TEACHING WITH TECH: A LOVE (AND HATE) STORY

ALSO INSIDE: The Changing Role of the CTO • Teachers and Tech: Time to Reevaluate Your Perception • Enhancing Audio: Beyond Amplification • What Makes a Great Makerspace? • 3 Years to Digital Transformation and Success
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Available as separate solutions or as an integrated education bundle; ideal for the complete management of IT assets at both classroom and district level.
TEACHING WITH TECHNOLOGY
In our latest survey of more than 1,300 educators, respondents reveal an overwhelmingly positive outlook on the use of digital technologies in the classroom — with a few intense exceptions.
By Dian Schaffhauser and David Nagel

ROUNDTABLE: THE CHANGING ROLE OF THE CTO
As technology has changed K–12 education, so has it changed the role of the chief technology officer, a job title that just barely existed 15 years ago. Today’s CTO is not your grandfather’s infrastructure manager!
By Leila Meyer

FEATURES

What Makes a Great Makerspace?
As schools across the country are demonstrating, makerspaces aren’t just about technology. They’re about giving outlet to students’ creativity. Spaces can be as elaborate as sophisticated machine shops or as simple as libraries converted to support hands-on learning.

Enhancing Classroom Audio: Beyond Amplification
Systems designed to improve audibility in classrooms are changing. They used to be all about amplification. That’s still the single most critical component. But systems are now also adding lecture capture, emergency features, paging, monitoring and collaboration capabilities to enhance not just sound, but student learning as well.
Teachers and Tech: Time to Reevaluate Your Perception

When it comes to tech initiatives, teachers are often portrayed as fearful at best, obstructionist at worst. But it’s always (OK, mostly) seemed to me teachers are not, in fact, fearful of or resistant to technology. In the last decade in which I’ve covered education, the teachers I’ve dealt with have always been enthusiastic and generally competent when it comes to digital tools—or, if not competent, at least eager to learn.

That perception is borne out in our first-ever Teaching with Technology Survey, where we asked teachers (more than 1,300 of whom participated) to tell us candidly, anonymously—and without fear of reprisal—what they actually think about the technologies they encounter in their daily lives.

The results were quite positive. Teachers not only use technology: They like it; they get it; and they turn to each other for support when they need it.

Full results of the survey (8 1/2 pages of them!) start on page 6. But let me highlight some broad points.

Where Are the Obstructionists?

First of all, an overwhelming majority (86 percent) said they think technology has had an extremely positive or mostly positive impact on education.

Only 0.51 percent said technology has had a mostly negative or extremely negative impact on education. (Around 13 percent said it’s been mixed.)

Another large majority (about 80 percent) are confident or extremely confident in leadership’s vision for technology in their school.

A whopping 92 percent said it’s made their teaching more effective, with about the same percentage saying it has positively impacted student learning.

About 85 percent said tech has made their job easier. And about 84 percent said they are very confident or absolutely confident in their ability to use the technology tools they have at their disposal.

When asked, “Do you believe technology will have a positive role to play in education in the future?” 99 percent responded, “Yes.”

These are not obstructionists. These are educators who are eager, willing and enthusiastic about bringing tech to the teaching and learning process.

In fact, what we heard from teachers is that education is not keeping up with rapid advances in technology—the same message we often hear from those who accuse teachers of obstructionism!

Take Heed

Administrators and policymakers take note: Teachers aren’t afraid of technology at all (well, except cell phones, which topped the list of technologies educators wished would die off—more on that topic on page 10). What they’re interested in is technology that helps them fulfill the mission of education, explore possibilities and take care of their mundane processes (and busywork) more efficiently.

In short, teachers get it.

This survey is the first in what is planned as an annual research project. And we’d love to hear from you about any additional questions you’d like to see in there! To continue the conversation, e-mail me at dnagel@1105media.com.
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Teaching with Tech: A Love (AND HATE) Story

By Dian Schaffhauser and David Nagel

Responses from the many educators who shared their opinions reveal an overwhelmingly positive outlook on the use of digital technologies in the classroom — with a few intense exceptions.

TEACHERS LOVE TECHNOLOGY. More than nine in 10 say that it has helped them teach and helped their students learn; almost nine in 10 are positive about its impact on education; and 85 percent believe it makes their jobs easier. Most would like their schools to run 1-to-1 programs, to ensure that every student had a computing device, thereby enabling them to flip their classes and introduce blended learning. However, they also hate technology; a lot of them wish their students’ personal mobile phones would just die out.

Those results and others come from an online survey THE Journal recently ran to better understand this love (and sometimes hate) relationship educators have with technology in teaching. A total of 1,307 qualified respondents from K-12 schools across the country answered our multiple choice questions and also shared a lot of open-ended opinions about what works and doesn’t work for them in their classrooms, schools and districts.
Who Responded

Because this survey was intended to understand more about technology for teaching, we targeted our questions around those topics teachers could answer better than anybody else in the school or district. In fact, two-thirds of respondents (66 percent) said they were teachers. Another 9 percent were library and media specialists. Everybody else — including the ample number of individuals who work in school IT organizations — fell into the “other” category.

Even though technology sometimes comes across as a young person’s game, our typical respondent has spent an average of 20 years in the field. Most (84 percent) work in public schools, teaching in grades K–12.

THE SUBJECTS MOST FREQUENTLY TAUGHT BY RESPONDENTS

- Science: 42%
- Social studies: 41%
- English: 29%
- Computer: 26%
- Math: 24%
- Career/technical education: 17%
- Humanities: 11%

The average number of students for schools represented in our survey was 1,107; however, about two-thirds (65 percent) of respondents work in schools with fewer than 1,000 students.

Perspective on Tech

As you might expect, people who respond to the use of digital technology in the classroom are generally upbeat about its influence in schools. Nearly nine in 10 respondents (86 percent) said they were either “extremely” or “mostly” positive about its impact on education. Those who felt the opposite came in at about half a percent.

Respondents were highly affirmative about how it has helped their work as teachers. Eighty-five percent reported that technology has made their jobs easier to some degree. However, in this question a greater number of people were more circumspect about its challenges; 9 percent said that tech has made their jobs harder.

Teachers smack in the middle of the more extreme points of view must be remembered too. As one technology teacher at a middle school in Winder, GA observed, “Moderation is key. With the emphasis on increasing technology, I feel we are losing other skills found in traditional methods.” She offered as an example the case of students who use screen capture or photos instead of writing notes. “Their ability to write legibly has definitely been impacted, but also their memory development and long-term retention suffers.” This tech teacher’s steady guidance: “A well
balanced mix of technology and traditional teaching methods will result in a more well-rounded student.

Teachers are overwhelmingly happy about how tech has helped their ability to teach and their students’ ability to learn. Nine in 10 people (92 percent) said it had "positively" affected their ability to teach, and a similar number (91 percent) said the same about student learning.

Educators have reached a point in their own learning where most (84 percent) prefer a mix of face-to-face and online professional development. About a tenth (12 percent) would like to eliminate the in-person PD altogether and go strictly to electronically delivered training.

To understand how supported these tech-positive educators felt, we asked them to tell us how confident they were about their administration’s vision for the use of tech in education. As many involved in new tech programs have learned, supportive leadership can make all the difference in making a program successful.

Survey found that eight in 10 educators were confident about leader vision; just one in 10 (11 percent) was doubtful.

Putting Technology in the Hands of Students
As you might predict, teachers who see benefit in the use of tech in teaching favor the idea of schools providing devices to all students. More than half of respondents (52 percent) said they would "absolutely" support that idea. Another third (34 percent) said they’d support that but with some reservations. Not all of those schools have reached that point; only four in 10 (41 percent) people said their schools have some kind of 1-to-1 program going on in some or all grades, where every student is supplied with his or her own computing device. Another six in 10 (59 percent) do not have that type of program going yet.

An elementary teacher in Monett, MO told THE Journal that she had been “blessed” with 1-to-1 since her second year of teaching full time. This is now her 10th year of teaching. Her take: “I have seen it completely change the students’ modalities of learning…. Technology in every student’s hands levels the playing field for all.” Besides, she added, “In today’s world, a student who doesn’t understand technology will not make it far. We are equipping students to do tomorrow’s jobs — the ones that don’t even exist today!”

However, a CTEC teacher at a Midlothian, VA high school was more reserved in her enthusiasm. “The Chromebook 1-to-1 initiative at our school has led to increased cheating,” she reported. “Many documents are now ‘shared’ by students with other students. It is too easy to use someone else’s work as your own. Very disappointed that technology has hindered our learning experience and made cheating so easy.”

In order to understand how actual experience with 1-to-1 programs influenced teachers’ opinions, we drilled into the numbers. Among educators who are highly supportive of 1-to-1, 47 percent work in schools that have such programs, and 53 percent are in schools without 1-to-1. Among the very few who are completely against it, only 21 percent are in schools with such programs, and 79 percent have no 1-to-1. Those who are slightly less certain in either direction hold similar opinions. About a third of teachers (33 percent) who said they would support 1-to-1 “with reservations” are in schools with 1-to-1. And a similar proportion (29 percent) who said they would not have that type of program going yet.
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percent) of those who would vote mostly no are also in schools with 1-to-1.

Overall, 60 percent of those in a 1-to-1 school absolutely favor giving every student a computing device. When you add in those with some reservations, over 88 percent are in favor of 1-to-1. On the opposite end of the spectrum, among those in 1-to-1 schools, just over half of 1 percent are absolutely against it. Even when those who oppose it with reservations are included, just over 3 percent don’t think it’s a great idea.

When it comes to bring-your-own-device or BYO-technology programs in schools, respondents are less enthusiastic, but most are willing to consider it. Fifty-nine percent said they’d favor to some extent allowing students to provide their own devices for classroom learning. Twenty-one percent said no thanks to that idea. Only one in 10 respondents works in a school where students are “required” to provide their own computing devices.

Apparently, phones are on a plane far removed from other types of devices in the classroom. Whereas 22 percent of respondents said they supported BYOD without reservations, only 6 percent said the same when the technology was specifically a mobile phone. Most people said they could get behind the idea of students bringing their phones into class — but with limitations. And 41 percent would prefer to decline any such activity.

Only 2 percent of schools have policies that encourage mobile phones. The majority of educators (69 percent) work for schools where the phones are allowed but with restrictions, such as not being able to pull them out in the classroom. Those mobile phone policies also lay out specific penalties for students who break the rules; the most typical one is confiscation of the offending device; in 14 percent of campuses, students have to head to the principal’s office.

To understand overall what kind of technology is seen as the most useful for teaching and learning, we asked people to assess the value of specific types of devices in the classroom. Laptops came out on top in that ranking; 93 percent of respondents said they consider those either “essential or “valuable.” Chromebooks and workstations came in second and third, respectively. Smart watches landed in last place on the list with 10 percent of teachers judging them favorably, and less than 1 percent finding them essential.

**Technology and the Homework Gap**

It used to be that schools struggled to
address the “digital gap” — making sure that all of their students could get their hands on computers outside of school. Nowadays, the gap needs to encompass Internet access too. This “access gap” is widespread. Three in 10 students (31 percent) lack adequate Internet access at home, according to those respondents who ventured an estimate in the survey. Such access is important because it’s hard for teachers to assign homework requiring access to broadband when almost a third of the class will have to hunt down another source of WiFi to get their work done. Currently, only 8 percent of schools or districts provide broadband to students whose families can’t afford it. A majority of teachers (57 percent) do assign homework that requires the use of technology, but that doesn’t necessarily equate to assignments that require the Internet; it may be something students need to write, read or create on the computer.

The equity and access gaps pose serious challenges to a sixth grade teacher in Hillsboro, OR. “If I [assign] homework that requires a computer, by law I [or the district] must supply the computer. And since our school and much of the district bans cell phones, that limits what I can do in class with formative assessment apps.” As she noted, “Equity issues are huge at my school and in my district.”

**Technology in the Classroom**

Although 84 percent of respondents said they prefer a blend of face-to-face and online modes for their own learning in professional development, most of them work in non-blended classrooms. Only a third (32 percent) reported some form of online instruction in their teaching environment. The rest are exclusively face-to-face.

Yet, when we asked people directly, “Are you using a blended or hybrid model for your classes?” the numbers came out differently. There, 57 percent said they were. Another 27 percent said they would offer blended instruction in the next year or were exploring that option.

As one CTEC teacher in Conroe, TX explained, “All courses offered in public school need both online platforms and face-to-face to offer the students a choice in how they learn.”

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A larger number — 43 percent — are exploring the possibility of flipping classes or expect to do so in the next year.

Overall, our respondents are putting tech to use a lot in the classroom. Teachers reported using tech for instructional purposes on average about 61 percent of the time. One in 10 people use it all the time.

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<table>
<thead>
<tr>
<th>PERCENTAGE OF STUDENTS WHO HAVE INTERNET ACCESS AT HOME</th>
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<tbody>
<tr>
<td>0%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>1%-25%</td>
<td>5.8%</td>
</tr>
<tr>
<td>26%-50%</td>
<td>14.5%</td>
</tr>
<tr>
<td>51%-75%</td>
<td>24.7%</td>
</tr>
<tr>
<td>76%-99%</td>
<td>40%</td>
</tr>
<tr>
<td>100%</td>
<td>6.1%</td>
</tr>
<tr>
<td>I don’t have even the vaguest idea.</td>
<td>8.8%</td>
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<table>
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<tr>
<th>PERCENTAGE OF INSTITUTIONS THAT PROVIDE A WAY FOR STUDENTS TO GAIN INTERNET ACCESS AT HOME WHEN THEIR FAMILIES CAN’T AFFORD IT</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Yes</td>
<td>8%</td>
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<tr>
<td>No</td>
<td>92%</td>
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<table>
<thead>
<tr>
<th>PERCENTAGE OF TEACHERS WHO ASSIGN HOMEWORK THAT REQUIRES TECHNOLOGY</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Yes</td>
<td>92%</td>
</tr>
<tr>
<td>No</td>
<td>43%</td>
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<table>
<thead>
<tr>
<th>THE USE OF THE BLENDED OR HYBRID MODEL IN CLASS</th>
<th></th>
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<tbody>
<tr>
<td>Yes, all of my classes are blended.</td>
<td>20.8%</td>
</tr>
<tr>
<td>Yes, some of my classes are blended.</td>
<td>36.9%</td>
</tr>
<tr>
<td>No, but they will be within the next year.</td>
<td>7.6%</td>
</tr>
<tr>
<td>No, but I’m exploring the option.</td>
<td>18.7%</td>
</tr>
<tr>
<td>No, none of my classes are blended.</td>
<td>16%</td>
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<tr>
<th>THE USE OF FLIPPED CLASSES</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Yes, all of my classes are flipped.</td>
<td>3.5%</td>
</tr>
<tr>
<td>Yes, some of my classes are flipped.</td>
<td>27%</td>
</tr>
<tr>
<td>No, but they will be within the next year.</td>
<td>8%</td>
</tr>
<tr>
<td>No, but I’m exploring the possibility.</td>
<td>34.5%</td>
</tr>
<tr>
<td>No, none of my classes are flipped.</td>
<td>27%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERCENTAGE OF INSTRUCTIONAL TIME WHEN TECHNOLOGY IS USED</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>1%-25%</td>
<td>12.3%</td>
</tr>
<tr>
<td>26%-50%</td>
<td>26%</td>
</tr>
<tr>
<td>51%-75%</td>
<td>23.3%</td>
</tr>
<tr>
<td>76%-99%</td>
<td>28%</td>
</tr>
<tr>
<td>100%</td>
<td>9.5%</td>
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</table>
The use of tech isn’t a luxury for educators. For example, one special education teacher in a middle school in Scituate, MA considers the use of technology in school “critical” for her students. “It gives them increased access to the curriculum and provides multiple means of engagement and response,” she explained.

The five most common forms that instructional tech hardware takes right now are the traditional desktop computer or workstation, traditional laptops, document cameras, other kinds of cameras and interactive whiteboards. However, those certainly aren’t on teachers’ “wishlists.” That compilation is led by 3D technology, primarily 3D scanners and 3D printers, mentioned by 31 percent and 26 percent of respondents in that order. Virtual reality gear comes in third, and detachable tablets, such as the Microsoft Surface or Lenovo Yoga, is fourth.

On the software front, presentation applications currently lead the pack in terms of usage in the classroom, closely followed by word processing programs, gradebook apps and online video services, such as YouTube or Vimeo. In this category of wishlist, animation software is No. 1, followed by 3D modeling software.

The majority of teachers in the survey (60 percent) have shifted from using paper-based textbooks to using a mix of printed matter and digital content. Most of that digital content is made up of open educational resources. Oftentimes, OER refers to a type of complete digital textbook made available for free that can often be modified and customized by the instructor for his or her class. In this case, we suspect that most of the OER teachers are referencing here consists of other kinds of learning content such as web 2.0 resources — and not just textbooks.

### Getting Tech Help

A large majority of educators in this survey are fairly confident about their tech abilities. A solid 84 percent said their tech skills are “maxed out” or that they know enough to “get the job done” and adapt to new tech “quickly.” On the other end, a tiny number of respondents (less than 3 percent) acknowledged that they have tech skills that are “below average” or even nonexistent.

However, they weren’t so confident of the tech abilities of their students. Nearly half (47 percent) said students were only average in this area. Fewer — 44 percent — said their students were either excellent or above average.

It isn’t just the tech abilities of students that concern teachers either. As a librarian for a San Antonio, TX-based elementary school acknowledged, “The longer I teach with technology as a tool, the less equipped...
children seem to be to use it. Their memories seem to function less; they appear to be lazier; and they expect the technology to do everything for them, without any effort or thought on their part. It is horrifying.”

While she was happy enough to use tech to her “advantage,” she added that she believes teachers are being told to “use it with children far too soon in their developmental process — to their detriment. I do it because I am expected to do so.”

If other teachers agree with that sentiment — that they’re “expected” to use tech in teaching — at least they feel supported to some extent. In a salute to school leadership and IT organizations, two-thirds of respondents (63 percent) said they have adequate support and training for the tech they use.

But when help is needed, teachers don’t necessarily turn to the help desk first. The most frequent response was to do an online search (37 percent) or turn to peers (23 percent).

However, in spite of working with a corps of educators who possess an overall readiness to perform self-help in tech matters, school and district leaders would do well to remember this advice from a Baker County, FL eighth-grade teacher: “Our school could greatly benefit from having a full-time technology trainer/coach. Our teachers have an interest in incorporating technology more often, but need help getting started and troubleshooting.”

### SOFTWARE IN USE IN TEACHING ENVIRONMENTS

<table>
<thead>
<tr>
<th>Software</th>
<th>In use now</th>
<th>Will be in use within one year</th>
<th>Not in use but on my wish list</th>
<th>Not in use at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation software (PowerPoint, Keynote, Prezi, etc.)</td>
<td>96%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Word processing</td>
<td>89%</td>
<td>2%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Gradebook</td>
<td>94%</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Online video services (YouTube, Vimeo)</td>
<td>90%</td>
<td>2%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Classroom management</td>
<td>69%</td>
<td>5%</td>
<td>5%</td>
<td>21%</td>
</tr>
<tr>
<td>Collaboration/whiteboard software</td>
<td>67%</td>
<td>5%</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Games</td>
<td>65%</td>
<td>7%</td>
<td>9%</td>
<td>23%</td>
</tr>
<tr>
<td>Subscription-based education streaming services</td>
<td>60%</td>
<td>8%</td>
<td>10%</td>
<td>27%</td>
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<tr>
<td>Image editing</td>
<td>60%</td>
<td>4%</td>
<td>10%</td>
<td>26%</td>
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<tr>
<td>Learning management system</td>
<td>58%</td>
<td>6%</td>
<td>7%</td>
<td>28%</td>
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<tr>
<td>Video editing</td>
<td>56%</td>
<td>5%</td>
<td>9%</td>
<td>36%</td>
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<td>E-books</td>
<td>63%</td>
<td>6%</td>
<td>9%</td>
<td>22%</td>
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<tr>
<td>Social media services</td>
<td>51%</td>
<td>9%</td>
<td>17%</td>
<td>32%</td>
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<tr>
<td>Lecture capture/screen capture</td>
<td>46%</td>
<td>6%</td>
<td>10%</td>
<td>38%</td>
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<td>Audio editing/mixing</td>
<td>44%</td>
<td>6%</td>
<td>12%</td>
<td>38%</td>
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<td>Adaptive learning</td>
<td>34%</td>
<td>6%</td>
<td>12%</td>
<td>48%</td>
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<tr>
<td>Animation software</td>
<td>34%</td>
<td>6%</td>
<td>12%</td>
<td>48%</td>
</tr>
<tr>
<td>E-portfolios</td>
<td>34%</td>
<td>11%</td>
<td>12%</td>
<td>42.5%</td>
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<tr>
<td>3D modeling</td>
<td>21%</td>
<td>6%</td>
<td>16%</td>
<td>57%</td>
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### TYPE OF TEXTBOOKS IN USE IN CLASSES

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<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Paper</td>
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<td>Electronic</td>
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<tr>
<td>Mixed</td>
<td>60%</td>
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### USE OF OPEN EDUCATIONAL RESOURCES IN CLASSES

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<tr>
<th>Availability</th>
<th>Percentage</th>
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<tr>
<td>Yes</td>
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<td>No</td>
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### TEACHERS REPORTING ON THEIR OWN TECH ABILITIES

<table>
<thead>
<tr>
<th>Confidence Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolutely confident. My skills are maxed out.</td>
<td>19%</td>
</tr>
<tr>
<td>Very confident. I get the job done and adapt to new tech quickly.</td>
<td>69%</td>
</tr>
<tr>
<td>My tech skills are adequate.</td>
<td>14%</td>
</tr>
<tr>
<td>I lack confidence. My tech skills are below average, and I’m a bit overwhelmed by new technologies.</td>
<td>2%</td>
</tr>
<tr>
<td>I’m extremely incompetent with technology. I need help all the time.</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

### TEACHERS REPORTING ON THE TECH ABILITIES OF THEIR STUDENTS

<table>
<thead>
<tr>
<th>Tech Ability</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>5%</td>
</tr>
<tr>
<td>Above average</td>
<td>39%</td>
</tr>
<tr>
<td>Average</td>
<td>47%</td>
</tr>
<tr>
<td>Below average</td>
<td>9%</td>
</tr>
<tr>
<td>Failing</td>
<td>&lt;1%</td>
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</tbody>
</table>

### ACCESS TO ADEQUATE SUPPORT AND TRAINING FOR TECHNOLOGY IN USE

<table>
<thead>
<tr>
<th>Availability</th>
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<tr>
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### PREFERRED SOURCE FOR HELP WITH TECHNOLOGY

<table>
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<td>Peers</td>
<td>23%</td>
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<td>Help desk/IT department</td>
<td>17%</td>
</tr>
<tr>
<td>Instructional technologist</td>
<td>11%</td>
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<tr>
<td>Students</td>
<td>4%</td>
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<tr>
<td>User forums</td>
<td>3%</td>
</tr>
<tr>
<td>Vendor support</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Product manual</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Other</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
**What the Future Holds for Technology in Teaching**

Overwhelmingly, educators believe that tech will play a positive role in education in the future.

## TECHNOLOGY WILL PLAY A POSITIVE ROLE IN EDUCATION IN THE FUTURE

| Yes | 99% |
| No  | 1%  |

However, the technologies that exist in classrooms today won’t necessarily be the same ones that are around in 10 years. Respondents were asked in an open-ended question to predict what education tech would die over the next decade. Desktop computers were mentioned by 38 percent of the 1,073 people who suggested anything at all. That type of tech won hands-down by a margin of nearly 2-to-1 compared to the next most popular vote: interactive whiteboards, referenced in 20 percent of the votes.

### TECHNOLOGIES CURRENTLY USED IN EDUCATION THAT WILL BE DEAD AND GONE IN THE NEXT DECADE

1. Personal cell phones/mobile phones/mobile devices
2. Desktop computers
3. Interactive boards
4. Printers
5. iPads
6. Non-interactive projectors
7. Internet limitations and outages
8. Wiring and cabling in any form
9. Document cameras
10. Gradebooks

The two choices that blow all other suggestions out of the water were 3D *anything*—scanning, printing and design—and augmented and virtual reality. These two categories each received hundreds of votes by teachers.

### TECHNOLOGIES THAT WILL BECOME IMPORTANT IN EDUCATION OVER THE NEXT DECADE

1. 3D anything—scanning, printing, design
2. Augmented and virtual reality
3. Mobile devices, especially tablets, as well as laptops
4. Chromebooks
5. Interactive displays, projectors, screens, walls
6. Robots and robotics
7. Coding and computer science lessons
8. Learning management systems
9. Smart watches, smart wear
10. Cloud-based services, including apps, storage, computing

But desktop computers only came in second when we asked people to specify which classroom tech they wished would die. The top choice there was the student cellphone, mobile phone or mobile device. Many of the same items show up on both lists, but people were also more creative as they pondered what they’d kill off. For example, many suggested doing away with Internet limitations (including web filtering) and outages as well as wiring and cabling “in any form.”

And since respondents were dreaming big, we also asked them to predict which emerging technologies would become important to education in the next decade.

The result: Kids use the tablets to look for pornographic images and any curiosity. He concluded, “There is no app for that.”

A high school teacher in Philadelphia wishes there were more “vision in the field of what technology can do for the classroom.” Right now, he pointed out, “There is still a great deal of fear and push back from educators, administrators and parents on the use of technology in the classroom and even more so regarding online/distance learning.”

A library media specialist for a high school in Washington said her “biggest frustration” is the teachers who “don’t care what students use as long as they just keep/took busy.” What she’d like is for teachers to “change their outcomes and instruction so technology is used more as the great tool it is.”

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But, like over-reaching predictions that foretold the death of printing once e-mail became ubiquitous, schools follow their own timetables in these matters, as a secondary school teacher in Dudley, NC pointed out. “Some items that I would say will be gone in the next decade for businesses and home will still be in use for schools. The same is true for ‘emerging’ technology. Some items emerging now will not be emerging for schools [for another] 10 to 15 years.” She includes in that category items such as netbooks that surfaced more than a decade ago for personal use and are only now finding their way into school systems.

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now showing up in schools in an evolved form: the Chromebook.
If there’s one conclusion we could reach by reading through the results of this first tech-enabled teaching survey, we’d have to say that educators are a hopeful bunch. Exclaimed one high school teacher in Tuscaloosa, AL, “I am excited to see what the future will hold!!” Declared another who works in an alternative learning environment in Lonoke, AR, “I think we have barely begun to tap into the possibilities that technology has in store for the future.”

Dian Schaffhauser is senior contributing editor for THE Journal. She is a writer who covers technology and business for a number of publications.

David Nagel is editor-in-chief of THE Journal.

YOU MUST REMEMBER THIS: A NOTE TO SCHOOL LEADERS

Respondents in this survey on tech in teaching offered plenty of guidance for school leaders and district tech enthusiasts, most of it focused on teacher preparation and budgetary constraints.

“We can have all the technology/hardware in the world,” said one tech director in a New Lenox, IL high school. “But unless teachers change the way they teach, it is of no use!”

A teacher at a Denver elementary school agreed with that assessment. “The difficulty with tech in education is realizing [it] will not automatically make you a better teacher.” As he observed, “It is simply another vehicle/modality of learning.”

A CTEC teacher in Woodland, CA wishes district leaders “would stop chasing the latest-and-greatest fads.” His advice: “Listen to the teaching faculty in the field before buying what the sales reps are selling.”

That opinion was seconded by an elementary school STEM teacher in Missoula, MT. “The technology we need costs more than our budgets allow. We are always scraping for more money, having fundraisers, writing grants, begging for donations, etc.” If American teachers “want to lead the world in educating our children,” she said, “we have to invest in them.” That includes investing in training teachers too by “giving them time to learn in a supportive environment.”

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THE CHANGING ROLE OF THE CTO
As technology has changed K–12 education, so has it changed the role of the chief technology officer, a job title that just barely existed 15 years ago. Today's CTO is not your grandfather's infrastructure manager! **BY MICHAEL HART**

Technology is ubiquitous in today's classroom, so we sometimes forget it was just a short while ago that not even teachers had their own computers, let alone their students, who now sometimes come to school with two or three electronic devices.

*THE Journal* contributing writer Michael Hart spoke recently with four veteran chief technology officers who were present at almost the very introduction of technology to K–12 education and asked them how their jobs have changed over the last 15 to 20 years.
THE Journal: How has the role of the chief technology officer in K–12 education changed over the last 20 years?

Keith Krueger: Twenty years ago, when CoSN was started, there wasn’t a career path to what we now call a CTO. It was only about 15 years ago that we started using that as a generic term for the lead person for technology in a school district.

Kurt Madden: In the beginning it was all about wired networks and wired infrastructure. There was no wireless. Now, it’s about moving things to the cloud. It’s a lot more about facilitating collaboration and communication. And it’s about analytics. Back then, you captured student data, but you didn’t spend much time providing it for reports. We do more analytics of student and employee data to improve student results, hiring results and to improve professional learning.

Mark Finstrom: It used to be that I dealt with buying and managing the hardware and software. And I provided services to the end user. That’s no longer the case. Everything we do is integrating one thing with another thing.

Krueger: Fifteen years ago, 80 percent of your job was wires and boxes. Today, that’s only about 30 percent of the job. Now, the vast majority is understanding the educational environment and, increasingly, you have to have leadership and vision skills.

THE Journal: How has technology changed the lives of students and teachers?

Jackson: Students are connected 24 hours a day. They have the ability to collaborate and communicate all the time, to learn outside the classroom with instructional materials that are now readily available. The classroom walls have come down, learning is available at anytime and anywhere.

Madden: The biggest change for students is having their own personal technology. Ten years ago, almost no student had a smartphone. Today, even lower-income students have their own.

Mark Finstrom: Nine or 10 years ago, I wasn’t even on the cabinet. I was considered an operations person. It was not necessary for me to be involved in decisions related to instruction because the accountability was with the superintendent. Now, if I’m not at the table, they don’t know how to get to the data they’re looking for. They don’t know what systems are available for us to provide feedback.

Frankie Jackson: The primary difference is that we now work with executive-level leadership. Twenty years ago, technology leaders were thought to be leaders of hardware and software, leaders of student information systems. But since then, there’s been this gradual move to where now technology is the underlying foundation of all services.

Krueger: It has changed dramatically, but it’s less about the title and more about the scope of work. How do you help the professional learning department? How do you help everybody do things in new and powerful ways?

THE Journal: What role does the CTO now play in the district-wide decision-making process compared to 10 or 20 years ago?

Madden: The stakes are much higher today.

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Krueger: It has changed dramatically, but it’s less about the title and more about the scope of work. How do you help the professional learning department? How do you help everybody do things in new and powerful ways?
Finstrom: We’ve gotten more into the role of providing students with devices. Students take the device home with them, and they’re using it to do homework, to do social media. Parents are using them too because it may be the only computer in the household. It’s helping mom and dad possibly to get a job.

Madden: In the classroom, most of our teachers do a mixed media thing. The good ones are roaming around the classroom talking to students while the students are doing the work. Even those teachers who stay stuck at the front of the classroom, they have projectors and laptops utilizing rich media.

Finstrom: Teachers are now as mobile as mobile can be, and they would love to be even more mobile. Our goal is to untether the teacher so that interaction doesn’t require them to sit down with a device.

THE Journal: What was the big challenge to CTOs in the past, and how does it compare to today?

Jackson: The great challenge in the past was moving PCs into every staff member’s hands. We weren’t even thinking about student computers at that time. Now we’re building an infrastructure to support everybody, not only to access devices provided by the district, but so they can bring their own devices and connect to the network. They’ve got phones, their own laptops, a district laptop. They may have a watch. We’re planning for wearable technology.

Krueger: The biggest complaint about the CTO in the past was that they were Dr. No. Their job was to lock down the network and to centralize the decisions for what got on the network. Now, the vision we have as a professional is to enable a collaborative environment. The path to IT leadership differs for women and men. The vast majority of women come from educational and instructional backgrounds (72 percent). The majority of men (54 percent) come from technology or technical backgrounds.

Racial diversity in IT leadership is lacking. Ninety percent of school IT leaders are white.

IT leaders have advanced education, with 75 percent earning some credit beyond their bachelor’s degree.

More than one-third of IT leaders plan to retire in the next six years.

10 Findings from the CoSN 2016 IT Leadership Survey

EACH YEAR, CoSN conducts a survey of technology leaders in K–12 education. Typically, the survey paints a picture of how the field is changing and provides an overview of the challenges CTOs are facing, as well as their shifting priorities.

The 2016 survey results were released in early May, and listed below are 10 key findings of the survey. The complete survey is available for free at cosn.org/itsurvey.

1. Broadband and network capacity is the top priority for IT leaders, replacing assessment readiness (which for the first year failed to make the top 3).

2. Privacy and security of student data is an increasing concern for IT leaders, with 64 percent saying they are more important than they were last year.

3. Nearly 90 percent of respondents expect their instructional materials to be at least 50 percent digital within the next three years.

4. Virtually all responders (99 percent) expect to incorporate digital open educational resources (OER) over the next three years, with 45 percent expecting their digital content to be at least 50 percent OER within that time frame.

5. Nearly 80 percent of IT leaders use online productivity tools — the largest use of cloud-based solutions in education.

6. District bans on student personal devices are a thing of the past — only 11 percent have banning policies.

7. The path to IT leadership differs for women and men. The vast majority of women come from educational and instructional backgrounds (72 percent). The majority of men (54 percent) come from technology or technical backgrounds.

8. Racial diversity in IT leadership is lacking. Ninety percent of school IT leaders are white.

9. IT leaders have advanced education, with 75 percent earning some credit beyond their bachelor’s degree.

10. More than one-third of IT leaders plan to retire in the next six years.
the network. So we immediately utilized E-rate and were able to put fiber optic lines to all our schools and then began to do the wireless deployment.

Making sure there is enough access is still the biggest challenge. Moving to cloud structure is one of those shifts you want to make sure you do right.

Jackson: The other challenge is student safety. It used to be that students sat in the classroom and teachers could keep their eye on them. Now, once you give them a device, they can spin off and request information on the Internet and we have to be concerned about filtering content and appropriate, responsible usage.

**THE Journal:** When it comes to the skills required of a CTO, is there any tension between technology and education?

Krueger: I wouldn’t exactly call it a tension. A lot of times people think that’s you’re the MIS [management information systems] director. That isn’t the strategic piece most districts want you to meet though. You can contract out the technological stuff, but you can’t contract out the leadership and understanding of the educational environment.

Finstrom: If a technologist doesn’t act like an educator, they will drive the technology side of the house in an efficient manner for them and leave the education behind. I know there are people still in that old mindset.

I’ve got a master’s in curriculum and instruction. Being an educator has allowed me to probably be more “all in” with the leadership team because I’m able to address things we’re talking about. But I know peers who don’t have that background are put into that role and, hopefully, have learned enough through their interaction with teaching and learning to know how to respond on an educational point of view as well.

**THE Journal:** What will the CTO of the future have to know and do that today’s technology leaders don’t have to worry about?

Finstrom: The CTO of the future has to be a change agent, an innovator and a thinker. The one that is going to drive change. We’re not going to be dealing with the data in future years because other people will know it well enough to be able to do it. We will be innovating instructional practice.

Krueger: We need to ask ourselves what we even mean by technology. I like what one of the founders of Apple, Alan Kay, said: “Technology is anything that came after you were born.” Less and less the word technology will be in the CTO’s title. More and more it will be chief innovation officer. We’re going to see, as technology becomes less and less visible, innovation becomes more and more critical.

Jackson: Our entire business is based on the ability to connect. If e-mail goes down, we’re dead in the water. We just can’t work. As we move more applications into the cloud, an absolute guarantee of 100 percent connectivity will have to be more of a priority.

Madden: We’re really switching to it being about information and less about devices. You won’t have to worry about devices. You’ll be focused on the flow of communication and information. The emphasis will be on how you can help people make better decisions.

**THE Journal:** What advice do you wish somebody had given you when you first became a CTO?

Finstrom: Don’t be afraid of change. I wish a mentor would have said, “Just start making things happen.”

It took me three years to get to the point where change was something I should initiate. Now I do it every day. It’s part of my job.

Madden: I wish somebody had told me how long it takes to get things done. I was not used to the pace in public schools and the tendency to maintain the status quo. You can’t just come in and change things quickly. You’re a cruise ship that takes 3 degree turns, not a jet airplane.

Jackson: I started my career in mission operations at the Johnson Space Center. I came from a very technical career to public education. I wish somebody had told me how far behind public education was. I never thought a district in 1994 wouldn’t have a network. There was not the understanding that technology would come to be so mission-critical.

Michael Hart is a Los Angeles-based freelance writer and the former executive editor of **THE Journal.**

### What Does a CTO Do?

**IN AN EFFORT** to assist public school districts, CoSN has established a “Framework of Essential Skills of the K–12 CTO,” comprising three primary professional categories that attempt to define the work of leaders in the education technology field. These categories encompass specific skill areas that outline the responsibilities and knowledge needed to be a viable educational technology leader.

#### 1. Leadership and vision
- Ethics and policy
- Strategic planning

#### 2. Understanding the educational environment
- Instructional focus and professional development
- Team building and staff
- Stakeholder focus

#### 3. Managing technology and support resources
- Information technology management
- Communication systems management
- Business management
- Data management
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On-campus connectivity is critical to enhanced learning experiences, and it received a major boost in 2014. The Federal Communications Commission voted to increase funding for campus connectivity through its E-rate program by an additional $7.5 billion over five years. However, that funding didn’t address the problem of families without high-speed internet in their homes.

A February 2016 report on “Digital Equity,” produced by the Consortium for School Networking (CoSN) and co-sponsored by Dell and other organizations, reports five million American households with school-age children lack broadband connectivity. A “disproportionate number” of those families are low-income.

CoSN considers this situation a “critical problem.” Anywhere/anytime learning can’t happen when students lack reliable, high-speed connectivity. Likewise, as school and teacher communications with families are increasingly handled through on-line forms, this “homework gap,” as the February report points out, is becoming a “widening chasm into which parents/guardians also fall.”

If you’re in one of the 75 percent of districts with no strategy for providing connectivity to students at home or after school, here are five ways to tackle the challenge of delivering internet access outside the classroom.

**Extend school reach:** While two-thirds of school districts (68 percent) told CoSN they lacked sufficient internet bandwidth for the computing activities going on during the school day, that same bandwidth is barely tapped at all when school closes for the day. An increasing number of school systems are providing access to hotspots students can access after school hours. Rowan-Salisbury Schools in North Carolina, for example, keeps its elementary schools open at least one afternoon each week as wireless hotspots. Some go even farther. Kent School District in Washington runs a “Student Technology, Access and Resources (STAR) Kiosk” program that sets up computer kiosks with Wi-Fi signals at apartment complexes, church lobbies and other sites for students to pick up and submit homework.

**Team up with local government and colleges:** Both Austin, TX and Davidson, NC have instituted programs to deliver devices and broadband to those needing them through “digital inclusion” projects. These are supported by city government, higher education, corporate benefactors and non-profits. Both initiatives won “digital inclusion leadership awards” last year from Next Century Cities.

**Point people to free Wi-Fi:** Some districts are compiling surveys of free wireless access in the area to help people find places where they can do their work. The Fairfax, VA “community internet access maps” compilation includes schools, libraries and local community and career centers. A similar effort in Forsyth County, GA includes businesses as well—dentists and doctors, car dealers and restaurants—that have requested inclusion on the list.

**Promote low-cost access:** Connect2Compete (for families of students who participate in the National School Lunch Program) provides reduced pricing on “fast, affordable internet” with no deposit, contract or fee related to installation or modem rental. EveryoneOn, which runs the program, partners with major service providers including Cox and Comcast. AT&T runs a similar program for families participating in the U.S. Supplemental Nutrition Assistance Program (SNAP). The FCC has also updated its Lifeline Support program. Its discounts now cover a landline or wireless service for eligible low-income households.

**Go for grants:** Dozens of national organizations and hundreds of local groups offer funding for education initiatives. The National Education Association Foundation offers “student achievement grants” and the Foundation for Blended and Online Learning runs a teacher grant program. Both provide money to initiate student access programs. These and many other examples are listed in a database of possible funding sources compiled by education technology company Kajeet in its “Homework Gap Funding Sources” website.
Prepare Your School for a Data Breach

A thumb drive with personal information is misplaced. More data is sent than requested. Server vulnerabilities are discovered. An online program is misused, unintentionally exposing student information. A student steals school data and keeps it on a flash drive. Those are just a few of the data breaches reported between January and June 2016 at seven school districts, according to information maintained by the Privacy Rights Clearinghouse.

In most of these cases, there was no apparent harm done. There was only the possibility of data theft. The district’s reputation was tainted. And funding that could have been invested in education had to be redirected to forensic analysis and credit monitoring services.

Accounts of those data breaches may not surprise many IT education leaders. According to a recent THE Journal survey, more than 1 in 10 schools (14 percent) reported they had uncovered a data breach within the previous 12 months. Breaches were more likely to happen in districts with 15,000 or more students (24 percent) than in smaller school systems.

As the number of computing devices on campus dedicated to learning increases, so too does the potential for problems. While much of the network security response typically focuses on putting systems in place to minimize exposure, less time is spent preparing for the inevitable—the day when somebody in your school community uncovers a data breach. What do you do then?

Almost every state has some form of data breach notification laws. These require that you contact affected individuals and notify them about the potential loss or access to their sensitive information. However, they don’t necessarily provide strong guidance on how to manage the details of that process, particularly if you work in a school.

Practice Your Response
That’s why the Privacy Technical Assistance Center, an office in the U.S. Department of Education, has developed its “data breach response training kit.” The kit includes a data breach “checklist” that covers how to identify and monitor personally identifiable information (PII) residing in school systems. It also spells out how to create a data breach response policy and how to actually respond to a breach.

One major recommendation is to run privacy and information security training on a regular basis. To help with that, the kit includes practice materials to put people into the shoes of school leaders who need to respond to a data breach. The session is timed to run between an hour and two hours with teams of five to seven people working together.

In the practice scenario, a teacher notifies the IT manager that course grades in the system have been changed. Apparently, somebody has logged into the gradebook with the teacher’s user name and password (kept on a sticky note) to raise everybody’s scores. At the same time, the logs indicate reports containing staff PII have been downloaded.

Training participants must develop response plans that evolve as they receive additional information. The scenario grows in seriousness to reflect what happens in real life—PII posted to Facebook pages, news of the breach leaked, and concerned parents calling the school.

Safeguarding PII is a multi-step process. It starts with the caliber of security systems you put in place, but that certainly isn’t the end of the story. Schools must learn to minimize the amount of personal information they collect. They need to secure and safeguard this information. When transferring PII, it must automatically be encrypted or password-protected. And finally, the data must be disposed of properly when it’s no longer needed.

Even with the best measures in place, though, data breaches occur. When one hits your district, practice can make your response perfect.
CONTENT FILTERING IN THE ERA OF 1-TO-1

Even though the Federal Communications Commission bumped up funding through its E-rate program, one thing has not changed for schools. If they’re pursuing discounts related to internet access or internal connections, they still need to filter web content as part of Children’s Internet Protection Act (CIPA) compliance.

Districts are used to running web filters to meet this requirement for computers at their campuses. In this era of 1-to-1 programs and flipped classrooms, where students are expected to continue their online studies after class, schools are less accustomed to ensuring devices taken off campus are filtering web content as well. In fact, in a recent THE Journal survey 3 in 10 respondents (29 percent) acknowledged they don’t filter district-provided devices outside of school.

Those school systems are putting themselves into a risky position, says Scott Grebe, who manages product marketing for SonicWALL’s security products. “Imagine you’re the principal of a school. The last thing you want is to get a phone call from a very angry parent saying, ‘You gave my child an internet-enabled device [without protection], and he/she took that device off-campus and was able to access all the sites students are not allowed to when at school. You did nothing to protect my child.’”

Your school’s content filtering technology and strategy needs to adapt to new challenges brought about with the growth of 1-to-1 programs. The next time you’re evaluating web content filtering programs, consider adding new kinds of capabilities to your evaluation rubric.

Extend Filtering Off-campus

The basic idea behind content filtering solutions is to establish policies regarding the type of sites or URLs those with specific school roles can visit. Those roles include teacher, staff, and student. When the user directs the browser to that site or URL, a filtering engine checks the policies and either allows access to the site or alerts the user that the site has been blocked. The newest content filtering applications deliver that same capability no matter where the device is located—inside or outside the district network.

SonicWALL is a frontrunner in this category. There are two complementary products to address the dual nature of on-campus and off-campus filtering. SonicWALL Content Filtering Service (CFS), as part of an overall security appliance, is oriented to schools needing automatic protection when devices are behind the school firewall. SonicWALL Content Filtering Client (CFC) helps IT deliver web content filtering policies for roaming devices—the ones taken home by students each day—from the cloud. Both support Windows, Mac and Chrome OS devices.

“We try to integrate them as much as possible so that the user experience is as seamless as possible in order to eliminate any boundaries from a functional standpoint,” says Edgar Godoy, SonicWALL, product management “ninja.” At the same time, IT can maintain different policies that take effect for on-premises usage or for roaming. For example, student access to certain social networking or online chat sites may be looser when they’re on a device at home versus in the classroom.

Both approaches have benefits. That same THE Journal survey found among those districts that filter web traffic on school-owned devices off campus, 50 percent filter through a VPN that transports requests back to the district data center. The “tunnel all” mode routes traffic to and from the remote user over a VPN tunnel. However, among schools Godoy has consulted, the new best practice (in use by 30 percent of respondents) is to use the client approach and filter directly from the cloud.

More Nimble Control

Schools also need the ability to adjust content filtering controls more rapidly. Previously, says Godoy, schools used all-encompassing website blocking. “We immediately saw the need to provide the ability to bypass those restrictions for those times when teachers would like to study a specific topic and want to bypass the traditional blocking.” For the software to achieve that, it needs some kind of “challenge mechanism” granted to specific users to let them access specific websites required for an assignment for a limited period of time.

Proactive Response

The innate ability of filtering programs to discover web access patterns and identify the user creating those patterns provides benefits beyond CIPA compliance. These solutions can now alert staff when certain search patterns emerge, especially useful when those trends could point to problems. If students are having a hard time with bullying or depression, for example, IT can be proactive about alerting principals and counselors. As SonicWALL’s Godoy explains, “These products can now help schools be in closer contact with the students.”

For more information on SonicWALL solutions, visit https://www.sonicwall.com/solutions/education/
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What Makes a Great Makerspace?

As schools across the country are demonstrating, makerspaces aren’t just about technology. They’re about giving outlet to students’ creativity. Spaces can be as elaborate as sophisticated machine shops or as simple as libraries converted to support hands-on learning.

The Maker education movement has sparked a minor revolution in K–12 STEAM education. A growing number of schools and entire districts across the country are implementing dedicated, in-school makerspaces — sometimes called STEAM labs or fab labs — where students are encouraged to experiment, invent and tinker with a range of materials and technologies. But what constitutes an effective in-school makerspace?

“A makerspace is more of a mindset than a toolset,” said Casey Shea, curriculum coordinator for maker education for the Sonoma County Office of Education (SCOE). “Many of the most successful makerspaces I’ve seen started with very little equipment and a lot of creativity. It’s a fundamental mistake to think that dropping a 3D printer into a room will turn it into a makerspace.”

Shea has been involved with the maker education movement almost from its inception. During the 2011-2012 school year when Dale Dougherty, the publisher of Make Magazine and founder of the Maker Faire, approached him about an experimental maker education project. Shea ended up leading a class of about 30 young makers, who met at the magazine’s nearby headquarters twice a week.

Analy’s Project Make is now taught on campus and includes three sections open to 9th–12th graders. The program has emerged as something of a model for hands-on learning. In fact, Shea worked with educators at Sonoma State University to develop a 50-hour, first-of-its-kind Maker Certificate Program, designed for people seeking to lead maker activities in schools, clubs, community centers, libraries and other organizations.

In his new role — he was appointed in July 2016 — Shea helps educators throughout the county establish and expand “making opportunities” in their schools and classrooms. He said he believes that “making and tinkering” and the philosophies behind those activities are an essential part of the formula for a true 21st century education.

“Making is definitely not a fad. One of the...
secrets to providing students with an effective in-school makerspace lies in keeping its fundamental purpose in mind, Shea said.

“A successful in-school makerspace provides kids with a variety of tools and materials and the freedom to create,” he said. “It’s really that simple — and that challenging. There’s a lot of great technology out there finding its way into these spaces — laser cutters, 3D printers, robotics technologies and all kinds of computing components. But honestly, it doesn’t have to be equipped with high-tech digital manufacturing tools to be an effective makerspace; it can be stocked with glue guns and cardboard if students are engaged and using their hands and minds to create and solve problems.”

Analy High’s in-school makerspace is a converted shop-class building with a concrete floor. It’s equipped with a laser engraver and a vinyl cutter, among other high-tech equipment, as well as tools for wood and metal working. The space, which is also used to host classes for non-student members of the community, is well organized with labeled shelves and areas sectioned off for different types of projects.

“The shop classes I took in a space like this were, more often than not, about following a set of plans, and you were assessed on how well you followed those plans,” Shea said. “There was a time when that approach made sense. But that’s not what this space is about today.”

A makerspace can be a combination of woodshop, computer lab and art studio, so the space has to be flexible, Shea said.

“When things are cooking in a makerspace, you might have 15 to 20 very different projects going at one time,” he said. “Students occupying the same space might be building everything from micro-controlled robots to hardwood furniture, drones to squishy circuits made with conductive Play-Doh. A lot depends on what materials and tools are available at the school. There’s a random element to all this; a local business might contribute some lumber or some Arduino microcontrollers. And things get repaired and repurposed in this environment. A successful makerspace has the flexibility to accommodate all this.”
A High-End Makerspace for the Whole Community

As an example of an in-school makerspace designed from the ground up, Shea points to Lane Tech College Preparatory High School in Chicago. It’s an environment rarely seen in high schools, where space repurposing is the norm.

The Lane Tech Innovation and Creation Lab is clean and open, and it’s equipped with four Epilog laser cutters, 10 MakerBot and UP! 3D printers, six ShapeOko2 CNC mills, four Silhouette Cameo vinyl cutters, four MakerBot 3D Scanners, 30 MacBook Pro Retina laptops, two 15-foot wall projectors, a mobile Smart Board, multiple custom-designed workspaces with power drops, collaboration spaces with HDTV and laptop HDMI switching, a large variety of production and prototyping materials and “a variety of power and hand tools.”

Learning Commons: Where Librarians Support Maker Activities

Of course, an in-school makerspace doesn’t have to be purpose-built to be effective. Nor does it have to be a place where woodchips are flying at one end while circuits are being soldered at the other.

Traditional libraries, for example, are being used to implement maker education in a number of K–12 districts. The Castle Rock Middle School library, for example, is one of a number of school libraries in Colorado’s Douglas County School District redesigned to accommodate a makerspace. Called a Learning Commons, the space exists within the library, surrounded by shelves of books, and the maker classes are actually supported by the librarians. Curved tables encourage collaboration among the young students, who also have access to a 3D printer and lots of laptop computers. An estimated 50 libraries in the district have made, or are making, this change.

“Now [the library] is a place where kids whose talents haven’t been tapped into before have a place to call home,” said Castle Rock librarian Yvonne Miller in a promotional video. “While still fostering a love of reading and books and something that I, myself, love, it has something more, too. It’s joyful, and it’s noisy, and it’s full of love and laughter and light and kids who are experimenting and playful with their learning.”

Innovation Centers: Cultivating Collaboration

In the Brevard County Public School District in Florida, existing library media centers have been repurposed as 21st century makerspaces, which the district is calling Innovation Centers. The spaces are organized to support things like computer coding and robotics, 3D printing, electronics and circuits, building and construction and even “consumables.” Even with a grant from Northrup Grumman to launch a pilot Innovation Center project in six schools, the budget was tight, said Technology Integrator Pam Aulakh and Library Media Resource teacher Gina Clark in a blog post.

The space was furnished with inexpensive, adjustable tables with whiteboards on top. “We picked simple chairs in bright colors to make the space more inviting and lively,” they said. They also purchased three daVinci Jr 3D printers and a variety of mobile devices for each space, and a 70-inch Promethean ActivPanel for each of the Innovation Centers. “These panels help students to collaborate on projects, 3D modeling and communication,” they said.

“There’s no single way to design a great in-school makerspace,” Shea said, but if there is a common element among spaces that truly foster the maker mentality, it’s that collaboration piece.

“You don’t want to feel like you’re working alone in your garage,” he said. “In a well designed space, I can look over somebody’s shoulder to see what they’re working on, and that might trigger something that fits into something I’m working on or thinking about. The space shouldn’t be like a secret R&D lab. It’s more like an ongoing, transparent beta test. Open and messy is better.”

John K. Waters is a freelance journalist and author based in Palo Alto, CA.
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Enhancing Classroom Audio: Beyond Amplification

Systems designed to improve audibility in classrooms are changing. They used to be all about amplification. That’s still the single most critical component. But systems are now also adding lecture capture, emergency features, paging, monitoring and collaboration capabilities to enhance not just sound, but student learning as well.

In Louisiana’s Calcasieu Parish Schools, a classroom audio system called Flexcat is helping to support more collaborative learning. Teachers can project their voice to the entire class, enabling students to hear more effectively — but they also can listen in on up to six distinct clusters of students as the children work on projects in small groups. Teachers can monitor this group work from a distance, giving students the opportunity to feel independent while still making teachers available to support those students, if needed.

“What we have found as a result is much more engaged classrooms,” said Sheryl Abshire, the school system’s chief technology officer. “I’ve been to quite a few classrooms with the Flexcat system in them, and I’ve seen students working on different projects and teachers being able to manage those classrooms in a way that I haven’t seen before.”

The Flexcat system is one example of how classroom audio systems have become more sophisticated in recent years. No longer just technologies that amplify the teacher’s voice so students can hear better, today’s classroom audio systems often can perform multiple functions.

Voice amplification is still as important as ever. Studies suggest that voice amplification systems can help improve student achievement and lower special education referral rates, while also leading to better classroom management and fewer teacher sick days as a result of voice strain. And earlier this year, researchers concluded that ambient noise is more distracting to a child’s brain than an adult’s, hindering how students learn. In fact, the ability to understand and process speech against competing background noise is a skill that doesn’t mature until adolescence, the researchers said.

But classroom audio systems have advanced beyond just voice amplification to include additional features. For instance, manufacturers such as Audio Enhancement, Extron Electronics, FrontRow and others have offered emergency alert capabilities on their teacher microphone pendants for some time now. With this life safety feature, a teacher can notify the front office or other staff members if there is a classroom emergency with just the push of a button.

Audio Enhancement and FrontRow
sound systems also include lecture capture features, allowing teachers to record the audio from a lesson and make it available for students who want to hear it again as they are reviewing the concept — or for those who might have been absent from class that day.

Smart Technologies’ Smart Audio classroom amplification system integrates with the company’s Smart Notebook software and is designed to work with a Smart Board interactive whiteboard. Smart Notebook software has a Gallery feature that comes with audio files a teacher can play through the Smart Audio system’s speakers. The software also includes a Recorder tool that teachers can use to capture their voice or a student’s voice and save the recording for use in future Smart Board lessons.

Lightspeed Technologies has made it easier for teachers to manage collaborative group work with its Flexcat audio system. And both Audio Enhancement and FrontRow have developed products that integrate paging and classroom audio within a single system. FrontRow’s Juno Connect even allows teachers to control a classroom projector or record the audio from a lesson with simple voice commands.

**Combining Classroom Audio and Paging**

In South Carolina’s Clover School District, several classrooms have been outfitted with the Juno Connect system to amplify teachers’ voices. But in the district’s two newest schools that are being built now, Juno Connect will be used for both classroom audio and paging, said Matt Hoffman, executive director of technology for the district — so there will be no need for a separate paging system.

“Our operations manager was very nervous about this endeavor at first,” Hoffman said. “He’s an old-school phone guy who’s been in the industry for more than 30 years. One of his reservations was, what if the power goes out? How would you tell people, ‘The school is on fire and we need to evacuate’? But Juno has a Power-Ethernet connector that allows us to pull power not from the wall but from our switch, which is on a battery backup and has a secondary generator backup. So if the power goes out, we don’t lose that classroom audio or paging ability. The teacher still has her call button to call the front office if there’s an emergency during a power loss. It just seems like a better tool, in my opinion.”

When Hoffman and his team were evaluating the Juno system, they filled a room with a dozen or so adults and asked them to simulate a classroom environment by talking loudly with each other. Hoffman then walked around the perimeter of the classroom while someone played the part of the teacher.

“I was surprised,” he said. “I could hear the teacher’s voice much clearer as he spoke into the Juno microphone, compared with just raising his voice. The projection technology was able to penetrate the chatter of all the other people in the room.”

Combining classroom audio and paging in the district’s new school buildings will save money because the district will not have to install a separate paging system. But it will bring some additional benefits as well, Hoffman said.

“If the teacher is speaking or is playing some other audio and a page happens in our legacy classrooms, that paging speaker has to be loud enough to overcome the audio that’s already being pumped into the classroom,” he said. “With Juno Connect, the page takes over the audio. So if there’s an emergency situation, the page will be crystal clear. That’s another feature that we liked: It’s cutting out the distractions and getting to the heart of the point.”

What’s more, with Juno Connect, system administrators can set up flexible paging zones and can adjust these easily on the fly.

“With our legacy paging systems, after the install is complete, you’re tied into X number of paging zones,” Hoffman said. “I can page the 100 hall, or the 200 hall — or I can do an ‘all call.’ But what if my school is so diverse that the 100 hall isn’t just first grade; what if it also has a fifth-grade class for some reason?”

With Juno Connect, “I can go in through the interface and just pick and choose from my map to dynamically change what rooms are in which paging zones,” he said. “Then, we’re not disturbing first-grade classrooms that might be in quiet time with a page that says we’re serving ice cream in the cafeteria for all fifth graders.”

**Enabling the ‘Magic’ to Occur**

Calcasieu Parish was part of a development team working with Lightspeed Technologies to think about classroom audio in different ways, Abshire said. The result of these efforts was the Flexcat system, which includes a headset and microphone for the teacher and a set of speaker pods placed strategically around a classroom.

If children are working in groups, doing project-based learning, the teacher can listen in and comment on what each group is doing from wherever she is in the room through these pods. “She can nudge them and monitor them,” Abshire said. “And the students can ask the teacher questions — so it’s a two-way communication system.”

It’s possible for teachers to manage small-group learning effectively without a system like Flexcat, she said. But this often requires a lot of “running all over the place.”

“Just when you’ve got your back turned on one group, somebody over here would need something,” she said. “We have found this technology to be a transformative tool, enabling teachers to do a better job at what they’re already good at.”

She concluded: “The magic in the classroom is what happens in the interaction between the teacher and the student. Technology enables that magic to occur — and the Flexcat system is a good example. It has empowered better teaching and learning in our classrooms. We feel like this is moving the whole concept of an engaged classroom forward in profound ways.”

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The transformation to digital teaching and learning typically takes three years. What does this transformation look like in years 1, 2, 3 and beyond? It depends on what a district does to prepare before even beginning. Depending on the size and culture of a district, it is common and appropriate to start planning for the digital leap 12 to 18 months in advance.

CoSN, the Consortium for School Networking, has developed a framework that outlines the conditions for transformation success. (See the June/July 2016 issue of THE Journal.) The framework is accompanied by a rubric that identifies what each of these areas looks like at the following stages: considering, basic, emerging and transformational.

In many cases, the “basic” level can be considered “year 1” and the “transformational” level as “year 3.” However, some conditions must be in place much earlier in the process.

**YEAR 0:** Before beginning a digital leap, the planning process must result in a clear, shared vision for teaching and learning supported by technology. Without a “true north” for decision making, the day-to-day efforts of accelerating and leading the digital leap will be scattered in different directions.

It is also important to have a brand for the initiative. It should have a name and a compelling story that can be shared with parents, students, the community and the press.

**YEAR 1:** Not only should there be a clear, shared vision in place, but schools must have autonomy in achieving it. To structure that autonomy, the district must establish initial goals, along with the metrics that allow schools to measure their progress.

YEAR 1 is a critical time to ensure that professional development is in place. Not only do teachers need to gain familiarity with digital tools, they also need to learn how to use them to support a student-centered classroom. Schools should encourage professional development through various formats, including social media, blended learning and face-to-face or shoulder-to-shoulder coaching.

For year 1, infrastructure should support the initial rollout of devices to students. The FCC and ConnectEd program set a goal of 1 Mbps per student. Often, the first year is less resource-intensive as students and teachers are getting comfortable with the technology, but there should be a plan to support full usage by year 3 and ongoing growth moving forward.

**YEAR 2:** Teachers and students should be comfortable using technology and digital tools regularly. At this point, it is critical to begin bringing innovation to the initiative. The best programs are developed not by merely following a prescriptive curriculum, but by teachers evolving their classroom practice to be more student-centric.

To support prudent risk-taking and schools as learning organizations, the district and leadership need to create an intrinsically motivating work and learning environment, providing principals, teachers, students and staff with the opportunity for autonomy, mastery and meaning.

The district should continue ongoing professional development and align resources with the new functions created by the digital leap. Old functions should be removed from the budget and the resources used to fund critical new roles.

**YEAR 3:** All teachers should be comfortable and capable of using technology in a student-centered classroom. There are often 20 percent who can’t or won’t adapt to the change, and after three years, it may be time for them to seek other opportunities.

Infrastructure should be developed to support a growing network of demands for capacity, reliability and number of devices. There should be efficient workflows for the new systems.

Finally, the district must, at this point, have funding plans and approaches that assure long-term sustainability.

**GOING FORWARD:** Moving ahead from year 3, the district will find that its vision will evolve based on what it learns and the goals reached. It is important to continually reflect on the vision and goals to keep them relevant.

Transformation is not an end-goal; it is an ongoing process. With the three-year investment, schools can become learning organizations that are, in fact, platforms for continual, ongoing transformation.

Learn more about CoSN’s framework at cosn.org/schoolsuccess.

Marie Bjerede is Principal, Mobile Learning and Infrastructure, at CoSN — Consortium for School Networking.
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