

CREATING THE CONNECTED CAMPUS:

Smart Campus Strategies
For Higher Education



INTRODUCTION

Colleges and universities are moving toward the converged and connected systems that power smart campuses. Today, almost 80 percent of higher education leaders who participated in a new survey conducted by the Center for Digital Education (CDE) and sponsored by Spectrum Enterprise have implemented or are planning smart campus initiatives. More than three-quarters (77 percent) believe their campuses will be completely connected within five years; nearly one in three (29 percent) say connected campuses will be a reality in just two years.

Higher education leaders and students both view the technology with optimism, saying it will make campuses safer and improve teaching and learning. Technology is also becoming an important factor for students deciding where to attend college. They expect to stream video content for classes and entertainment, and from anywhere on campus.

At the same time, higher education faces unprecedented challenges. The COVID-19 outbreak that sparked a rapid transition to online learning in spring 2020 is just the latest in a series of demographic and cultural shifts that is jeopardizing the traditional residential campus model. Some experts estimate four-year colleges nationwide could lose nearly 280,000 students by the end of the decade.¹

“It’s a fundamental change in how we do business going forward,” says John Fritz, associate vice president of instructional technology at the University of Maryland Baltimore County (UMBC). “Even when the current pandemic subsides, we [will] get back to campus and re-imagine how we do everything.”

Drawing from survey responses and interviews with forward-thinking higher education technology leaders, this report explores the technologies that make up smart campuses, identifies key challenges, and outlines strategies to help educators prepare for connected campuses and the benefits they bring.

ABOUT THE SURVEY

To better understand perceptions and plans for smart and connected technologies on college campuses, CDE surveyed 155 higher education leaders and 1,000 students in October 2019. Roughly half of students (51 percent) and campus leaders (46 percent) were from four-year public colleges and universities, with another quarter from public two-year community colleges (26 percent of students and 25 percent of leaders). The remainder were from four-year private universities or colleges, vocational schools, or two-year private universities or colleges. Institutions of all sizes were represented.

Campus leaders held a broad range of roles, including educators, administrative officials and staff, IT leaders, managers and procurement professionals. All were involved in technology decisions on their campuses.

UNDERSTANDING THE CONNECTED CAMPUS

As the smart campus vision continues to mature, the ways in which colleges and universities across the country use technology are changing.

“It has evolved quite a bit over the past three to four years,” says Steven Zink, a CDE senior fellow and former vice president of information technology at the University of Nevada, Reno. “There’s been a tremendous push and pull within campus administration about smart technology.”

Initially, higher education focused on instructional technology — the “smart classroom” part of smart campuses — and the emergence of Internet of Things (IoT) devices that simplified facilities management and campus safety. Now, the emphasis is shifting to convergence: connecting disparate systems in ways that leverage data to help institutions make better business decisions and improve student outcomes and engagement.

“I see a gradual transformation from the practicalities of operations, to the research function, to trying to

make the campus more connected in a social sense,” says Zink, who also served as vice chancellor of the Nevada System of Higher Education. “I think the smart campus concept has broadened — the ubiquitous network was never achievable until now.”

Using data in new ways will become particularly important if the pool of prospective students shrinks, says Jim Jorstad, director of IT client services at the University of Wisconsin-La Crosse.

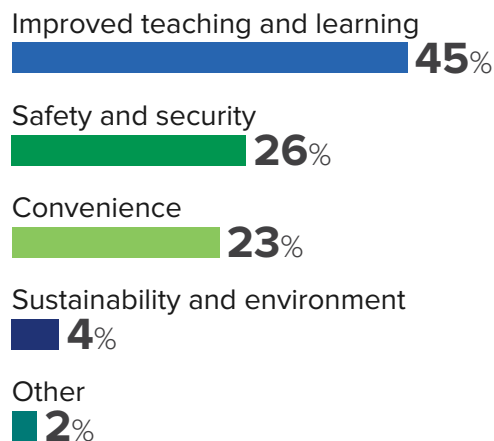
“All the different aspects of the enterprise — financial aid, residency, payroll — start coming into the mix,” he says. “We need to track the cost-basis for the campus — residence halls, food services, supplies and facilities. Today’s tools separate them out academically and administratively. In the end, you’ve got to combine them and do analyses of both.”

High Expectations

Institutional leaders view smart campus initiatives positively, with nearly two-thirds (63 percent) of survey respondents speaking favorably about efforts on their campuses. Similarly, more than half of students (55 percent) feel positively about their institutions’ progress and use of IoT devices on campus. Even more students (59 percent) believe connected campuses will make them feel safer. And most believe these technologies will arrive soon. More than half (62 percent) of students who responded to the CDE survey expect smart campuses to become a reality within five years. Nearly one-quarter (22 percent) think that will be the case within two years.

Higher education leaders also see the potential of smart campus technologies, particularly to improve

SMART CAMPUS BENEFITS



SOURCE: CDE SMART CAMPUS SURVEY

teaching and learning. Survey respondents were nearly twice as likely to consider educational improvements the top benefit of smart campus technology as the next most impactful use case, safety and security.

Teaching and Learning

For the past two decades, many higher education technology initiatives have focused on improving teaching and learning. Learning management systems (LMS) have proliferated on campuses across the country, driving both instruction and data analysis.

Even before the coronavirus pandemic abruptly accelerated the shift to online instruction, smart classroom technology and pedagogical models such as the “flipped” classroom blurred the lines between in-person and virtual instruction.

SMALL SOLUTIONS TO BIG DATA

At the University of Wisconsin-La Crosse, one sign of how big data will power smart campuses appears small at first, but it will pay high dividends, says Jorstad. The institution’s IT department recently added software requisitions to its existing web-based help desk ticketing system, simplifying for users a laborious, multi-department approval and purchasing process. Not only did the change make it easier for staff to get software they need, it also collects comprehensive data about department-specific software expenditures — “creating a data set that did not exist,” says Jorstad, which now can be used to better understand siloed purchasing decisions.

“It’s a small story, but it’s a good one because it explains how we can make our processes better, more remote, more efficient and more cost effective,” Jorstad says.

“In our old and new normal, the key is that you need to have data to analyze progress,” Jorstad says.

Now campuses are using information collected in these systems to inform teaching and learning in new ways — through early-warning systems that identify students who begin to struggle in the process, digital learning tools that help customize instruction for students, and interactive and video elements that make learning more engaging. A common thread: Helping students succeed.

“Access is not enough anymore,” Fritz says. “It’s not just about who we admit; it’s about who we

graduate, and the inequality of outcomes. We have to be more engaged with indications that students may be struggling.”

The IoT Imperative

Smart campuses increasingly are powered by the IoT. These “things,” or connected devices, first made inroads onto campuses in the form of connected heating and cooling systems, followed by smart lighting, security and access control solutions, as well as Bluetooth beacons and other tools that can help students navigate campus or track traffic patterns. Now campus leaders also see a broader role for IoT around improving the on-campus experience.

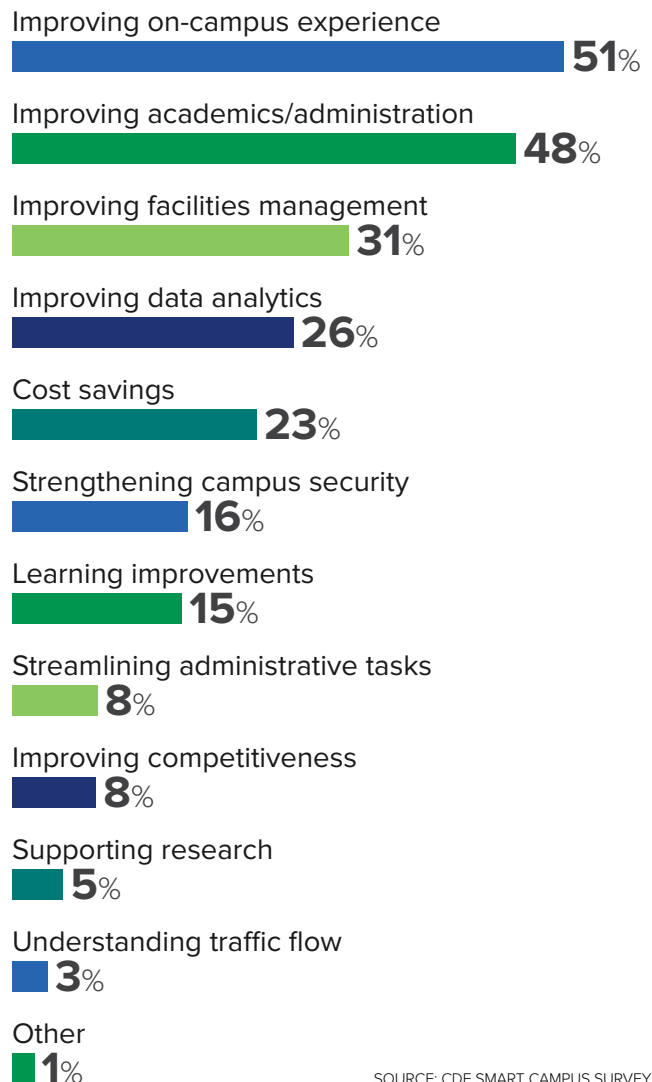
PREDICTING PERFORMANCE

The most effective predictors of student success are final grades and overall GPA, but it’s hard for educators to act on either before it’s too late. Many colleges and universities use early-warning systems that use a combination of analytics and faculty interventions to help students early in a semester or term. Data from a wide range of sources can play a key role in designing better strategies to help students succeed.

The University of Maryland Baltimore County (UMBC), for example, is mapping out a range of interventions over the length of its 15-week terms. The goal? “Getting the right message to the right student at the right time from the right person, based on signs people exhibit early on in the term,” Fritz says.

While many schools monitor indicators such as attendance, deeper analytics can surface other predictors. For example, one UMBC faculty member gives a quiz on the course syllabus — “the thing people never read” — during the first week of class, Fritz says. Data shows that students who attempt the quiz — not just those who pass it — are four times more likely to pass the course than those who don’t. “We need to start looking at things like this,” he says.

IOT USE CASES



SOURCE: CDE SMART CAMPUS SURVEY

However, managing today's IoT devices remains challenging, given the wide range of use cases, manufacturers and security considerations. Even a single IoT category — say smart locks or security cameras — may have a host of manufacturers with differing approaches to connectivity and security.

“The standards still aren't there; the interoperability isn't there,” Zink says.

Networks Under Pressure

An underlying and often invisible impediment to converging campus technology is the network tasked with pulling together all the disparate pieces. Smart campus technology frequently is added to existing networks that aren't optimized to support it, Zink cautions.

“You often have an unsmart network with all the smart activities on top of it,” he says. “It's the weakest point.”

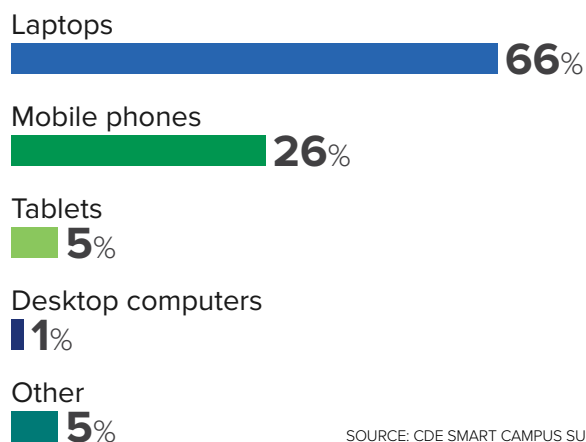
Although smart campus initiatives place new strain on campus networks and resources, the day-to-day study and leisure activities of students already demand considerable bandwidth.

A frequently cited study says students, on average, bring seven connected devices with them to campus — computers, smartphones, tablets, televisions and gaming consoles among them.² What's less remarked on, though, is that this particular survey is now five years old, and the number of connected devices has only continued to grow. Consider the proliferation of wearable devices like the Apple Watch and smart assistants like Amazon Alexa and Google Home in just the past few years. Some institutions, including Saint Louis University in Missouri and Arizona State University, have even deployed smart assistants in dorm rooms and common spaces to help answer questions about campus life.³

Students also use multiple devices for their coursework. CDE survey respondents, on average, reported using more than three devices for their daily studies. Laptops and mobile phones were the most common devices for coursework; just one percent of respondents said they used traditional desktop computers.

CONNECTED COURSEWORK

On average, students use more than three devices daily to complete their coursework. Among them:*



SOURCE: CDE SMART CAMPUS SURVEY

*Figures add up to more than 100 percent due to rounding

Evolving course content also is placing new demands on college networks. Students responding to the CDE survey said just 11 percent of their coursework involves no video content streaming. Almost all courses rely on at least some streaming, students said, with three-quarters (74 percent) streaming video for up to 50 percent of coursework.

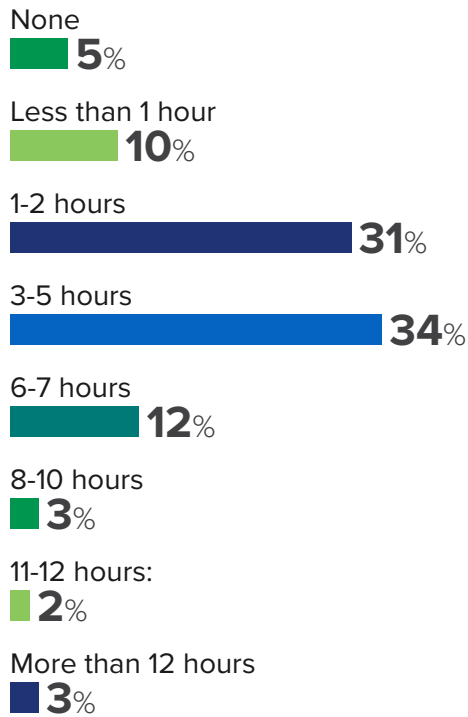
In addition, Netflix, YouTube and other streaming video services are primary entertainment sources for students. Three-quarters of students (77 percent) report streaming web content for entertainment, according to the CDE survey. Nearly all (79 percent) watch television shows and movies on demand, as opposed to viewing live television, and they do it for large periods of time.

Nearly two-thirds (65 percent) of students spend between one and five hours a day streaming web content. Mobile phones and laptops are the primary ways students consume media content for entertainment, with more than two-thirds of students using both devices.

Students most often use campus Internet in three places: the school library, the building that houses their major, and their dorm room or home, according to the CDE survey. When asked where they want better connectivity, outdoor areas were the most common response, followed by dorms and academic buildings.

TIME SPENT STREAMING ENTERTAINMENT

Students say they rely on streaming web content from platforms such as Netflix or YouTube for entertainment. Most say they spend multiple hours a day connected to these services.



SOURCE: CDE SMART CAMPUS SURVEY



Meeting Expectations — For Now

Almost all (86 percent) of students expect seamless Internet connectivity, according to the CDE survey. The good news is that nearly as many (76 percent) believe their campus provides adequate levels of connectivity and that wireless connections are at least somewhat reliable (69 percent). Two-thirds (65 percent) are also confident their institution can fix technology problems in a timely manner. Faculty and staff generally agree, with 78 percent of survey respondents saying the institution's current Internet speeds meet their needs.

Students and staff also agree on what's needed to improve the student experience on their campuses. The top three priorities across both groups were better WiFi coverage, faster Internet and smart buildings. Students were more likely to value

connectivity, with nearly two-thirds (62 percent) calling for improved WiFi and more than half (55 percent) wanting faster Internet in particular.

And lest campus leaders think that connectivity is a luxury and not a necessity, more than half (58 percent) of students responding to the CDE survey said they considered Internet connections when deciding which school to attend. Nearly one in three (28 percent) said it was a major consideration.

A ROADMAP FOR SMART CAMPUSES

These expectations drive the technology roadmap for higher education IT leaders, who must develop strategies that accommodate both current and future needs.

“When you’re working in IT and moving forward, you have to be a good chess player,” Jorstad says. “You’ve got to think three steps down the line.”

Like students, higher education leaders are confident their systems can accommodate smart campus technologies. Nearly two-thirds (64 percent) believe their current connectivity is adequate to support an intelligently connected campus. Even so, they are aware that network demands are increasing rapidly. Two-thirds (67 percent) believe bandwidth needs will increase within the next two years.

And as always, budgetary issues remain the top challenge to adopting IoT and other smart campus technologies among campus leadership. Given the high levels of optimism associated with connected campuses, however, the typical institutional challenges involving executive and stakeholder support are relatively minimal. One important exception is faculty priorities, which were cited by more than one-third (36 percent) of respondents as a potential roadblock to implementing instructional tools.

Networking Needs

Networks, the backbone upon which all smart campus initiatives are built, must keep pace with growing and evolving needs.

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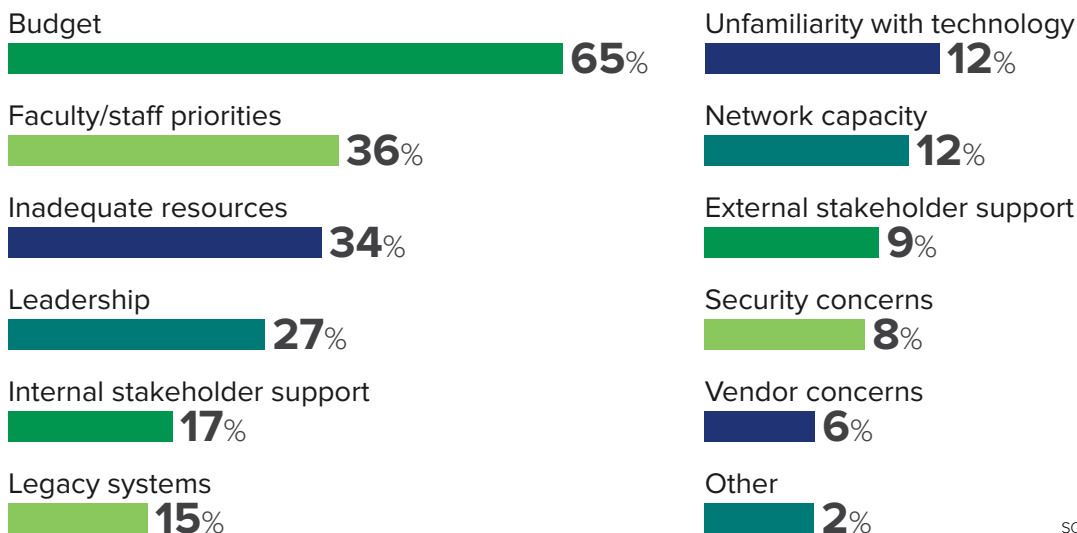
– Jim Jorstad, director of IT Client Services,
University of Wisconsin-La Crosse

As they began connecting IoT devices and offering wireless access for students and staff, many campuses focused on network coverage, says Jorstad. Now, he argues, the emphasis must shift to bandwidth — ensuring networks can support large numbers of devices connecting in classrooms or other single locations.

Many large institutions have gotten a head start on this work in their stadiums, where wide-scale networking expansions have focused on providing access for crowds that can reach the tens of thousands during sports events. The other question is timing — understanding when the biggest demands are placed on networks, which on residential campuses might be in the evenings.

As you monitor your campus bandwidth requirements today and plan for the future, here are some key factors to consider:

INSTITUTIONAL CHALLENGES TO SMART CAMPUS ADOPTION



SOURCE: CDE SMART CAMPUS SURVEY

- ▶ **Capacity:** It's vital to get a sense of not just headcount, but also the number and types of devices that will access the network — including student and faculty smartphones and computers, as well as the growing number of IoT devices.
- ▶ **Resiliency:** Plan for network outages and identify alternatives to ensure that teaching and learning and other critical operations aren't disrupted when problems arise.
- ▶ **Flexibility:** Infrastructure should be programmable and capable of adjustments such as adding new locations or adjusting bandwidth.
- ▶ **Visibility:** Analytics can provide real-time and historical insights into network performance, allowing IT staff to make changes before issues arise.
- ▶ **Efficiency:** Traffic steering and other tools can help prioritize mission-critical applications, which is particularly important in campus environments where bandwidth-consuming streaming video often competes with security and operational applications.
- ▶ **WiFi:** Along with providing more access in outdoor locations, modern wireless infrastructure can automatically optimize network performance in crowded areas such as academic buildings or stadiums and create separate networks for student, research and administrative use.
- ▶ **Cloud and other service models:** Increasingly, network operations are being outsourced to cloud and network providers. Identifying the right partner means determining their experience in supporting higher education customers and their ability to provide support options that meet an institution's staffing capabilities.

Even if they don't outsource networking services, higher education institutions will likely follow the path of other industries and adopt common third-party tools, including software-defined networking and network virtualization, Zink predicts.

"Such network systems can be more flexible and run at far higher speeds; the software takes

out the human management element that has been throttling full network capabilities," he says.

Security and Student Information

In the wake of high-profile security breaches, students want their personal data protected. Three-quarters of students who responded to the CDE survey said data protection was "very important." They also believe their campuses are doing a good job on the issue: 78 percent said they were at least fairly confident their personal information is being safeguarded. Campus leaders agree, with 88 percent saying that student data is at least somewhat secure.

"You have to make it clear how data is being used. The CFO and IT leadership can mutually demonstrate the importance of transparency and ethical leadership."

— Jim Jorstad, director of IT Client Services, University of Wisconsin-La Crosse

However, security threats are real and continue to grow. Just one breach at a large public university in 2019 exposed the records of as many as 1.3 million students, student applicants, and current and former faculty and staff.⁴ IoT devices, which come from multiple vendors with differing standards and vulnerabilities, complicate the security picture.

Two-thirds of campus leaders who responded to a separate 2018 CDE survey ranked cyberattacks as a top safety concern; only active shooter events and assaults ranked higher. Response efforts, however, may not match the severity of the threat. Fewer than half of higher education institutions (41 percent) say they have dedicated information security staff.⁵

Campus leaders should consider security as they evaluate new technology, with a focus on unified threat management that combines alerts and controls from a wide range of systems. Another key is network segmentation that walls off sensitive data from other parts of the network.

In addition, protecting privacy must be a clear priority for campus leaders — and it must be communicated as such to stakeholders, Jorstad argues.



KEYS TO IMPROVING FACULTY ADOPTION OF NEW TECHNOLOGY

- **Benefit to students.** Analytics can help measure student engagement and identify individuals who are struggling, improving college completion rates.
- **Confidence the technology will work.** Along with the digital learning tools themselves, connectivity and norms about device usage are essential.
- **Reward and recognition structures.** Institutions can offer incentives to promote advancements in pedagogy, such as stipends or recognition of scholarly articles.

“You have to make it clear how data is being used,” he says. “The CFO and IT leadership can mutually demonstrate the importance of transparency and ethical decision-making. Policy statements should be shared and discussed with campus governance. Having these dialogues is critical to our success.”

Teaching and Learning

While digital learning tools are in place on many campuses, ensuring their success demands more than the right technology.

“It’s not just the technology and the support for it, but the institutional structures in place to support it and incentivize its use among faculty,” Fritz says. “The pace of change in edtech is so fast and so completely counter to the culture of how and when faculty change teaching. That culture has to be brokered or bridged.”

One key is leveraging faculty champions enthused about trying new technology, Fritz says. “When we roll something out, do we have someone willing to try it out?”

Identifying the right educator to test different tools and strategies, he says, requires IT leaders to think about “almost a CRM version of faculty development” — that is, knowing who is likely to embrace a particular new technology and then “reverse engineer” it so others can learn.

“That changes the role IT plays in not just supporting the technology, but also infiltrating the faculty with opportunities for examination,” Fritz says.

The other key is to leverage analytics to see if edtech investments are paying off with improved outcomes for students.

“The value proposition is still kind of an assumption,” Fritz says.

Even so, UMBC has found that students who receive Ds and Fs use the school’s LMS 40 percent less, on average, than students getting Cs or higher. Feedback tools also let students compare their activity level against peers with higher and lower grades on assignments.

Together, engaging faculty and tracking outcomes will likely mean “the difference between what works and what doesn’t,” Fritz says.

CONCLUSION

It’s clear the move toward connected campuses will continue. Planned purchases by campus leaders who responded to the CDE survey largely target technologies that improve connectivity and analysis of data generated by connected campus systems. They’re also focused on strengthening protection of student information as new tools are introduced.

Long-term planning for the connected campuses of tomorrow requires higher education leaders to approach technology in new ways. Among them:

► **Break down traditional barriers:** It will be important to focus beyond the campus walls, particularly as technologies like 5G offer richer alternatives to students using mobile devices. This is especially important for serving today’s cohort of older, often working students whose lives aren’t centered around the campuses they attend.

“Students have a lot of activities, and college is just one of them,” Zink says. “Also, faculty want to make their resources and expertise available to the community. The network can help break down the town-gown barrier if you think about it the right way.”

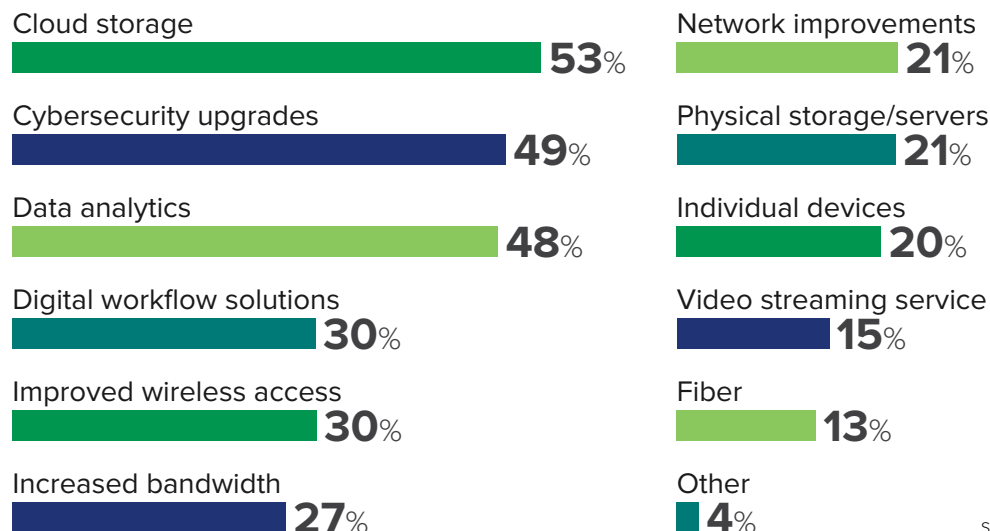
Already, many campuses collaborate with municipalities on transit and parking, and further technology partnerships could help them reach larger numbers of current — and potential — students, Zink argues. The CDE survey demographics bear out the importance of these shifts. Two-thirds of the students surveyed (67 percent) reported living off-campus instead of in residence halls or other campus housing.

► **Play to your strengths:** Even as a wide range of systems and functions coalesce around smart campus initiatives, it will be important to focus efforts on the core of higher education — teaching and learning.

On the other hand, technology leaders should focus on differentiating instructional technology

TECHNOLOGY PROCUREMENT PRIORITIES

Procurement priorities for campus leaders over the next 12-18 months show a focus on expanding data storage and analytics capacity, strengthening cybersecurity and improving connectivity.



SOURCE: CDE SMART CAMPUS SURVEY



and practices, Zink argues. “What has stalled instruction is the commoditization of instructional best practices.”

Campus leaders also should look to pockets of technology innovation on campus — researchers, but also athletics and esports programs, which often have the most demanding technology needs of all.

► **Focus on people:** Finally, converged smart campuses will require new thinking beyond technology — among faculty, senior administration officials and everyone in between. That gives IT leaders newfound importance, Jorstad argues.

Ultimately, the key is to bring together the right team around the problem — one that understands how things function and can pull all the pieces together. And, of course, to plan ahead.

Endnotes:

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