, which today is like an educational cornucopia, overflowing with primary and secondary materials. It has everything from Martin Luther King speeches to tutorials on Shakespeare's plays. Overall, 93% of our group of educators said that the Web is very important to teaching today.

By contrast, just 8% said the Web is only somewhat important. The Internet has such an impact on education that nobody in the survey group said that the Web isn't important for classroom education.

What's the Web being used for in classrooms today? The most popular response was putting online resources for research into the hands of students directly. A total of 97% said online investigation and exploration is either very or somewhat important. The second biggest use is for curriculum (94%).

At the moment, the educational community is split nearly evenly on the use of collaborative displays, with 45% saying they use them for teaching. But 55% still don't use this valuable pedagogical resource.

When asked why, most cited the significant expense of buying and installing the equipment. We feel certain that if vendors could create a generation of inexpensive large screen interactive displays that are easy to install in the typical classroom, more schools would use them—and this would enhance education at all levels.

Video conferencing in the classroom is not as common. A total of 75%—nearly three quarters of those surveyed—think video conferencing is somewhat or very important. But only 19% of respondents said they use it at their schools.

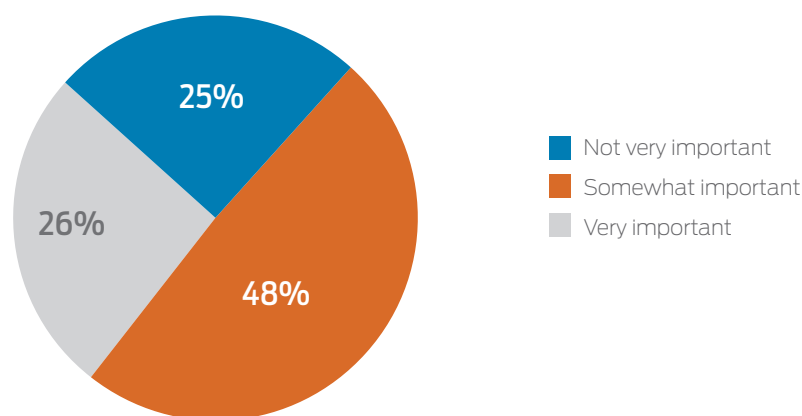
Those that do have video conferencing capability use it more to connect with classrooms or instructors off campus than with others on campus (86% vs. 57%). These results show how smaller institutions without the resources to hire full-time faculty for low-demand classes have embraced distance learning. They bring the teacher in electronically.

Video Conferencing

While 48% said it's somewhat important, only 26% said video conferencing is very important in the classroom. A nearly equal number (25%) said it's not very important.

Figure 3

Importance of Video Conferencing



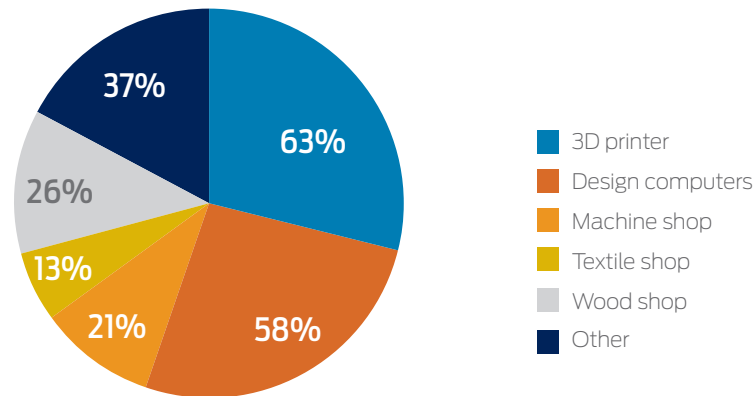
Makerspaces

Whether it's a textile lab at New York's Parsons School of Design or 3D printers at Montclair (NJ) Public Schools, the big trend in education is the creation of maker zones. Here students, and often instructors, can hone creative, technological, and industrial skills that are valuable in today's and tomorrow's workforce. While only 28% of respondents have a place for students to make things, the number of makerspaces is rising.

For those with maker labs, the top equipment choices are a mix of old and new tech. They include 3D printers (63%), design computers (58%), and machine shop (21%). Oddly, wood shops—once part and parcel of just about every high school in America—have fallen on hard times (26%), as have textile shops (13%). A total of 37% responded with the "Other" category.

Figure 4

Maker Lab Specialties



Technology Trends in K–12—Drilling Down to the Specifics

Nowhere has education changed more than at America's 116,000 primary and secondary schools. With the advent of interactive projectors and large screen displays, notebooks, and high-speed communication links, every classroom can outdo the computer lab of the previous generation.

The potential and pitfalls of using technology for learning can be seen in elementary, middle, and high schools throughout the US. An overwhelming majority of the participants in our survey, 91%, think that technology helps them achieve their teaching or performance goals in K–12 classrooms. Only 9% think technology is not helpful in the classroom.

In an age when everyone carries around the equivalent of a supercomputer that's tied into all the media and data in the world, the result in the classroom is a more engaged student body, stimulated and ready to learn. Only a handful responded that students are less engaged and more distracted by technology.

Figure 5

Has Technology Helped in the Classroom?





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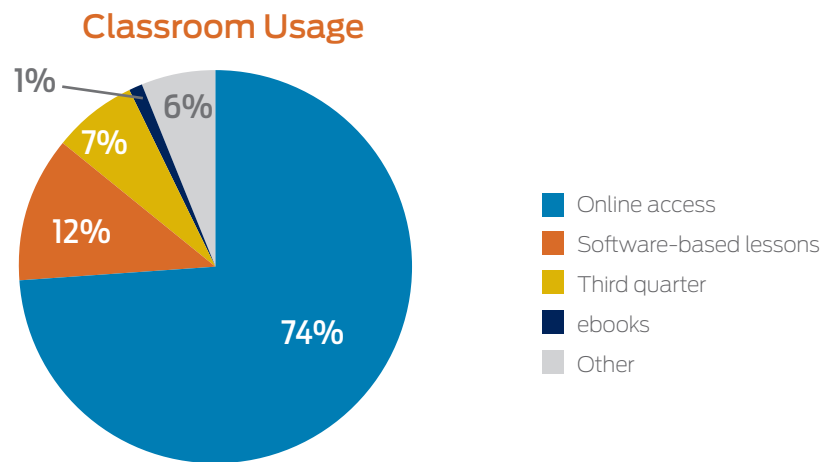
Whether it's a 1:1 school where every student has a computer at their disposal or a school with carts that distribute devices as needed, elementary-, middle-, and high-school teachers are using technology to augment their traditional lessons. At primary and secondary schools, Chromebooks are the most popular devices. This platform, that didn't exist even six years ago, is at once rugged and inexpensive and offers an ever-widening variety of software. Chromebooks are followed by Windows PCs, tablets, and the old fallback—desktop computers. When it comes to tablets, schools have chosen iPads overwhelmingly over Android systems.

The top use of these systems, according to our survey, is to gain online access in the classroom (74%) to research, news stories, and videos of historic events. The second most popular use for these devices is software-based lessons that don't require online access (12%). With the proliferation of the educational Web, this seems to be a remnant of a pre-online era of education and will continue to wither away. Schools are also using devices for Web research (7%) and ebooks (1%).

Below the surface of these obvious answers, a sizable population (all answered "other") think that this technology should primarily be used to support the professional development of teachers and administrators. This is a growing area that will influence all levels of education, as it brings the ability to train teachers on a wide variety of subjects without the need to travel to a seminar or conference. Those states that require professional development for K–12 administrators and teachers will likely see the strongest adoption of this use.

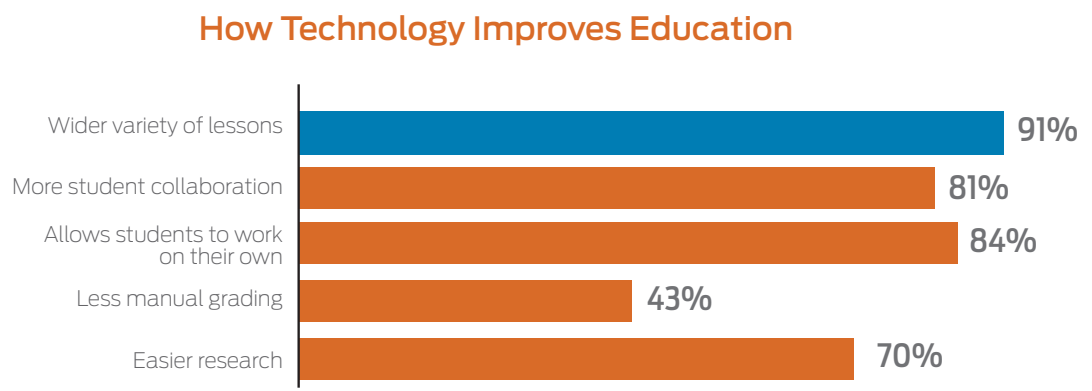
The respondents agreed overwhelmingly that teaching with technology offers a wider variety of lessons through online curriculum (91%) and allows students to do their work on their own (84%). This enables teachers to seek out the class's leaders and laggards to help with enrichment and remedial work. In a very real sense, technology can allow teachers to be much more responsive to the needs of the entire class and more productive for the school and community.

Figure 6



Of the K–12 professionals surveyed, 81% responded that classroom technology spurs greater collaboration among students to learn their lessons, perform joint research, and create group projects. They said that using the Web in the classroom also makes research easier (70%), but only 43% said less manual grading is the prime advantage when using online curriculum with built-in assessments.

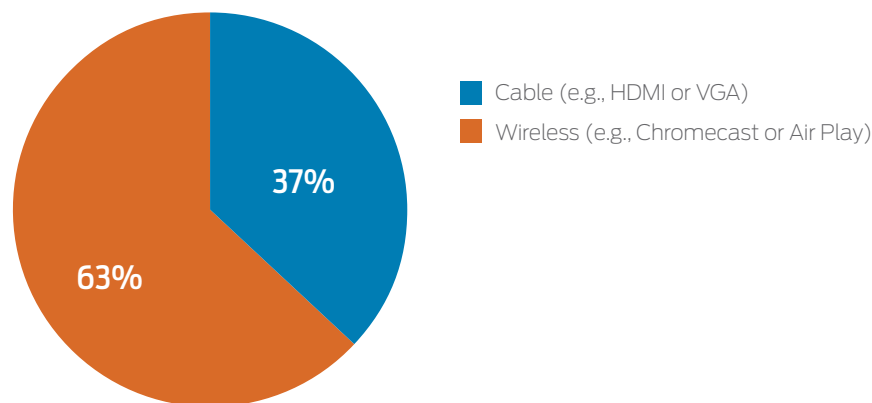
Figure 7



Schools have overwhelmingly adopted wireless technology as the preferred method of streaming a teacher or student's screen so the whole class can see it on the classroom's projector or large display; using tools including Google's Chromecast and Apple's Air Play. A little more than a third of respondents use old-school cables (like HDMI or VGA) to share their screens with the class and are, therefore, tied to the projector or front desk. The teachers who use wireless, on the other hand, can roam about the class while still transmitting video to the large screen.

Figure 8

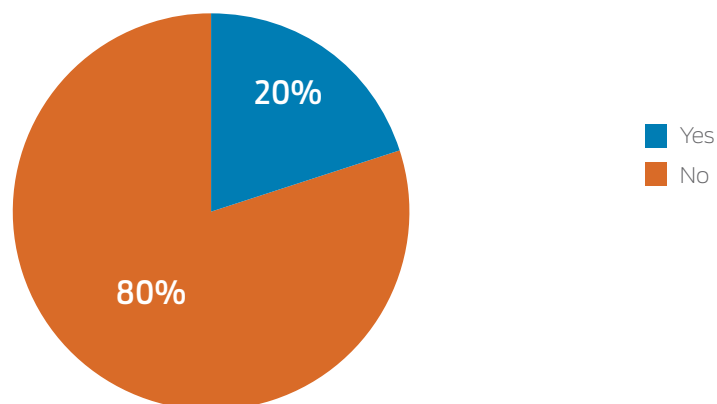
Classroom Connections



That said, there appears to be a widening gap between the haves and have-nots when it comes to screen sharing. Only about a fifth (20%) of respondents are able to show multiple screens at once to do things like compare how two students solved a problem or analyzed a sentence. This is a valuable teaching technique that most of the latest educational projectors and large format displays support. Unfortunately, it appears to be out of the reach for the majority of America's classrooms.

Figure 9

Show Multiple Screens at Once



Without a doubt, the K–12 classroom is changing, and according to our survey it's for the better. But it continues to evolve, with teachers and buyers putting together wish lists to improve technology and the classroom experience. In addition to perennial gripes, like the desire for better software design and better security, uppermost on our respondents' minds were three items:

- More high definition and larger display devices to show more detail and engage students.
- More touch-capable and interactive screens that react to inputs more quickly—for example, being able to draw on a map with a finger.
- Brighter solid state projectors that can be used in classrooms and lecture halls with fewer maintenance concerns over the long term.

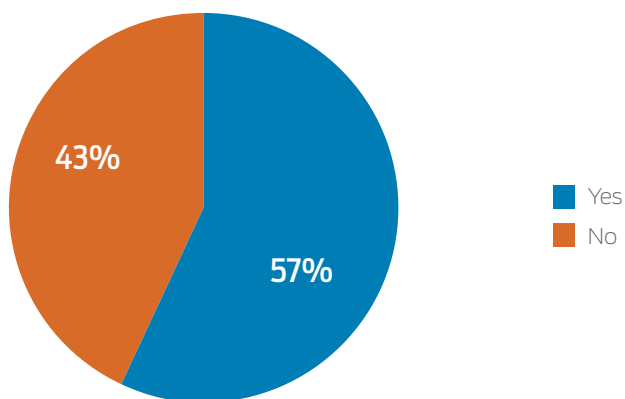
Technology Trends in Higher Education—Drilling Down to the Specifics

The budgets at colleges, particularly those with large endowments, typically are more flexible than they are at K–12 schools. This flexibility allows these institutions to acquire and use the latest classroom technology more quickly than schools in the K–12 realm.

But there's a striking dichotomy developing: A little over half of those polled said that collaboration displays at their university are standardized and centrally bought. Standardization and buying in volume can drive down the cost per classroom, and using the same displays can make training and switching between classrooms simpler for instructors. That said, this buying practice places big bets on the vendor and models chosen. For instance, ten years ago, it would have been hard to foresee the proliferation of short- and ultra-short-throw interactive projectors, and institutions that invested in a large number of early standard-throw interactive projectors—a class of device that doesn't exist anymore—now have a fleet of obsolete equipment.

Figure 10

Display Equipment Centrally Purchased?



Still, collaboration in the classroom and the lab is a major part of higher education's pedagogy today. Of our college crowd, 62% of respondents said that they plan in advance to use classroom collaboration, presumably as part of a preexisting lesson plan, making it the 21st-century equivalent of the curated classroom discussion. By contrast, only 29% employ spontaneous collaboration in their classes.

This can miss the point of collaboration, which is most useful when it's used to solve a problem that crops up in the class or lab. Imagine this scenario: students are having trouble fathoming the rhyming pattern of couplets in Philip Sidney's sonnets, and the instructor walks over to the interactive board and writes out,

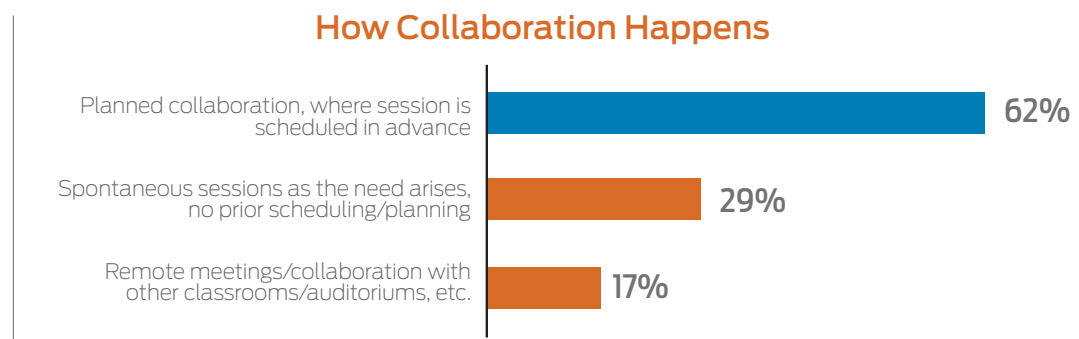
*Who will in fairest book of Nature know
How Virtue may best lodged in Beauty be,
Let him but learn of Love to read in thee,
Stella, those fair lines, which true goodness show.*

Next, he scribbles the ABBA pattern. Nothing could be simpler and more meaningful for the student's understanding of the subject at hand.

It's also important to note that a lot of college collaboration takes place outside of the formal classroom setting. The University of Michigan's newest dorms have interactive collaboration zones in their basements that include nooks with flat-screen monitors and connection points for notebooks, tablets, and phones, so students can each show their portion of a joint project or try out different scenarios for solving an engineering problem. The idea is to provide places where students can work together, formally or informally, on joint projects.

On the same question, 17% of those surveyed said they use collaboration hardware to connect to remote meetings, either with colleagues or other classrooms. This can include inviting an expert in a specific area from another school to be a remote guest lecturer and allowing students to participate in distance learning.

Figure 11

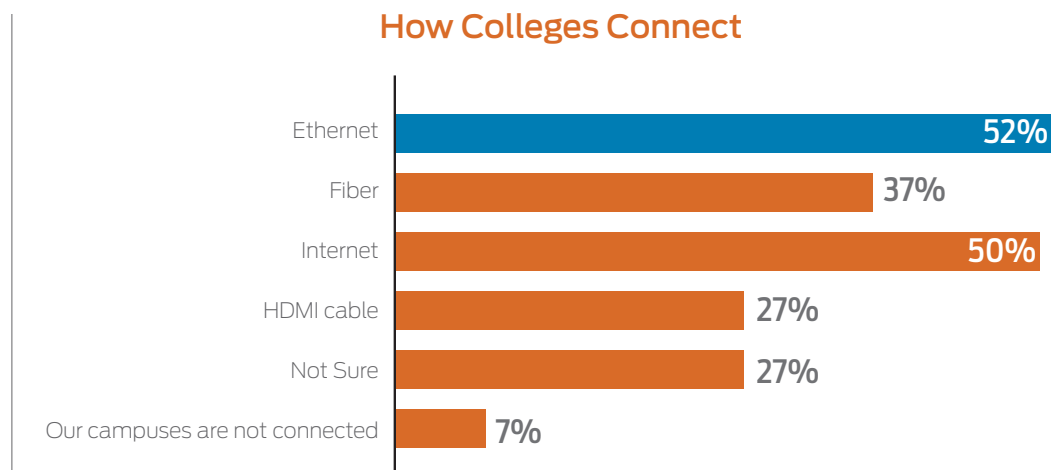


While Wi-Fi is the most popular choice for connecting individual student and teacher systems at most colleges, 53% of universities use good old Ethernet to get the data into the classroom. Presumably, these institutions also have Wi-Fi access points in or near each classroom to fill the school with wireless data.

That said, fiber optic cabling is catching on in a big way because of the enormous data demands that teaching and research make on the infrastructure—particularly if the school is considering transmitting 4K video across the campus. The ability to move 10Gbps, an order of magnitude more than Ethernet can deliver, as well as falling prices for equipment and unused fiber capacity, make this the right technology at the right time. In our survey, 37% of respondents said that their college are using fiber optic cable to connect classrooms and buildings.

Interestingly, 7% said 'Our campuses are not connected'. This is surprising in a day and age where educators rely on the Internet for everything from downloading maps for geology classes to watching movies in film studies seminars.

Figure 12



Half of the schools we polled use the Internet, probably through a virtual private network, to connect classes and campuses via the Internet. While it has the virtue of using existing cabling and infrastructure, this technique can slow data to a crawl, particularly when the Internet is overloaded.

While the K–12 crowd relies on wireless technologies to move screens from a notebook or tablet to the classroom’s projector or flat-screen display, at colleges, 17% still use the venerable HDMI cable. This may make it simpler to connect, but it misses out on an attribute of wireless that’s important in the classroom—the ability of the teacher to stay connected to the screen while roaming around the room and helping those in need of assistance. In a very real sense, the teacher is handcuffed to the projector.

When it comes to the future, the college crowd is looking for brighter projectors and better user interfaces—as well as 4K options for some applications. Due to the greater use of Mac systems in higher education, better integration of the Mac with Microsoft Office software was also on their wish list.

One more enticing concept came up as a harbinger of things to come at schools. Several respondents wanted to see better augmented and virtual reality systems for schools. The idea is to move from flat desktop and wall monitors to immersive goggles that can create learning landscapes that immerse the student in the subject at hand.



Less than half of those polled currently use collaborative displays in their schools or classrooms.

Conclusion

Overall, this survey showed that both higher education and K–12 schools remain at a crossroads as they move from analog to digital education. While analog devices and techniques such as the chalkboard and overhead projector are quickly becoming distant memories, the transition to digital technology with interactive displays and projectors, online curriculum, and video conferencing is not happening as quickly as it could. For many schools, the equipment remains too expensive and out of reach.

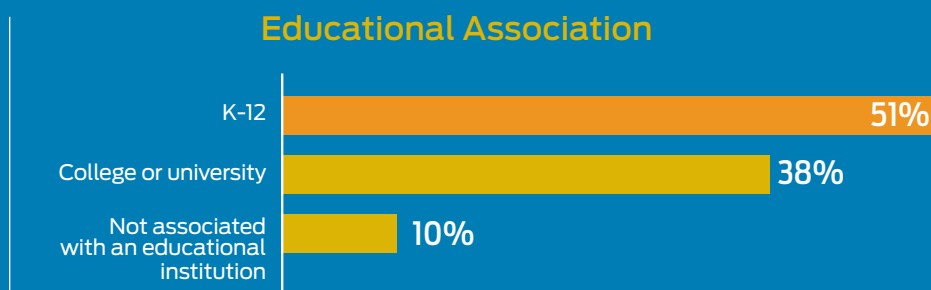
- Most respondents look forward to a better way to teach with online curriculum, video conferencing, and virtual reality in the near future.
- While some think that all the bells and whistles can be a distraction that diminishes educational outcomes, the vast majority of respondents think that technology is helpful in all classrooms from K–12 to college. The key is providing access to online curriculum, video conferencing, and online avenues for research.
- Many classrooms lag behind these goals because the best and most appropriate equipment (typically interactive projectors and large displays) are out of reach. While many schools have wireless, many can't transmit student or teacher screens to the room's projector or big display. That said, most can't even do something as simple as show multiple student screens at once on the classroom display device.

In other words, there's a technology gap in our schools that up-to-date projectors, large displays, and better teaching software can fill. If that comes to pass—and the tools exist today to facilitate that goal—teachers and students will be the winners.

RESPONDENT PROFILE

AV Technology and Tech & Learning's survey of K–12 and higher education buyers was accomplished online in the winter of 2017/2018 with 201 responses tabulated. The response population was formed from a diverse group of teachers and buyers of technology. Overall, 52% of the respondents work at a K–12 school, while 37% have positions at a higher education institution. Of the total, 11% are not associated with an educational institution and presumably work as consultants in this area or with one of the companies that supply educational technology to schools.

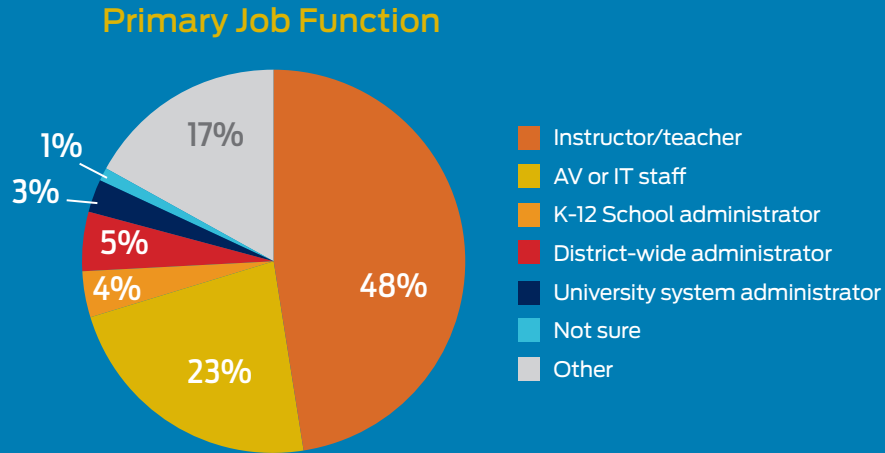
Figure 13



Because their disciplines and job titles span the range of positions at today's primary, secondary, and higher educational institutions, the survey provided insight into a broad range of wants and needs. As expected, the group was dominated by instructors and teachers (48%) at all levels. This was followed by AV or IT staff at schools, at 23% of the total. Primary school administrators constituted 4 percent of the total, and district administrators for primary and secondary schools, 5%. By contrast, university department administrators were less well represented in the results. They accounted for 3% of the total and there was one university system administrator who participated (for 1%) in this survey.

Of the respondents, 17% answered that their jobs were none of the above, which demonstrates the range of the survey. These included librarians, consultants, and directors of technology.

Figure 14

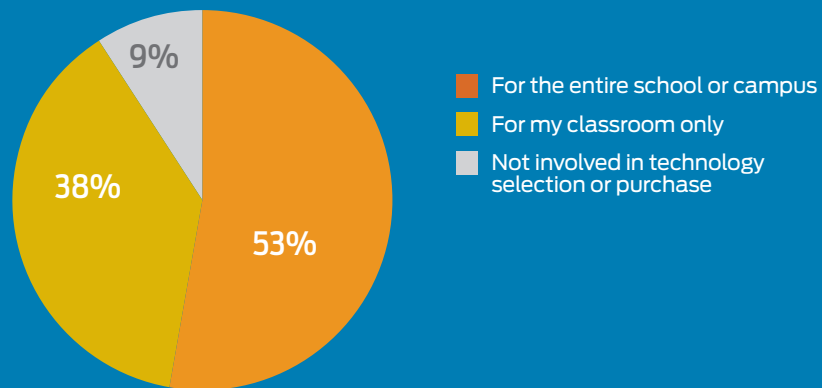


Buying the most appropriate equipment and services for their schools is a priority concern for them on a daily basis. Over half—53% of the respondents—select and purchase technology for their entire campus, regardless of whether it's a 100-seat elementary school or a college campus with thousands of students, teachers, and staff. By contrast, 38% of the respondents make purchases for a single classroom, probably their own.

Of the total population of respondents, only 9% are not involved in technology selection or purchasing. Presumably these are teachers who use the equipment daily and are actually the local experts on features and the nitty-gritty of actually using technology to teach. Don't count them out of the purchasing equation, however, because often these frontline users subtly influence purchasing decisions informally or indirectly or are called upon to train new staff.

Figure 15

Purchase Involvement



Finally, when asked about how involved they are in the purchase of displays or collaborative technology, the vast majority of the group (69%) said they recommend products for the institution to buy, while 61.3% said they influence purchasing decision indirectly. Typically, this group does so by determining the product specifications. Of the polled group of educators, 60% said they establish the need for buying new products and 29% specify the brand to be purchased. It is important to note that respondents to this question could include all relevant purchasing functions in their responses, so the total adds up to more than 100%.

While 21% of our group have the budgetary authority to make final purchasing decisions on new classroom equipment, 19% have to approve purchases before the deal goes through. Think of this latter group as the gatekeepers of technology at a school, with the ultimate authority to decide to buy or not to buy.

Figure 16**Primary Job Function**