EDUCAUSE CENTER FOR ANALYSIS AND RESEARCH

ECAR Study of Undergraduate Students and Information Technology, 2018

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Contents

Authors

Joseph D. Galanek, EDUCAUSE Center for Analysis and Research
Dana C. Gierdowski, EDUCAUSE Center for Analysis and Research
D. Christopher Brooks, EDUCAUSE Center for Analysis and Research

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Foreword

EDUCAUSE is pleased to present our 15th annual ECAR study of undergraduate students and information technology. With survey responses from a broad sample of 130 US and international institutions, and from more than 64,000 students, this study continues to stand as one of the higher education IT industry's largest and longest-running explorations of students' technology experiences, behaviors, and preferences. Whatever interests or questions have brought you to this report—whether student learning, institutional operations, information technology, scholarly research, or a combination of these or other things—I hope you'll take the time to enjoy the rich insights offered within these pages. And I hope you'll walk away with fresh ideas and perhaps even some new questions to pursue.

As we would expect, a number of the things we've asked students consistently from year to year haven't seemed to change much this year. Students love their laptops and smartphones, and they view laptops especially as critical to their school work. And students remain generally pleased with their technology experiences on campus, reporting satisfaction with the technology support they've received and with their institution's LMS. Yet much of what we present in this report feels different, even fresh, representing new ground for our student technology research. For example, our examination of off-campus student learning environment preferences will hopefully offer faculty and institutional leadership new insights into when and how they might implement online and blended learning, and how to communicate its benefits to diverse student populations. This year we stake out a stronger, more nuanced stance in the ongoing debate surrounding students and the devices they bring into classrooms, highlighting issues of accessibility and the experiences and preferences of underrepresented student populations. Finally, we've also taken a fresh look at our own research practices—the questions we ask from year to year and the methods we deploy—charting out new ways to ask questions and present our findings. We've extended our questions on student device ownership to include considerations of access, for example, and we've layered this report with data-based student vignettes to help breathe more life into our findings and recommendations.

I am confident the resulting report you have in front of you will feel new again in some ways, though we've been offering this report to the higher education and technology communities for 15 years. It is my hope that you will engage deeply with this report and experience it with a sense of discovery and even a little fun, as I know I have. It is my even more profound hope that this report will help spark positive changes in your professional practice and, ultimately, in the experiences and successes of students now and in the years ahead.

I invite you to have an enlightening journey through this report.

—Mark McCormack, EDUCAUSE

Introduction

For 15 years, the EDUCAUSE Center for Analysis and Research (ECAR) has conducted research on information technology (IT) and higher education's most important end users, undergraduate students. While the form, function, and findings of these reports have evolved over the years, the common thread that binds them is a need to understand students' perspectives on how technology impacts their academic experiences and how they are using technology to enhance their academic success. Of particular note in this year's report is our inclusion of the perspectives of students with learning and physical disabilities on how their institutions respond to their technology, accessibility, and academic needs. We are excited to be presenting, as part of our diversity, equity, and inclusion (DEI) initiatives, these findings for our 2018 report.[1] Although higher education IT organizations are the primary audience for this report, we are confident that these findings can benefit administrators and staff in faculty and professional development programs; instructors from every type of institution, discipline, and level of experience; student affairs professionals; and students themselves. Our aim for this report is for these diverse institutional stakeholders to leverage these findings and recommendations to contribute to institutional IT and academic goals and, most importantly, to student success.

In this report, readers will find data and analysis related to the following topics:

- Device access, use, and importance to academic success
- Campus Wi-Fi experiences
- Learning management system (LMS) use and satisfaction
- Student learning environment preferences
- Experiences with instructors and technology
- Commuter students and internet access
- Student online activities
- Institutional awareness of student disability and accessibility
- Student use and assessment of success tools

For the 2018 report, 64,536 students from 130 institutions in 9 countries and 36 US states participated in the research. The quantitative findings in this report were developed using the 54,285 survey responses from 114 US institutions. This report makes generalized statements about the findings based on the large number of survey respondents. Applying these findings, however, is an institutionally specific undertaking. The priorities, strategic vision, and culture of an institution will inevitably affect the meaning and use of these findings in a specific academic context. This report should therefore be seen not as the final discussion about student use of IT on campus but as the beginning.

Key Findings

- **Practically all college and university students have access to the most important technologies for their academic success.** US students reported near-universal access to a desktop, laptop, tablet, or smartphone, with no systematic differences in access based on ethnicity, gender, age, and socioeconomic status. However, students reported low levels of access to newer, more expensive technologies such as augmented reality (AR) and virtual reality (VR) headsets and 3D printers.
- **While laptops, hybrids, desktops, and smartphones continue to be rated as very to extremely important to student success, the importance of these devices differs considerably by student demographics.** Generally, women, students of color, students with disabilities, first-generation students, students who are independent (with or without dependents of their own), and students who come from disadvantaged socioeconomic backgrounds see their devices as significantly more important to their success than do their counterparts. White students are significantly less likely than non-white students to think desktops, tablets, and smartphones are important to their success.
- **Students' overall technology experiences continue to be correlated with their evaluation of campus Wi-Fi reliability and ease of login.** Students' evaluation of campus Wi-Fi in various locations has remained largely flat in recent years, but significant gaps remain in terms of the quality of connectivity in dormitories/student housing and outdoor spaces, as well as ease of network login.
- **LMS use remains prevalent across higher education institutions, with continued high rates of use and student satisfaction.** Three-quarters of all students reported being either satisfied or very satisfied with their institution's LMS, and more than three-quarters of students reported their LMS was used for most or all of their courses. This likely reflects satisfaction primarily with the functional aspects of their institution's LMS.
- **A majority of students continue to express preferences for learning environments that fall somewhere on the "blended" continuum (from mostly face-to-face to mostly online).** While a plurality (38%) of students prefer fully face-to-face classroom environments, students who have taken some fully online courses are significantly more likely to prefer blended environments and less likely to prefer purely face-to-face courses.
- **Although a majority of students said their instructors use technology to enhance their pedagogy, improve communication, and carry out course tasks, there are limitations when it comes to personal device use.**

Instructors encourage students to use their laptops more than smartphones, but nearly a third of students are not encouraged to use their own devices as learning tools in class, suggesting that many students take courses in which faculty discourage or ban the in-class use of students' technology.

- **Nearly three-quarters of students (72%) who live off campus reported their internet connections at their home/off-campus residence are either good or excellent, and only 2% reported having no internet access at home.** Students who live off campus have a stronger preference for online and blended courses than do their on-campus counterparts. This preference may reflect how online learning can benefit those who need to juggle work schedules and family responsibilities.
- **The typical student is fairly serious about doing the work of being a student, spending 1 to 4 hours per day online doing homework and conducting research.** Contrary to popular belief, students do not appear to spend most of their time using social media, watching TV, or playing video games. Indeed, the typical student spends 1 to 2 hours on social media and another 1 to 2 hours streaming video; more than half of students reported that they do not play video games.
- **A plurality of students who self-identify as having a physical and/or learning disability requiring accessible or adaptive technologies for their coursework rated their institution's awareness of their needs as poor.** According to students, larger and DR public institutions tend to have poorer awareness of disabled students' needs than do smaller and AA institutions. In addition to institutional limitations, students' fears of being stigmatized or penalized for disclosing their disabilities and engaging disability services to receive the aid they need may be contributing to low rates of awareness.
- **Students continue to view student success tools as at least moderately useful.** Students view success tools that help with transactional tasks related to the work of being students (e.g., conducting business, tracking credits, planning degrees, conducting degree audits) as slightly more useful than those that help them academically (e.g., early-alert systems, academic resources, course recommendations, improvement of academic performance).

Device Access and Ownership

EDUCAUSE has tracked student ownership of digital technologies that might be used for academic work for nearly a decade. We have observed how the rapid rise of laptop and smartphone ownership has increased to near-universal levels, squeezing out cumbersome desktops and redundant tablets to become the most popular combination of digital devices used by students.[2] While device ownership tells us a lot about the devices students have at their fingertips, it introduces socioeconomic bias into the measure in favor of those with higher incomes. This year, we improved our inquiry process to align more closely with the principle of equitable access outlined in UNESCO's Qingdao Declaration and EDUCAUSE's commitment to diversity, equity, and inclusion (DEI) by first asking if students had *access* to an array of technologies before turning to questions of *how* they have access to those technologies.

The percentages of students who have access to digital technologies vary considerably, with the workhorse technologies of smartphones (95%) and laptops (91%) topping the list and the newer, more expensive technologies of AR and VR headsets (4%) and 3D printers (3%) rounding out the bottom (see figure 1). And when it comes to access, practically every student has access to at least one of the technologies students identify as among the most important for their academic success (see "Device Use and Importance"). Only 65 participants (fewer than 1%) reported having no access to any of the four digital devices that their peers deem most critical to student success: laptops, desktops, hybrids,[3] or smartphones. In this way, US students now appear to have overcome the problem of digital inclusion[4] that relates to access to internet-enabled devices and reliable Wi-Fi. An analysis of the typical correlates of the digital divide—ethnicity, gender, age, and socioeconomic status—fails to reveal a pattern of unequal access to the devices most important to student academic success.

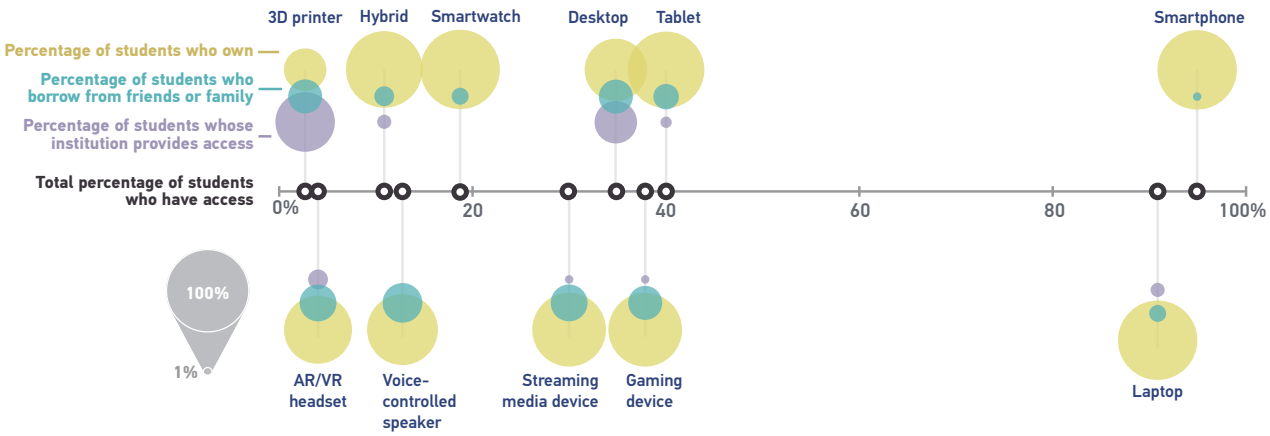


Figure 1. Student device access and ownership

How students access technology varies by a combination of device type and purpose. The first group of devices consists of smartphones, laptops, and hybrids, which are important contributors to student productivity and are owned at the highest rates. With the exception of the smartwatch, the second group includes personal devices that are designed for consumption and/or entertainment purposes and are mostly owned (tablets, gaming devices, streaming media devices, and voice-controlled speakers) but are also frequently borrowed from family and friends. The last group of devices (AR/VR headsets and 3D printers) is characterized mainly by a heavier student reliance on the provision of technologies by their institutions because presently they may be too bulky or expensive for individual ownership. A majority of students who have access to desktops own them; however, more than a quarter of students have access to desktops via their institutions, likely through computer labs. Similarly, bleeding-edge technologies such as AR/VR headsets and 3D printers are also made available by colleges and universities at higher rates than personal devices used for productive or consumptive activities. While Google Cardboard and other inexpensive stereoscopic AR/VR headset alternatives may increase ownership of these technologies, the vast majority of students (96%) do *not* have access to these devices.

One clear factor behind the disparities in students' access to campus-owned extended reality (XR)[5] technologies is a student's major. STEM-related majors such as computer science, engineering, architecture, and (to a lesser degree) manufacturing, construction, repair, or transportation tend to allow more access to the institution's 3D printers than other majors, as would be expected. Relatedly, the familiar patterns of age- and gender-based inequalities in terms of AR/VR headset ownership are also manifest here: Younger female students are significantly less likely to own these devices than older male students. When it comes to 3D printers, older students are more than two times as likely to own these new and expensive devices than younger students. The intersection of the prevalence of XR technologies in fields that tend to be dominated by men is not surprising, but the solution to increasing access is not necessarily opening XR labs to all so much as it is opening STEM majors to more women and thinking about how non-STEM fields can leverage these emerging technologies to their pedagogical advantage.

EDUCAUSE predicts that the adoption of XR technologies in teaching, learning, and research will only increase in the next few years as they become more affordable, user friendly, and portable. In our recent report on 3D technologies, *Learning in Three Dimensions: Report on the EDUCAUSE/HP Campus of the Future Project*, we recommended increasing student access to these expensive, cutting-edge technologies by housing them in public spaces (e.g., a makerspace, a library, a dedicated media space). Offering student orientation and training

programs and marketing these to diverse populations on campus are also key to increasing student access to this emerging tech. Gender disparities are especially problematic in makerspaces where women are underrepresented.[6] Research has shown gender bias in the ways these spaces are staffed, managed, and marketed,[7] which is an extension of the lack of female representation that has been examined in STEM fields.[8] Increasing student access to 3D technologies in these ways encourages student experimentation, provokes innovative interdisciplinary applications of these technologies,[9] and may support larger institutional XR goals and initiatives. Limited or no access to these expensive, emerging technologies, especially based on student major, may exacerbate existing or produce new patterns of digital exclusion among students at US institutions. And, given the near-universal access to the digital devices that students find most important for doing their work, it would be irresponsible to replace one digital divide with another by systematically limiting access. Indeed, we should not just avoid sustaining or replicating inequities—we should be intentionally providing equitable opportunities for all students.

Device Use and Importance

Since 2012, we have tracked the frequency with which students use various technologies for their coursework and the levels of importance students attribute to these technologies for their academic success. We should not be surprised that student use of and the importance placed on those technologies for students' success are significantly and positively correlated: The more courses in which students use the various devices, the more important they consider those devices to be in accomplishing academic tasks successfully (see figure 2). Laptops continue to reign supreme, with 98% of students reporting using them in at least one course last year and 94% rating them very or extremely important.[10] Similarly, smartphone usage and importance both increased modestly since 2017, continuing an upward trend for the third year in a row. More surprising is the reversal of fortunes for desktops and tablets. After two consecutive years of decline in importance and use, these devices have experienced a substantial rebound, especially in terms of the percentage of students who have used them for at least one course.[11] Comparatively fewer students reported high levels of use or importance with many of the newer and/or narrower technologies such as AR and VR headsets, smartwatches, gaming devices, streaming media devices, and voice-controlled speakers/assistants.

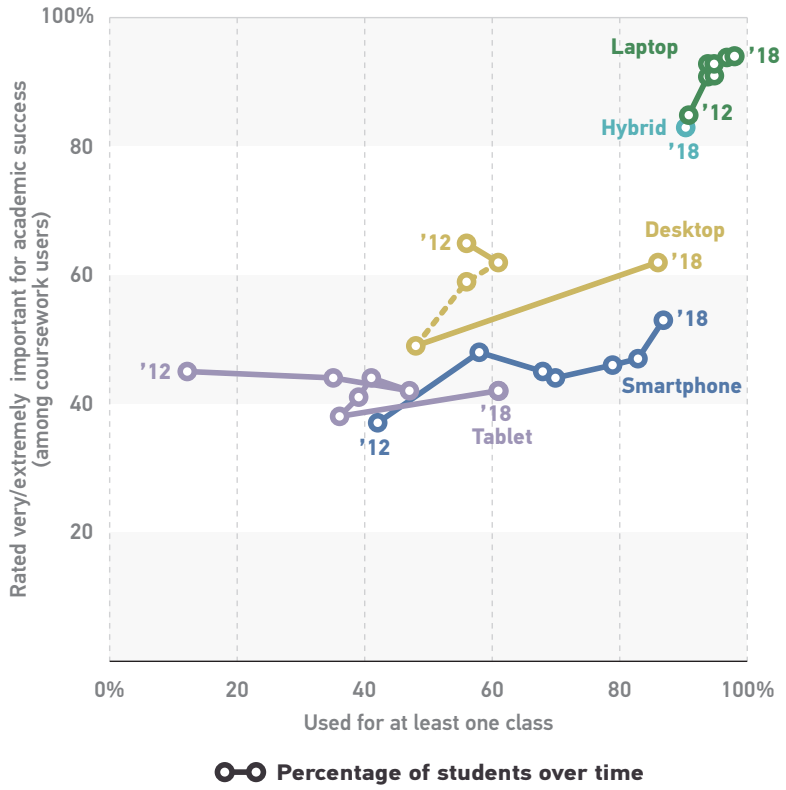


Figure 2. Student device use and ratings of importance

Students' assessment of the importance of different devices varies considerably. And the importance of these devices also varies for some important demographic groups. For example, students who come from lower-income families,[12] are non-white, and cannot be claimed by their parents as dependents are significantly more likely to see desktops as important to their academic success than wealthier, white, and dependent students. Additionally, women are significantly less likely than men to see desktops as important. Holding all other factors constant, women are significantly *more* likely than men to view laptops as important. Smartphones are significantly more important to non-white, first-generation college students, students whose families have lower incomes, and those with disabilities. Although white students are significantly less likely to think of tablets as important, independent, first-generation, non-white, and disabled students attribute significantly greater levels of importance of tablets to their academic work.[13]

In 2017 we reported that an increased number of students said their instructors were banning or discouraging the use of tablets (40%) and smartphones (70%) in class. Only 19% of students reported their instructors banned or discouraged the use of laptops in class last year.[14] Faculty reported a similar pattern of banning and discouraging student use of laptops (20%), tablets (24%), and smartphones (52%) in their classrooms.[15] In some cases, faculty ban or discourage devices in classrooms on the basis of research that simply confirms their biases against those digital devices—that they are distracting, that student device usage implies disrespect or a lack of attention, or that students are not taking good notes. This approach can do real, if unintended, harm.

Instructor policies that ban or discourage mobile device use in the classroom may disproportionately affect students of color, students with disabilities, first-generation students, students who are independent (with or without dependents of their own), and students who come from disadvantaged socioeconomic backgrounds. Given that these groups of students attach high levels of importance to these devices for their academic success, instructors should set aside their concerns about the use of such devices in class. The collective impact of our findings suggests that policies that ban and discourage student device use in the classroom may very well undermine the efforts of women, students of color, lower-income students, and students with disabilities to leverage their devices in ways that help them succeed in college.

Student Technology Experiences

Let's go in the way-back machine and experience dial-up internet[16] on our campuses, shall we? What? No one wants to go back to 1999 and wait for our college roommate to get off the phone so we can check our email? As funny (or awful) as this sounds to our higher education, tech-savvy ears in 2018, we need to acknowledge that poor-quality networks for students are analogous to higher education institutions' going back to dial-up. Students expect rapid and universal campus networks. The good news is that this year more than three-quarters of students (77% overall) across all demographics[17] reported either good or excellent overall technology experiences. However, differences were noted across institution types. MA private and DR private institutions had significantly higher percentages of students who rated their technology experiences as poor/fair than other institution types.[18] Students' overall technology experiences continue to be significantly and positively associated with their experiences of Wi-Fi connectivity (see figure 3). Specifically, students' ease of Wi-Fi login and assessments of Wi-Fi connectivity in dorms/housing, campus libraries, and classroom/instructional spaces were associated with students' overall technology experiences. Reliability of Wi-Fi access in outdoor spaces was a weaker predictor of overall technology experiences.

Although students have consistently rated Wi-Fi reliability as good or excellent in areas you would expect (e.g., libraries or classrooms), room for improvement remains in Wi-Fi network access in dormitories/student housing and outdoors.[19] Students who offered open-ended responses last year regarding their concerns with their institution's Wi-Fi networks focused primarily on poor network quality in dorms/housing and outdoors.[20] In 2017, students also reported pain points with Wi-Fi login: Multiple daily and monthly logins were barriers to using campus Wi-Fi.[21] Although fewer students rated ease of login negatively, it is still associated with overall technology experiences. IT departments should examine their users' login experiences when fielding calls of general concerns with Wi-Fi to ensure a seamless network login experience across campus throughout the school year.

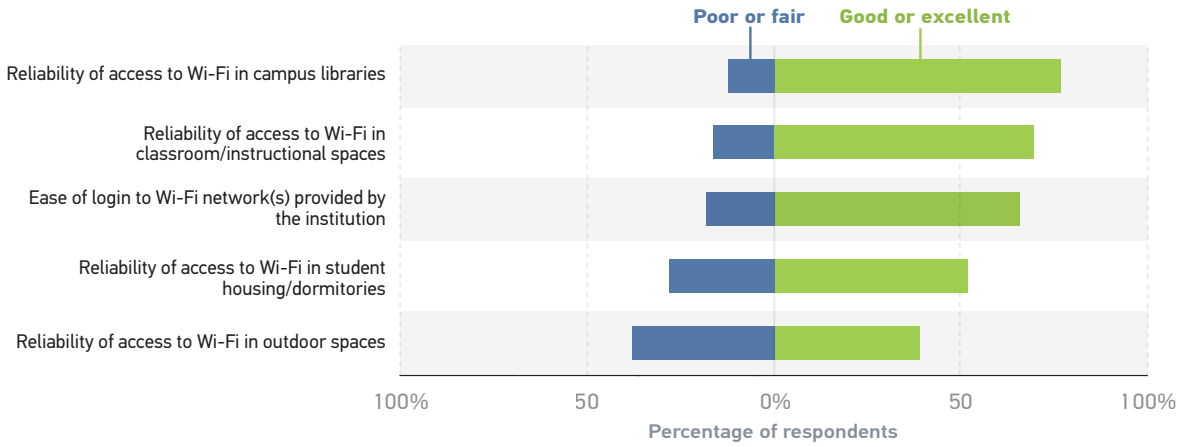


Figure 3. Student experiences of wireless networks

If IT departments seek to increase students' positive assessments of technology and address general complaints of "poor Wi-Fi," then a likely starting point would be assessing students' experiences with ease of login and connectivity in dormitories and outdoor spaces. Poor experiences in dorms may be the result of students' attempting to log on to the campus network with IoT (internet of things) devices. Most of these devices come from the consumer sector and are built with the home wireless router in mind rather than a complex institutional Wi-Fi network. The implementation of more secure campus networks may create additional steps to logging on or may not be compatible with all devices, so student assessments of Wi-Fi connectivity or login issues may also be the result of increasing network security. This suggests the weighing of security concerns with open, easily accessible Wi-Fi is a challenging balancing act for institutions. Private institutions should also be aware their students have slightly less-positive overall technology experiences than students at other types of institutions. Since experiences of Wi-Fi are correlated with overall technology experiences, connectivity needs to be a priority for these institutions.

Wi-Fi connectivity investments should be part of an IT department's institution-wide strategy that addresses students' needs and experiences.[22] Students' overall experiences at their institution, not just the classroom experience or completion rates, are now part of ensuring student success.[23] Consequently, network quality may be a means for students to assess a higher education institution's investments in student experiences.[24] Without quality networks, campus-wide technology initiatives may be impacted. For example, colleges moving course materials from print textbooks to digital open-educational resources (OER) will likely need

upgraded networks to meet the demands of increased student traffic to access and engage with materials. One institution has recently piloted voice command technology on campuses to improve and simplify student experiences.[25] This technology can help students (and faculty) obtain targeted information without having to sit at a computer, and it can draw on multiple data sources to provide students with up-to-date information.[26] Without strong networks in dorms, however, these types of innovations will not get off the ground, or the user experience will be mired in pain points.

Providing high-quality, pain-free networks responds to students' needs as consumers of technology. Like all people, students spend a significant portion of their time connecting through their devices—conducting business, accessing academic resources, completing tasks, communicating with family and friends, streaming content, listening to music, or gaming. These activities reflect how people engage with technology; students should be considered a critical part of this consumer group, not an exception. And perhaps most importantly, any initiatives to incorporate more educational technology will be stalled or poorly implemented if appropriate network infrastructure is not in place. We certainly wouldn't want colleges and universities to go back to using dial-up, and for the current generation of college students, poor campus network performance is equally as tortuous.

LMS Use and Satisfaction

The learning management system (LMS) is the educational technology most widely available to students, and it has been for some time. No matter how many times you slap the top of the LMS like a car salesman and tell the students and instructors, "You can get so much academic success in this bad boy!", it's not the sexy new thing on the block anymore. (As one expert recently put it, "It's more like the used minivan of ed tech."[27]) It doesn't matter how much we try to spruce it up each year with increasing options, cool new colors, or (cough, cough) reporting how using it could enhance student outcomes. It's just the good ol' reliable LMS, ready for our use. In this sense, the LMS is similar to basic utilities on higher education campuses, such as plumbing or electricity—functional, ubiquitous, with high levels of use and satisfaction for its most basic operations. And, of course, we expect that it can meet our academic or teaching goals if we use just the basic functions. It is these basic functions—such as submitting assignments—that students told us last year they were most satisfied with, rather than more complex tasks.[28] Given the reliability, dependability, and near universality of the LMS, students' ratings of their LMS remain relatively unchanged from last year. Three-quarters of all students reported being either satisfied or very satisfied with their institution's LMS, and more than three-quarters of students said their LMS was used for most or all of their courses (see figure 4).

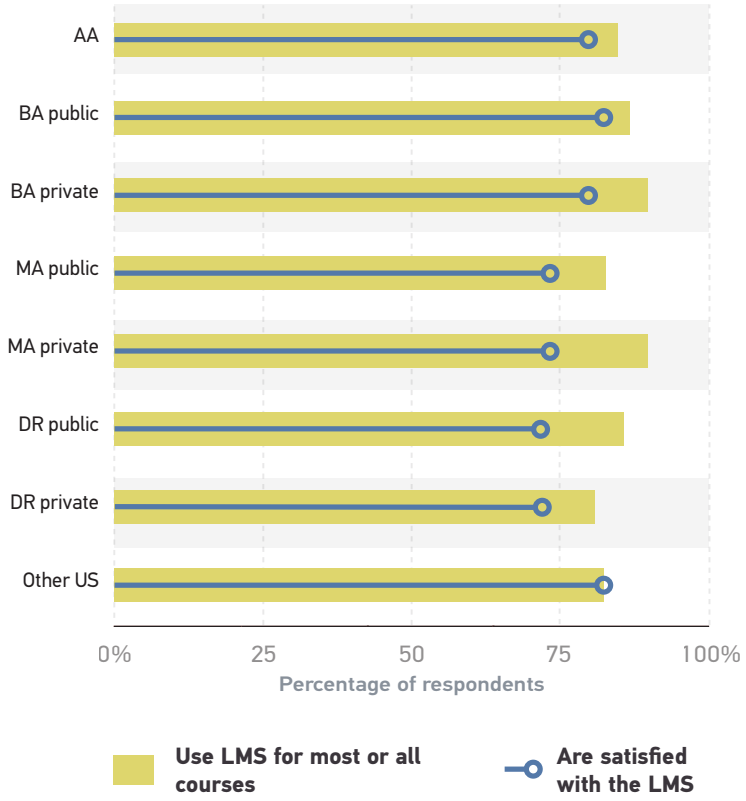


Figure 4. Student LMS use, by Carnegie class

We found significant differences, however, in both student LMS use and satisfaction across Carnegie class. BA private students reported the highest use of the LMS across all institutions, while more students at public institutions (MA, BA, and AA) told us they did not use their institution's LMS for at least one course.[29] Although increased access to and use of the LMS can serve all students, public institutions should aim to increase use of and access to the LMS, since they serve more first-generation college students, students eligible for Pell Grants, students with dependents, students who are married or in domestic partnerships, and black and Hispanic students. Higher numbers of students at public institutions, compared with those attending private institutions, work between 30 and 40 hours per week. Consistent and widespread use of the LMS and ensured access to it in public institutions can benefit students. Even the basic functions of the LMS, such as posting grades, have been found to contribute to a student's academic performance; access to grades allows for real-time monitoring of their course progress and the ability to make mid-course adjustments as needed.[30] And the convenience of the LMS offers off-campus students much-needed flexibility in contacting instructors and classmates, accessing course content, or taking quizzes.

Does this high use of the LMS affect student learning environment preferences? Perhaps not. Sixty-nine percent of students who reported being satisfied or very satisfied with their institution's LMS also said they prefer completely or mostly face-to-face classes. This may reflect a desire for using the operational features of the LMS, along with a desire for in-class time with instructors, which students told us they wanted in their 2017 open-ended responses.[31] The overall high levels of use and satisfaction with the LMS, but low preferences for mostly or entirely online courses across all students, may also reflect students' lack of knowledge of how online courses work or the benefits of blended learning. However, it may also stem from students' prior experiences with learning environments. As noted in this report, students' learning environment preferences depend on their previous learning environment experiences. So students who prefer face-to-face (based on past experiences) may still find functional aspects of the LMS useful and important to their courses, and they may not identify some of the LMS's limitations in a primarily face-to-face learning environment. Even face-to-face courses still rely on the LMS for distributing resources or as a means for communication, and students may be quite satisfied with the conveniences offered by the LMS in a face-to-face course. For example, in 2017 a majority of students reported higher satisfaction levels with functional aspects of the LMS—such as submitting assignments, accessing course content, or checking on their progress—than with the tasks that require more engagement, such as discussion boards.

However, this satisfaction with the LMS and the preference for face-to-face courses may also stem from how instructors are using the LMS. Since 2014, a majority of instructors have told us they primarily use the basic course management functions of the LMS, like circulating information such as the syllabus, handouts, and assignments.[32] Students also reported that functional aspects of the LMS can enhance their academic success.[33] Since students observe mostly the functional aspects of the LMS in action, their limited understanding of the LMS's more advanced capabilities, particularly in the context of online or blended learning, may reflect instructors' most common usage patterns.

So where do we go from here? Faculty are primarily using the most basic functions of the LMS; students are satisfied with that and report these functional operations are what assist them in their academic success. Perhaps the LMS does actually need an overhaul, but in a thoughtful and innovative manner that moves beyond using it to conveniently curate, package, and share content. We don't need to break the LMS. We need to acknowledge what it can (and can't) do and incorporate its best features into new models of digital learning: next-generation digital learning environments (NGDLEs). NGDLEs are not single, proprietary LMS applications. They constitute a digital learning architecture encompassing a confederation of learning applications, tools, and resources woven together by means of open standards that can be harnessed by higher education institutions for their own digital learning environment needs.[34] NGDLEs include personalization; interoperability; collaboration; accessibility and universal design; and analytics, advising, and learning assessment. NGDLEs may or may not include an LMS as a component, and the LMS may be used solely as a supplement to these open-standard digital applications, tools, and resources.[35] Incorporation of the LMS into a larger digital learning context may be the answer for students who want only a digital gradebook and shared drive for course documents. With the development and implementation of NGDLEs, we have the opportunity to take the used minivan of education technology and turn it into a high-performance, first-in-class vehicle for student success.

Learning Environment Preferences

What's the difference between students who prefer their courses to "have no online components" and students who prefer their courses to "be completely face-to-face"? Apparently, quite a bit. In 2018 we changed how we asked students about their learning environment preferences[36] and got starkly different answers. We had observed in recent years a steady decline in the percentage of students who prefer their courses to have no online components, but our results this year revealed a significant spike in the number of students who prefer completely face-to-face courses—38%, compared with the 9% in 2017 who said they prefer no online components. Although the added precision to the question presents us with more accurate but unexpected results, the general thrust of our findings from previous years—that the majority of students (55%) prefer some form of blended learning environment over either purely face-to-face or online versions—continues to hold (see figure 5).

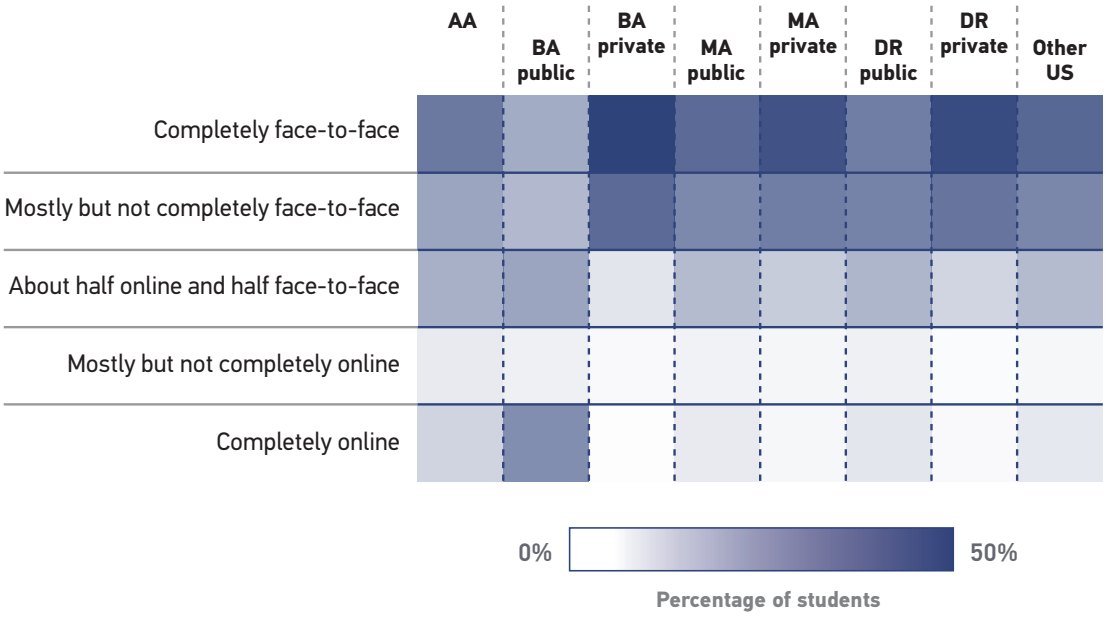


Figure 5. Student learning environment preferences

So what is driving students' inclinations? It seems that it's similar to what influences human preferences in other contexts as well: exposure and experience. Long-standing research has shown us that "mere exposure"[37] builds familiarity, which can lead to our preferences for everything from foods to sounds to faces. Our data from the past few years have suggested that students prefer learning

environments where they have had recent experiences, and the same correlation is holding for 2018. When we controlled for a host of factors,[38] the most significant predictor for learning environment preference was recent experience (over the past 12 months). Student preferences are also polarizing: Those who have never taken a completely online class are significantly more likely to prefer face-to-face-only courses, and vice versa. However, students who have taken at least some of their courses online are significantly more likely to prefer blended environments and less likely to prefer purely face-to-face courses.

These results make sense when we consider the science of exposure. It seems reasonable that students would like environments where they have had their most recent (and perhaps positive) experiences, since these are the most familiar. By the same token, students who are just starting their college careers and have never taken an online course may be hesitant to dive into an environment with a heavy digital format, especially if they are making the leap from high school or the workforce to college. Lack of confidence or concerns about how successful they may be—or have been in the past—in online courses may also influence their preferences. If students are to become more acclimated to blended learning environments, they should be exposed to courses with online components early in their college careers. Experiences in these settings can help them prepare for the demands of the 21st-century workforce, where blended and telecommuting work environments have grown exponentially.[39]

Educating students about the benefits, expectations, and demands of different learning environments is also critical to helping them make informed decisions about the environments that work best for them. IT can partner with other campus units to reach students via multiple sources to consistently share clear communications and resources about the differences between face-to-face, blended, and online courses. Collaboration opportunities exist at new-student orientations, during advisement and registration, at academic support centers, and in disciplinary departments, teaching and learning centers, and disability service offices. Faculty who lack experience teaching blended and/or online courses should also be exposed to professional development, training opportunities, IT campus resources, instructional designers, and teaching and learning centers.

Experiences with Instructors and Technology

To prepare for his driver's license exam, Oliver studies the driving handbook, memorizes road signs, and logs the state-required hours of behind-the-wheel training. He passes his exam with flying colors, but when he asks to borrow the car and drive by himself for the first time, mom and dad say "No." Their fears are certainly natural: They tell Oliver he's an inexperienced driver, and if he drives solo, they won't be there to correct him and prevent potentially serious mistakes. As he listens to his parents, though, Oliver wonders how he will ever continue to learn if he never gets the chance. Much like concerned parents, faculty are behind the wheel on how technology is used in their courses, and they may feel anxious about handing the tech keys over to their students in the classroom.

When we asked students about the different ways their instructors were using technology to teach, the majority told us instructors use tech to engage them in the learning process and enhance their learning with additional materials. Nearly half of students also agreed that their instructors encourage them to use technology for creative or critical-thinking tasks (see figure 6). These results signal that faculty are mostly comfortable with integrating technology to enhance their pedagogy, improve communication, and carry out course tasks—all good things for sure. These practices, though, are largely under the control of the instructor and are teacher-centered. Our data suggest a distinct break between these items and those where students were asked if they were encouraged to use their own devices in class—practices that involve some relinquishing of faculty control, are more student-centered, and can encourage more active learning pedagogies. While 38% of students said their instructors promoted the use of student-owned devices to deepen their learning, slightly fewer (32%) disagreed, which indicates that nearly a third of students are not asked, encouraged, or allowed to use their own devices as learning tools in class. Almost half of students agreed that instructors encourage them to use their own laptops to enhance in-class learning, but only a quarter said they were encouraged to use their smartphones, one of the most widely owned and used student-accessible technologies.

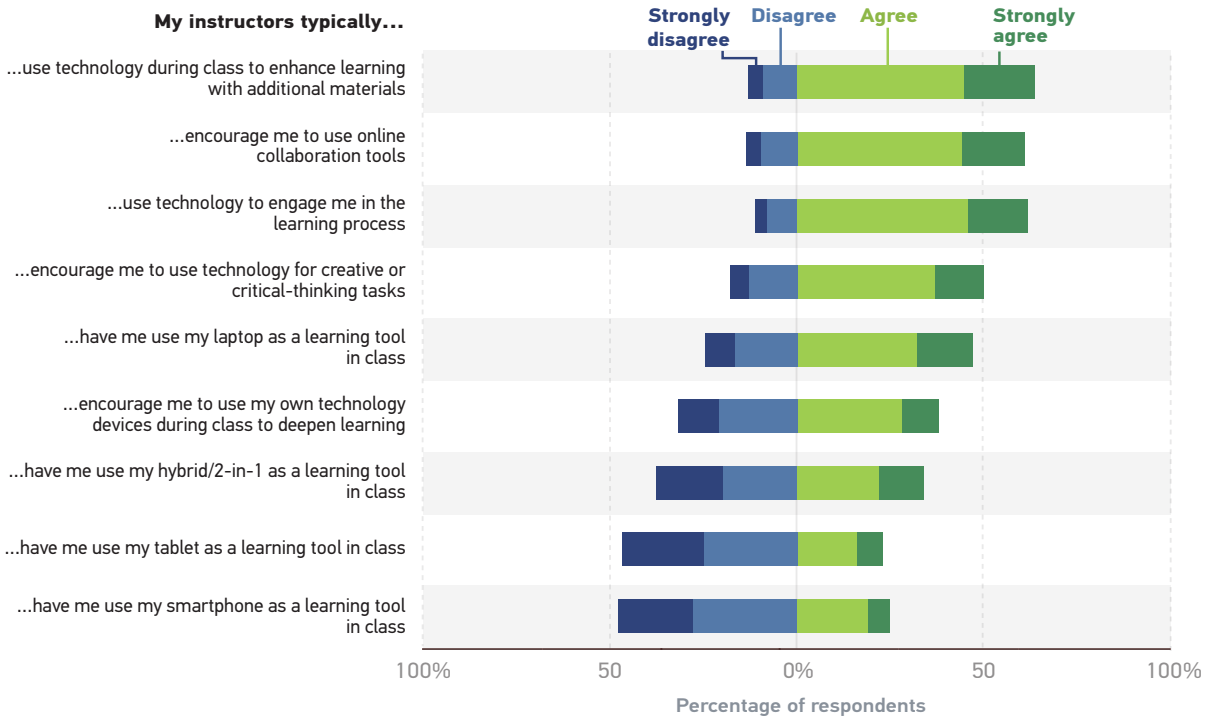


Figure 6. Student experiences with instructors and technology

Students were not asked if their instructors banned personal devices in the classroom; nevertheless, our data, along with many qualitative responses (as in the following examples), suggest that students continue to experience rigid policies for using personal devices during class:

- "About half of the professors I've had over the course of my college career have not allowed laptops in the classroom to take notes. This is not helpful for me…."
- "I would like for professors to encourage using technology in class such as laptops for note-taking, rather than reprimanding us [for] using it."
- "Due to my disability, allow me to use my smart-pen Bluetooth connected to my smartphone."

Discouraging the use of or banning devices altogether, particularly laptops, robs students of tools they report as essential to their academic success; this can be problematic for underrepresented populations (see "Device Access and Ownership," p. 7 of this report), especially for students with disabilities.[40] Allowing only students who have documented disabilities the use of digital

devices can draw unwanted attention from their peers, effectively identifying them as having a learning need they are entitled to keep private. Students with undisclosed disabilities or learning differences may also be disadvantaged by indiscriminate technology bans, as disability disclosure rates by students are low in higher education.[41] Allowing students to use their own technology is an inclusive and equitable teaching practice that stands to benefit far more students than we will ever know (for cases that go undisclosed and/or undiagnosed), but professional development in teaching with technology is needed to spread the word, especially in institutions where pedagogical training is not a requirement for faculty. Although trusting students with the keys to their own tech may feel uncomfortable or even scary, it allows faculty to test drive more student-centered teaching strategies and learn about and incorporate more of the tech tools students are already using in their academic work. Failing to leverage the power of student-owned devices is a missed opportunity to deepen student learning with technologies they are already licensed to drive.

Home Internet Access

Mariana is finishing her senior year and is on track to get a bachelor's degree in nursing. She is slightly older than the students in her classes who live on campus and is the first one in her family to attend college. She balances her full-time study with working 20 hours a week as a certified nursing assistant. Mariana could not have attended her local public university without the support of her husband, Gabriel, who cares for their 3-year-old daughter when she is on campus. Although she is busy with work and family, she pays extra for high-speed internet at home to make it easier to complete her online coursework. Before and after family dinners, using a laptop she shares with her husband, she does research, emails her instructor, and connects with a classmate about an assignment. She likes the convenience of online courses but still likes to engage with her nursing instructors face-to-face in the classroom, so she takes blended classes whenever they are offered. Life is busy, but she feels excited about completing her degree.

Mariana's story reflects what we found out about the characteristics of commuter students this year. As with many off-campus students, her ability to work, go to school, and attend to her family reflects a likely decreased distinction between work, leisure, and academic domains, so home connectivity is critical. Since commuter students told us they spend about the same number of hours per day engaging in online research/ homework as their on-campus peers, reliable home networks are necessary for this student population to facilitate seamless access to academic resources and student tasks (e.g., registration), regardless of location. Assessing these students' home internet connections can provide insight into the quality of noninstitutional networks used by this large group of students.

Nearly three-quarters (72%) of commuter students rated their internet connection at their home/off-campus residence either good or excellent; only 2% reported having no internet access at home.[42] With the majority of off-campus students giving positive ratings of connectivity in their homes, what are these students' learning environment preferences? As one might expect, slightly more commuter students than on-campus students told us they prefer online or blended learning environments. In a similar vein, fewer off-campus students than on-campus students reported preferring mostly or completely face-to-face courses. However, there were still high percentages of commuter students who said they prefer completely or mostly face-to-face learning environments (see figure 7).

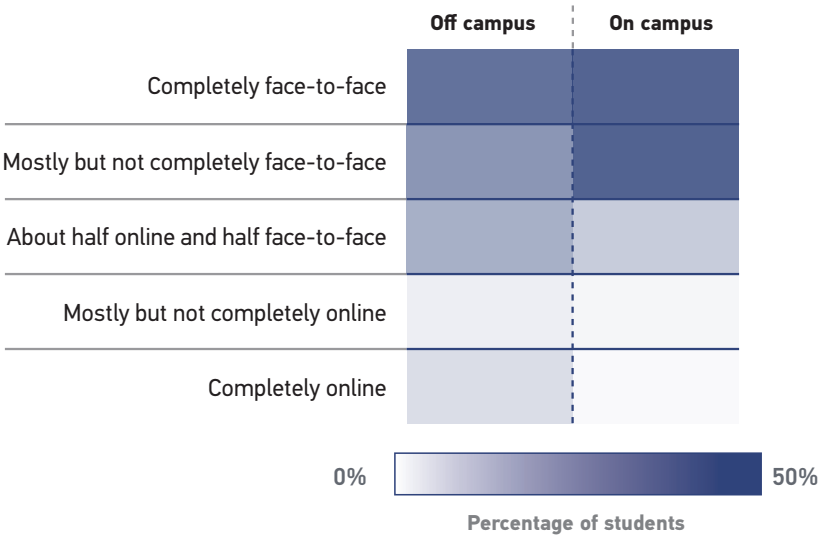


Figure 7. Learning environment preferences, by student living situation

Several factors might help explain why large numbers of commuter students still value in-class experiences. The face-to-face learning environment may be particularly important to commuter students because a larger portion of off-campus students are first-generation college students and may seek more interaction with their instructors in the classroom. Additionally, commuter students' limited or shared access to technology may explain why a majority said they prefer face-to-face learning environments—these students may be sharing access to home computers with family members for online academic work,[43] and primarily face-to-face learning environments may allow them to sidestep some of the challenges of using technology at home, regardless of their ratings of home connectivity.

On the other hand, the slightly higher preferences for online and blended learning environments among commuter students compared to on-campus students might reflect how online learning can benefit those who need to accommodate work schedules and family responsibilities. Twenty-nine percent of students with dependents, as well as 24% of those who identified as being married or in a domestic partnership, said they prefer mostly or completely online learning environments. Thirteen percent of students who live off campus and reported working 20 or more hours per week (excluding work study) said they would prefer taking online-only courses. These findings suggest that commuter students frequently need added flexibility and convenience in their academic work.[44]

Taken together, these findings suggest that for commuter students, there might be a tension between their desire for in-class experiences and a need to attend to additional, nonacademic responsibilities. In a perfect world, off-campus students might prefer to sit in class with peers, but that might not be feasible in the real world.

Consequently, commuter students need access to consistent and strong off-campus networks.

Of particular concern for commuter students (if not all students) is a recent FCC ruling that could allow network providers to place internet sites in a "slow lane" of connectivity and charge customers higher rates for fast access to certain websites. This fight over net neutrality remains an ongoing legislative battle.[45] The FCC's decision has been challenged by higher education and library communities, which view the overturning of net neutrality as jeopardizing an open internet, which is now "mission critical" to colleges, universities, and libraries.[46] If the FCC's decision is implemented, that could further impact students' ability to engage in online or blended learning or conduct research, particularly for economically disadvantaged students with multiple responsibilities who need the flexibility and convenience of online learning and research from their homes.

What can institutions do to mitigate some of the potential ramifications of a complete overturning of net neutrality? We recommend that IT units do the following:

- Ensure campus networks are frictionless and ubiquitous. For commuter students with poor or no connectivity and work and family responsibilities, the campus network may be their sole option for quality connectivity that enables them to take advantage of the convenience and flexibility of the blended learning environment.
- Increase awareness of off-campus students' learning environment preferences, which at face value are not intuitive (i.e., high percentages of commuter students still prefer face-to-face classes).
- Prioritize communicating the benefits of online or blended learning to the off-campus student population—not only the outcomes for student success but also how online and blended learning can accommodate students' family lives, work, and commuting.
- Help off-campus students determine the best learning environment for their learning preferences and academic needs so that they can make informed decisions on how, when, why, and to what extent they engage in online or blended learning.
- Communicate to commuter students the convenience of using Wi-Fi at their local public libraries, in case they can't make it to campus but still need access to a reliable network.

Commuter students need to know about the flexibility and the academic benefits that online or blended learning can offer them, including the inherent expectations and workload of an online course. Without knowledge of the demands and expectations of online or blended learning or how it can contribute to their academic success, commuter students' valuable time may be relegated to commuting, not degree completion.

A Day in the Online Life of a Student

We're living in ultra-connected times, and Jack and Jane College Student have access to a lot of technology, not all of it having a clear academic or pedagogical purpose. Recent research indicates nearly one-fourth of adults in America report being online almost constantly, and this proportion is higher for younger adults (18–29 years old).[47] Gaming systems, streaming media devices, and voice-activated personal assistants threaten to suck up valuable time and bandwidth that could otherwise be spent on more academic and intellectual pursuits. Although it might be tempting to think students while away the hours posting on Instagram, binge-watching Netflix, or racking up experience points in *World of Warcraft*, our data suggest otherwise. Indeed, the typical student is pretty serious about doing the work of being a student.

When we asked them to approximate how much time they spend engaged in online activities in a typical day, overall, students said they devote more time to homework and research online than they do to social media, streaming video, gaming, or other online activities (see figure 8). While the typical student may spend about as much time online doing homework or research as on other online activities, almost half (40%) of students reported spending between 3 and 4 hours a day working online; these results were largely similar across Carnegie class, ethnicity, and gender. The typical student spends about half that amount of time—between 1 and 2 hours—on social media (37% of respondents) and streaming video (36% of respondents). About a third of students (32%) spend less than 1 hour per day on other online activities. The majority of students told us they do not game online, but those who do game are predominantly male. In addition, students who do more homework and research online also tend to be women.

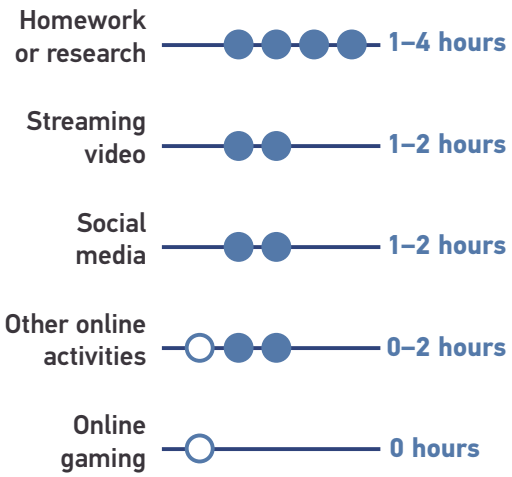


Figure 8. How the typical student spends time online

These results highlight the important role connectivity plays in both students' academic work and leisure interests; but more importantly, these findings suggest that much of students' time online is spent on activities related to their coursework. These data are especially salient when we bear in mind that the majority of students (69%) reported working a job while taking classes over the past year; among those, more than half (57%) work between 10 and 29 hours per week. Thus, it seems that Jack and Jane do not have much spare time. Providing dependable Wi-Fi connectivity is key to supporting students in the work they do for their academics, particularly when we also consider that the majority of students prefer blended learning environments. While students do not spend hours on end binging *Stranger Things* or playing *Call of Duty*, reliable Wi-Fi connections, especially in on-campus housing and in common spaces, offer them opportunities to balance the demands of college with popular leisure activities and connect with other communities. After all, all work and no play makes Jane and Jack dull students.

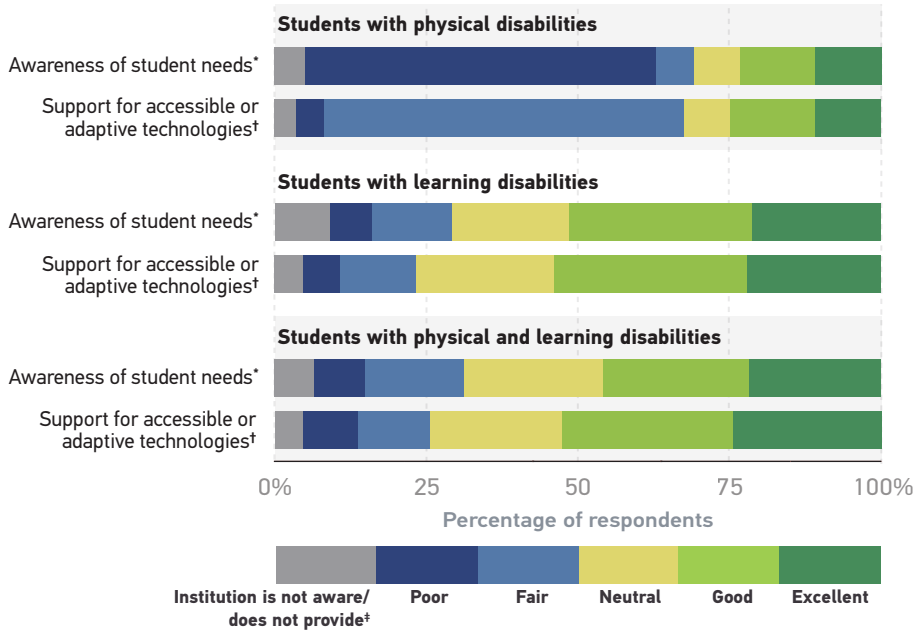
Accessibility

After a difficult freshman year, Lucas realizes he needs help. In high school he was diagnosed with a condition that affects his fine-motor skills, and he received therapy and accommodations that helped him succeed. When he started college, he decided not to register with the campus Office of Disability Services, but the demands of college proved challenging, and he struggled to keep up. Writing in longhand for extended periods is painful and results in illegible class notes. Using his laptop works best for him, but half of his instructors last year didn't allow laptops in class. The Office of Disability Services requires proof of his condition that must be no more than three years old, so Lucas visits his doctor for an updated exam, earns money to cover the medical fees to fill out his accommodation forms (which aren't covered by his insurance), and registers. He receives an accommodation to use his laptop in class and notifies all his instructors before classes begin. On the first day of his Intro to Economics course, the professor reviews the course policies, which include a ban on personal tech devices in class. As the student next to him packs her laptop away, she says, "Didn't you hear her? We can't use our computers in class." Even though he has an accommodation, Lucas doesn't want to talk about his disability with a stranger. He closes his laptop screen and takes out a pen and paper.

The Americans with Disabilities Act of 1990 (ADA) requires that colleges and universities make reasonable accommodations to students with documented disabilities by providing or modifying equipment, making facilities accessible, and/or providing readers or interpreters. The institutional provision of accessible web content and technologies is not then merely an issue of ethics or morality but one of legal liability. Institutions that fail to properly accommodate the needs of their students may find themselves confronted with lawsuits, complaints, and settlements. However, one of the major problems facing colleges and universities is that institutions may simply not be aware of students' needs. Of the 7% of student respondents who self-identified as having a physical and/or learning disability requiring accessible or adaptive technologies for their coursework in 2018, a concerning 27% rated their institution's awareness of their needs as poor.[48] More worrisome is the fact that students' poor ratings of their institutions' awareness of their needs have increased by 16 percentage points over the past three years. The news is somewhat better when it comes to the technology assistance these students reported receiving. The largest group of students (42% of those reporting a disability) said their support was good/excellent, and slightly fewer reported ratings of poor and neutral compared with last year.

Far more students with physical disabilities (58%) reported poor institutional awareness of their need for accessible technologies than those with learning

disabilities (7%) or with both physical and learning disabilities (8%) (see figure 9). Forty-four percent of students at DR public universities said knowledge of their needs was poor, which is significantly higher than any other Carnegie class (the next closest are MA public and DR public, both at 10%). AA institutions received significantly better marks than other institution types, with awareness and support of tech requirements rated as good or excellent by the majority of students at these schools. BA institutions also scored well on awareness and especially on support. Reinforcing this finding, our data indicate that institution size is also a factor, as poor ratings for awareness are highest (41%) and good/excellent ratings are lowest (32%) for institutions with full-time enrollments of 15,000 students or more. Slightly more students who have physical disabilities attend public DR institutions, and 93% of these students are eligible for Pell Grants.



* Institution's awareness of student needs for accessible or adaptive technologies needed for coursework
† Institution's support for accessible or adaptive technologies needed for coursework
‡ Institution is not aware of needs for accessible or adaptive technologies/Student is not provided with accessible or adaptive technologies needed

Figure 9. Institutional awareness of students' needs for accessible or adaptive technologies

Overall, our data suggest that IT accessibility is an issue for many college students with both physical and learning disabilities. According to these students, institutions have a lot of room for improvement. Awareness may be especially challenging for the largest public DR institutions given the sheer number of students they serve, but resources to accommodate may be an issue

as well. Being aware of these needs also depends on whether students choose to disclose disabilities to their institutions. Indeed, research indicates that student disability disclosure rates are low in colleges and universities.[49] Many students who have diagnosed disabilities do not divulge their disability for fear they may be stigmatized or penalized by their instructors or may not be believed if their condition is not apparent.[50] AA institutions may be more successful in addressing these needs since community colleges enroll more students with disabilities[51] than do other institutions.[52] Many community colleges also offer transition programs that provide academic support, and they help students develop self-advocacy skills so they can be more successful when they go on to four-year institutions and/or join the workforce.[53] However, some of these programs, which are also offered by other institution types, are fee-based, which may make them financially out of reach for some students, especially when we consider that most students with disabilities are eligible for Pell Grants, indicating a socioeconomic disadvantage.[54] To increase institutional awareness and provide better support to students with disabilities, we recommend the following:

- Be a collaborative partner in testing and implementing assistive/accessible technologies[55] and the principles of universal design for learning. IT units can take a proactive approach by working with disability services and other units to identify gaps in support that students with disabilities experience and be instrumental in closing those gaps.
- Provide professional development to IT staff via accessibility workshops, conferences, and training; develop campus IT accessibility policies related to the development, procurement, and implementation of products.[56] Encourage the cultivation of an "accessible mind-set" across all campus stakeholders to better understand the needs of students with disabilities.[57]Revise informational and course materials targeted to this population to emphasize accessibility, which focuses on inclusion and universal learning,[58] to help destigmatize student learning barriers. Accessibility statements on course syllabi are a critical contact point for students with disabilities that invite them to disclose personal information that impacts their learning[59] and can open a productive dialogue with their institution.
- Offer training for faculty on implementing Web Content Accessibility Guidelines[60] and other universal/inclusive instructional practices. Educate faculty on the inequitable impacts and potential legal implications that bans on in-class use of personal devices can have on students with disabilities.
- And stop us if you've heard this one before: Stop banning laptops.

While accessibility should certainly be a campus-wide commitment, IT can take these steps to be a strategic institutional partner in creating a more inclusive and supportive environment for students who have disabilities and learning differences.

Student Success Tools

Naomi's breakfast is interrupted by an alert on her mobile LMS app that she did not perform as well as she had thought on her recent psychology quiz. As a freshman, she was unsure what to expect from participating in these alerts. Naomi notes the tone of the alert is like a concerned "nudge," so she schedules a tutoring session from a list of options presented to her for that afternoon. While waiting for her class to begin, she logs in to her student account from her smartphone and confirms that the general education credits for the courses she took at her local community college have transferred. At her advising appointment, she explores the idea of adding an art history major to her chemistry major with the aim to enter the field of art restoration. That evening, using her campus's degree-planning tool, she begins mapping out several different paths to completing her double major and discovers she can actually complete both and graduate early.

As Naomi's story suggests, online student success tools can be categorized into two broad camps: tools that aid in academic success, such as early-alert systems, and tools that aid in the work of being a student, such as self-service systems for tracking credits or registration. We asked students if they were aware of whether their institution provided these student success tools and whether they found them helpful.[61] Overall, more students found tools that aided them in the work of being students more useful than tools that helped with academic performance (see figure 10). Nearly all students reported that the tools that helped them conduct business, conduct degree audits, track credits/credit transfers/dual enrollment, or plan degrees were at least moderately useful. In particular, higher percentages of students found degree-auditing tools very or extremely helpful compared with other types of tools. The group of tools least used by students was self-service referral systems (e.g., volunteer or crisis counseling services).

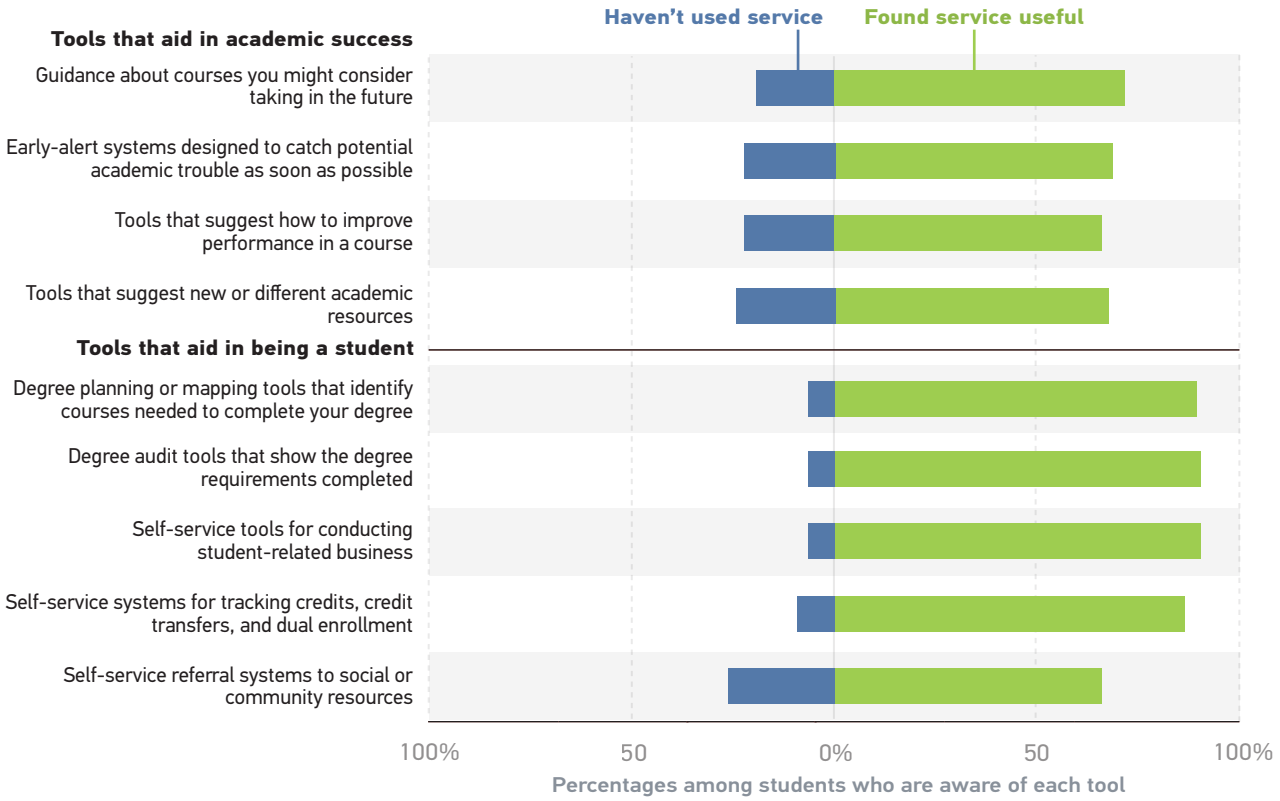


Figure 10. Student evaluations of student success tools

Two-thirds of students said tools that suggest how to improve course performance were at least moderately useful. However, more students told us they did not use tools for academic success as much as tools that aid in the work of being a student (e.g., registration tools). For example, 24% of students said they did not use tools that suggest new or different academic resources (e.g., tutoring or other skills-building opportunities). Of more concern was that a fifth of students did not use early-alert systems, which could be explained by negative attitudes toward these services. If the system is perceived as a Big Brother mechanism—a punitive, judgmental, all-knowing, all-seeing academic Robocop counselor—or a generator of guilt rather than support and encouragement, students may not want to use the system.[62] Tools that aid in transactions, such as tuition payments, do not ask students to do something; they provide students a service. Tools that engage students in making an appointment may also be perceived as generating additional work for them. Or they may simply not be aware of how these tools can be harnessed for their academic success.

Who are the students who found student success tools useful? Overall, compared with other students, more minority students and students eligible for Pell Grants found tools that aid in academic success at least moderately useful. Although first-generation students tend to be a priority for student success initiatives, they were not more likely to find these tools useful. Still, these findings are good news for institutions that seek to leverage these tools to increase rates of student success.[63] Low-income, first-generation minority students are predicted to be a large segment of student enrollment within the next several years.[64] However, research continues to show racial/ethnic disparities in completion rates.[65] The aims of the Integrated Planning and Advising for Student Success initiatives (e.g., first-generation IPAS and second-generation iPASS) were to increase completion rates, so underrepresented students' positive assessments of these tools is an encouraging finding.[66] Institutions should note, however, that even when students were aware of these tools for academic success, around 20% did not use them. This is of concern, since online student success tools such as early-alert systems have been found to benefit student performance.[67]

It's clear that students like Naomi want to leverage these tools for their success. Institutions should make greater investments in communicating the benefits of using these tools to students in orientation, during advising meetings, or by advertising these tools via social media or on institutional websites, and the messages need to be tailored to the audience, including institutional faculty and staff.[68] Institutions should also try to increase faculty buy-in for the use of these success tools. In 2017, we found that between 16% and 28% of faculty do not have access to these services and between 23% and 34% of faculty have access but apparently choose not to use them.[69] IT and student success leaders view faculty adoption of these initiatives as the top concern for implementation.[70] Institutions should also ensure early-alert messages are student-centered—for example, having an interactive component that responds to unique needs based on each student's identification of specific challenges in their courses. Personalizing these approaches may aid students in using tools that can increase opportunities for academic success.

Conclusion

Our findings this year reflect students who are serious about the work of being students and who continue to leverage personal and campus technology for their academic success. Personal technologies remain reliably prevalent; other technologies with potential impact to enhance student learning are emerging among our students. Meanwhile, campus technology infrastructure continues to influence students' overall tech experiences. This year we also determined that student demographics play an important role in the types of technology that are viewed as critical to their success as well as to their experiences of technology. We are also optimistic that this year's report can foster important dialogues among campus stakeholders regarding technology, diversity, equity, and inclusion, as well as accessibility. Although reporting that "change is occurring" while some things "remain the same" doesn't constitute a game-changing proclamation, we are confident this report provides strong insights into why these trends are occurring, as well as actionable recommendations for institutional stakeholders.

The more evidence that can be collected to understand students' technological preferences for and relations to technology, the better equipped faculty and IT organizations will be to address current needs and anticipate future student needs. In 2018, students continue to see technology as essential to their academic success. What is crucial now is identifying how best to leverage it for student success, based on institutional goals, costs, pedagogical approaches, and evidence of impact. This report supports these conversations by providing empirical evidence for addressing these goals rather than relying on anecdotal-based assumptions about students and technology or single studies that confirm our preconceived biases. We hope that this report will serve as the starting point of those conversations.

Recommendations

- **Continue providing students with access to the basic technologies that are most important to their academic success.** The maintenance of desktop computer labs, laptop and tablet rental programs, and negotiated discounts for personal academic devices enable nearly all students to have access to the technologies they need to succeed. Avoid the creation of a new digital divide by making bleeding-edge technologies such as AR and VR headsets and 3D printers and scanners equally and publicly available to all students in venues such as makerspaces and libraries.
- **Eliminate classroom bans of student devices important to their success.** Although devices that can connect to the internet have the potential to distract students during class, many students—especially women, students of color, students with disabilities, first-generation students, students who are independent (with or without dependents of their own), and students from disadvantaged socioeconomic backgrounds—find these devices significantly more important to their academic success than do their counterparts. Classroom device bans have the potential to indiscriminately undermine students who may disproportionately rely on them, creating unnecessary (and possibly illegal) obstacles for those who may need them the most.
- **Increase the reach and quality of campus Wi-Fi networks.** Students should have experiences with their institutional Wi-Fi similar to what they have in public places and with their home networks. Wi-Fi connectivity across all areas of campus should be considered the industry standard for higher education institutions. Without these improvements, campus IT departments will continue to hear students' complaints and concerns about connectivity while reporting poorer technology experiences at their institution. Campus IT should improve IoT connections to campus networks and proactively communicate to students, faculty, and staff how increased network security can affect their login experiences.
- **Expand student awareness of the benefits, expectations, and demands of blended learning environments.** Students should receive consistent and clear information from multiple campus sources so that they can make well-informed decisions about the learning environments that are best suited to their own learning and lives. Expose students to blended learning early in their college careers and provide faculty who lack blended learning experience with professional development and opportunities to teach in these environments.

- **Ensure that commuter students have the tools and information they need to take advantage of blended and online learning and leverage their institution's technology to meet their academic needs.** Off-campus students should be similarly informed of the benefits, expectations, and demands of blended or online learning environments. Ensuring quality networks across all areas of campus will also benefit commuter students who have poor, fair, or no internet connectivity at home. Institutions can also look to partner with community resources, such as public libraries in student communities, to facilitate commuter students' access to reliable Wi-Fi networks.
- **Build collaborative partnerships across campus to increase awareness and better meet the needs of students with disabilities who require assistive/adaptive technologies.** Many students with disabilities choose not to disclose their disabilities for fear of being stigmatized. Fostering an inclusive mind-set and using language that communicates "accessibility" instead of "disability" in resources and course materials is key to opening a productive dialogue with students so that they feel comfortable requesting the services they need to be successful. Work proactively with disability services and support the adoption of universal design for learning principles for tech across campus.
- **Increase the use of student success tools.** Student success tools can contribute to students' academic performance. However, fewer students used student success tools that aided in academic performance than online tools that aided them in conducting the business of being students. The benefits of these tools should be communicated early to students in orientation, during advising meetings, or by advertising these tools via social media or on institutional websites. In particular, instructors and institutions should be aware of, have buy-in, use, and consistently communicate the benefits of these tools to their students to increase their use.

Methodology

In 2018, ECAR conducted its latest annual study of undergraduate students and information technology to shed light on how IT affects the college/university experience. These studies have relied on students recruited from the enrollment of institutions that volunteer to participate in the project. After institutions secured local approval to participate in the 2018 study (e.g., successfully navigating the IRB process) and submitted sampling plan information, they received a link to the current year's survey. An institutional representative then sent the survey link to students in the institution's sample. Data were collected between February 5 and April 23, 2018, and 64,536 students from 130 institutional sites responded to the survey (see table M1). ECAR issued $50 or $100 Amazon.com gift cards to 39 randomly selected student respondents who opted in to an opportunity drawing offered as an incentive to participate in the survey. Colleges and universities use data from the EDUCAUSE Technology Research in the Academic Community (ETRAC) student and faculty surveys to develop and support their strategic objectives for educational technology. With ETRAC data, institutions can understand and benchmark what students and faculty need and expect from technology. There is no cost to participate. Campuses will have access to all research publications, the aggregate-level summary/benchmarking report, and the institution's raw (anonymous) response data.

Table M1. Summary of institutional participation and response rates, by institution type*

Carnegie Class	Institution Count	Invitations	Response Count	Group Response Rate	Percentage of Total Responses	US Percentage
AA	39	120,449	9,958	8%	15%	18%
BA public	1	2,756	360	13%	<1%	<1%
BA private	3	6,311	988	16%	2%	2%
MA public	24	121,656	13,319	11%	21%	25%
MA private	11	30,895	4,409	14%	7%	8%
DR public	30	328,124	23,115	7%	36%	43%
DR private	5	30,500	2,022	7%	3%	4%
Specialized US	1	670	114	17%	<1%	<1%
Total US	114	641,361	54,285	8%	84%	100%
Outside US	16	73,658	10,251	14%	16%	–
Grand total	**130**	**715,019**	**64,536**	**9%**	**100%**	**–**

** US institutions not in the Carnegie universe were classified according to the Carnegie Classification framework.*

The quantitative findings in this report were developed using 54,285 survey responses from 114 US institutions. Responses were neither sampled nor weighted. Comparisons by student type and institution type are included in the findings when there are meaningful differences, and all statements of significance are at the .001 level unless otherwise noted. Findings from past ECAR studies were also included, where applicable, to characterize longitudinal trends.

Table M2. Demographic breakdown of survey respondents

	US Institutions	Non-US Institutions	All Institutions
Basic demographics			
18–24	78%	80%	78%
25+	22%	20%	22%
Male	34%	54%	37%
Female	66%	46%	63%
White	58%	n/a	n/a
Black/African American	6%	n/a	n/a
Hispanic/Latino	17%	n/a	n/a
Asian/Pacific Islander	9%	n/a	n/a
Other or multiple races/ethnicities	10%	n/a	n/a
Student profile			
Freshman or first year	25%	29%	26%
Sophomore or second year	24%	30%	25%
Junior or third year	23%	17%	22%
Senior or fourth year	19%	18%	19%
Other class standing	9%	7%	8%
Part time	18%	20%	18%
Full time	82%	80%	82%
On campus	28%	33%	29%
Off campus	72%	67%	71%
First-generation college student	29%	40%	31%
Eligible for Pell Grants	59%	n/a	n/a

Cont'd

	US Institutions	Non-US Institutions	All Institutions
Major			
Agriculture and natural resources	2%	3%	2%
Biological/life sciences	8%	12%	9%
Business, management, marketing	13%	20%	14%
Communications/journalism	3%	<1%	3%
Computer and information sciences	7%	7%	7%
Education, including physical education	6%	8%	6%
Engineering and architecture	8%	16%	10%
Fine and performing arts	3%	1%	2%
Health sciences, including professional programs	18%	7%	16%
Humanities	2%	6%	3%
Liberal arts/general studies	5%	<1%	4%
Manufacturing, construction, repair, or transportation	<1%	<1%	<1%
Physical sciences, including mathematical sciences	2%	3%	2%
Public administration, legal, social, and protective services	2%	3%	2%
Social sciences	7%	4%	7%
Other major	10%	8%	9%
Undecided	2%	<1%	1%

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Appendix: Participating Institutions

Abilene Christian University
Alexandria Technical & Community College
American University of Rome
Anoka-Ramsey Community College
Anoka Technical College
Appalachian State University
Auburn University
Auburn University at Montgomery
Baylor University
Bemidji State University
Bradley University
Broward College
Burman University
Butler University
California State University–Fresno
California State University–Los Angeles
California State University–Northridge
Campbell University
Central Lakes College–Brainerd
Century College
Chadron State College
Clemson University
Cleveland State Community College
Collin County Community College District
Coppin State University
County College of Morris
Dakota County Technical College
Denison University
Embry-Riddle Aeronautical University–Daytona Beach
Evergreen Valley College
Fond du Lac Tribal and Community College
Fordham University
Forman Christian College
Gallaudet University
Georgia College & State University
Gonzaga University
Hennepin Technical College
Hibbing Community College
Indiana State University
Inver Hills Community College
Itasca Community College
Joliet Junior College
Lake Superior College
Lappeenranta University of Technology
Lawrence Technological University
Louisiana State University
Louisiana State University–Alexandria
Madison Area Technical College
McGill University
Mesabi Range College
Messiah College
Metropolitan State University
Middle East Technical University
Midwestern State University
Minneapolis Community and Technical College
Minnesota State College Southeast
Minnesota State Community and Technical College
Minnesota State University Moorhead
Minnesota State University–Mankato
Minnesota West Community and Technical
Montgomery County Community College
Morgan State University
National Defence University (Finland)
Nazareth College
New Jersey Institute of Technology
Normandale Community College
North Hennepin Community College
Northland Community and Technical College
Northwest Technical College
North-West University
Northwestern University
Oregon State University
Otterbein University
Pine Technical and Community College
Portland State University
Rainy River Community College

Ridgewater College
Riverland Community College
Rochester Community and Technical College
Rutgers University–New Brunswick
Saimaa University of Applied Sciences
Saint Cloud State University
Saint Paul College
San Jose City College
Sauk Valley Community College
Simpson College
Sonoma State University
South Central College
Southwest Minnesota State University
St. Cloud Technical and Community College
St. John's University (New York)
Tampere University of Applied Sciences
The American College of Greece
The University of Texas at Arlington
The University of Texas at San Antonio
The University of Texas Rio Grande Valley
Thomas College
Truman State University
University College Dublin
University of Alberta
University of Arkansas
University of Cape Town
University of Central Florida
University of Delaware
University of Houston
University of Maryland–Baltimore County
University of Maryland–College Park
University of Memphis
University of Michigan–Ann Arbor
University of Missouri–Columbia
University of Nevada–Las Vegas
University of Nevada–Reno
University of New Mexico
University of North Dakota
University of Pretoria
University of South Dakota
University of Trinidad and Tobago
University of Washington–Seattle Campus
University of Wisconsin–River Falls
Utah Valley University
Vermilion Community College
Virginia Polytechnic Institute and State University
Wake Forest University
Weber State University
West Chester University of Pennsylvania
West Virginia University
Western Carolina University
Western Washington University
Winona State University
Worcester State University

Notes

1. See Diversity, Equity, and Inclusion (DEI).
2. D. Christopher Brooks and Jeffrey Pomerantz, *ECAR Study of Undergraduate Students and Information Technology, 2017*, research report (Louisville, CO: ECAR, October 2017), 12–14.
3. For this project we defined hybrids as 2-in-1 devices that function as laptops with touchscreen capabilities (e.g., Lenovo Yoga, Microsoft Surface). In this way, a hybrid device replaces the need for laptops and tablets by the 11% of students who have access to them.
4. "Digital inclusion" is defined by the National Digital Inclusion Alliance as including five elements: "1) affordable, robust broadband internet service; 2) internet-enabled devices that meet the needs of the user; 3) access to digital literacy training; 4) quality technical support; and 5) applications and online content designed to enable and encourage self-sufficiency, participation and collaboration."
5. EDUCAUSE defines "extended reality" (XR) as a wide range of technologies along a continuum, with the real world at one end and fully immersive (e.g., virtual reality) simulations at the other, with gradations of mixed environments (e.g., augmented reality) in between. See Jeffrey Pomerantz, *Learning in Three Dimensions: Report on the EDUCAUSE/HP Campus of the Future Project*, research report (Louisville, CO: EDUCAUSE, August 2018), 3.
6. Stephen Noonoo, "Maker Culture Has a 'Deeply Unsettling' Gender Problem," *EdSurge*, June 14, 2018; "MakeHers Report: Engaging Girls and Women in Technology through Making, Creating, and Inventing," *Intel,* 2014.
7. Youngmoo E. Kim, Kareem Edouard, Katelyn Alderfer, and Brian K. Smith, *Making Culture: A National Study of Education Makerspaces*, Drexel University, 2018.
8. Noonoo, "Maker Culture Has a 'Deeply Unsettling' Gender Problem," 2018; Ryan Noonan, "Women in STEM: 2017 Update," U.S. Department of Commerce Economics and Statistics Administration, Office of the Chief Economist, November 13, 2017.
9. Dana Gierdowski and Daniel Reis, "The Mobile Maker: An Experiment with a Mobile Makerspace," *Library Hi Tech* 33, no. 4 (2015): 480–96, DOI: 10.1108/LHT-06-2015-0067; David. M. Sheridan, "Fabricating Consent: Three-Dimensional Objects as Rhetorical Compositions." *Computers and Composition* 27, no. 4 (2010): 249–65, DOI: 10.1016/j.compcom.2010.09.005.
10. Hybrid or 2-in-1 devices (e.g., Lenovo Yoga, Microsoft Surface) are the technologies that are closest to laptops in terms of students using them for at least one course (90%) and rating them as very to extremely important to their academic success (83%). Their relative usage and importance may be a product of the similar power and versatility of such devices to laptops. However, the relative position of hybrids to laptops is inflated given that only 11% of students reported having access to hybrid devices compared to 91% of students who have access to laptops.
11. Note that student use of desktops for coursework is significantly related to major. Majors for a majority of students who report using desktops in most to all of their courses include computer and information sciences (59%), engineering and architecture (56%), public administration, legal, social, and protective services (54%), and humanities (51%).
12. Here we use students' self-reported Pell Grant eligibility as a proxy for lower income levels among students.
13. Reported results are derived from multivariable ordered logistic regression models controlling for demographic predictors of device importance levels. All reported results are statistically significant at the $p < .001$ level.

14. Brooks and Pomerantz, *ECAR Study of Undergraduate Students and Information Technology, 2017*.

15. Jeffrey Pomerantz and D. Christopher Brooks, *ECAR Study of Faculty and Information Technology, 2017*, research report (Louisville, CO: ECAR, October 2017).

16. It's important to note that as of 2013, 3% of the US population still uses home dial-up internet services. See Joanna Brenner, "3% of Americans Use Dial-Up at Home," Pew Research Center, August 21, 2013.

17. These variables are gender, ethnicity, Pell Grant eligibility, age (18–24, 25+).

18. MA and DR private institution students accounted for 12% of all student responses.

19. All AA students' responses are included in these percentages. Fifty-eight percent of AA students reported that internet connectivity in dormitories/housing was either good or excellent, with 23% reporting neutral experiences. Although nearly all AA students do not live on campus (only 3% of AA students reported living on campus), community colleges are increasingly offering on-campus housing options. See, for example, Kate Barrington, "The Pros and Cons of On-Campus Housing for Community College," *Community College Review,* September 12, 2017.

20. Joseph D. Galanek and D. Christopher Brooks, *Enhancing Student Academic Success with Technology*, research report (Louisville, CO: ECAR, forthcoming).

21. Ibid.

22. Susan Grajek and the 2017–2018 EDUCAUSE IT Issues Panel, "Top 10 IT Issues, 2018: The Remaking of Higher Education," *EDUCAUSE Review* 53, no. 1 (January/February 2018): 10–59.

23. Ibid.

24. Lindsay McKenzie, "At What Cost Wi-Fi?" *Inside Higher Ed*, April 17, 2018.

25. Allie Nicodemo, "Can Alexa Simplify Student Life? Northeastern Gave 60 Students Amazon Echo Dots to Find Out," *News@Northeastern,* June 21, 2018.

26. Tina Nazerian, "Amazon Pushes Echo Smart Speakers on Campus," *EdSurge*, August 28, 2017.

27. Credit for this simile goes to Richard Sebastian, Director of the OER Degree Initiative for Achieving the Dream.

28. Brooks and Pomerantz, *ECAR Study of Undergraduate Students and Information Technology, 2017*.

29. Eighty-nine percent of BA students reported LMS use for "most" or "all" courses.

30. Doris Cheung, "Optimizing Student Learning with Online Formative Feedback," *EDUCAUSE Review*, April 4, 2016.

31. Galanek and Brooks, *Enhancing Student Academic Success with Technology*, forthcoming.

32. Pomerantz and Brooks, *ECAR Study of Faculty and Information Technology, 2017*; D. Christopher Brooks, *ECAR Study of Faculty and Information Technology, 2015*, research report (Louisville, CO: ECAR, October 2015).

33. Galanek and Brooks, *Enhancing Student Academic Success with Technology*, forthcoming.

34. Jeffrey Pomerantz, Malcolm Brown, and D. Christopher Brooks, *Foundations for a Next Generation Digital Learning Environment: Faculty, Students, and the LMS*, research report (Louisville, CO: ECAR, January 2018).

35. Malcolm Brown, Joanne Dehoney, and Nancy Millichap, "What's Next for the LMS?" *EDUCAUSE Review* 50, no. 4 (July/August 2015).

36. Between 2017 and 2018, we continued to ask the same question: "In what type of learning environment do you most prefer to learn?" In 2017, the response options included the following: "One with no online components," "One with some online components," "About half online and half face-to-face," "One that is mostly but not completely online," "One that is completely online," and "No preference." In 2018, we changed the response options to the following: "One that is completely face-to-face," "One that is mostly but not completely face-to-face," "About half online and half face-to-face," "One that is mostly but not completely online," "One that is completely online," and "No preference."

37. Robert B. Zajonc, "Attitudinal Effects of Mere Exposure," *Journal of Personality and Social Psychology* 9, no. 2 (pt. 2, 1968): 1–27, DOI:10.1037/h0025848.

38. These included variables such as Carnegie class, FTE, gender, ethnicity, Pell Grant eligibility, full-time/part-time enrollment status, and first-generation college status.

39. "2017 State of Telecommuting in the U.S. Employee Workforce," Global Workplace Analytics & FlexJobs.

40. Ruth Colker, "Universal Design: Stop Banning Laptops!" *Cardoza Law Review* 39 (2017): 483–93.

41. Candace Cortelia and Sheldon H. Horowitz, *The State of Learning Disabilities: Facts, Trends, and Emerging Issues* (New York: National Center for Learning Disabilities, 2014); Noreen Glover, Timothy Janikowski, and Mary Handley, "Rehabilitation Counseling Student Disclosure of Disability and Use of Educational Accommodations," *Rehabilitative Education* 17 (2003): 224–36.

42. Twelve percent of off-campus students reported "neutral" experiences with their home connectivity. Off-campus students without home internet connectivity (711, or 2% of total commuter students) still have access to the workhorse devices for students at percentages marginally lower than the general student population. Smartphones were the device to which they had the most access (92%), followed by laptops (82%), tablets (33%), desktops (29%), and hybrids (8%). Sixty-seven percent of commuter students without a home internet connection reported that they prefer a learning environment that is all or mostly face-to-face (compared to 70% among all students).

43. Maura Smale and Mariana Regalado, "Commuter Students Using Technology," *EDUCAUSE Review*, September 15, 2014.

44. Even commuter students who rated their internet connections as poor or fair had preferences for blended learning environments similar to those of commuter students who rated their connections as good or excellent.

45. Klint Finley, "FCC Plan to Kill Net Neutrality Rules Could Hurt Students," *Wired*, December 12, 2017. The possibility remains that the FCC's repeal of net neutrality could be overturned or that state legislation could ensure continued net neutrality. See, for example, Klint Finley, "The FCC's Net Neutrality Rules Are Dead, But the Fight Isn't," *Wired*, June 11. 2018.

46. EDUCAUSE joined with 19 other higher education and library groups, including the American Council on Education (ACE), the Association of Research Libraries (ARL), and the American Library Association (ALA), to file an amicus brief in support of reversing the FCC's net neutrality repeal and restoring its 2015 rules. For more information, see Jarret Cummings, "EDUCAUSE Joins Net Neutrality Amicus Brief," *EDUCAUSE Review*, August 29, 2018.

47. Andrew Perrin and Jingjing Jiang, "Almost a Quarter of U.S. Adults Say They Are 'Almost Constantly' Online," Pew Research Center, March 14, 2018.

48. We do not know if all students who reported having disabilities informed their institutions of their need for accommodations. In this way, statements regarding institutional awareness should be interpreted as general, not specific.

49. Cortelia and Horowitz, *The State of Learning Disabilities: Facts, Trends, and Emerging Issues*, 2014; Glover, Janikowski, and Handley, "Rehabilitation Counseling Student Disclosure," 2003.

50. Julie R. Alexandrin, Ilana Lyn Schreiber, and Elizabeth Henry, "Why Not Disclose?" in *Pedagogy and Student Services for Institutional Transformation: Implementing Universal Design in Higher Education*, eds. Jeanne L. Higbee and Emily Goff (Minneapolis: University of Minnesota, 2008).

51. See Fast Facts 2017, American Association of Community Colleges.

52. Based on the difference in prevalence of students with disabilities across Carnegie classes and the small overall prevalence in our data set, DR public institutions appear to serve more students with physical disabilities. However, these data differ from the most recent national statistics published by the American Association of Community Colleges, as well as data from the National Center for Education Statistics.

53. Grace Chen, "Students with Learning Disabilities Find Help in Community Colleges," *Community College Review,* April 26, 2018.

54. Individuals with disabilities are overrepresented in the United States among the poor, underemployed, and uneducated, which can impact the socioeconomic status of the family structure. See "Disability and Socioeconomic Status," American Psychological Association.

55. Tara Bunag, "Empathy and Collaboration: Accessibility in IT," *EDUCAUSE Review*, July 23, 2018.

56. "7 Things You Should Know About IT Accessibility," EDUCAUSE, August 13, 2014.

57. Bunag, "Empathy and Collaboration: Accessibility in IT," 2018.

58. Mark Sample, "Accessibility Statements on Syllabuses," *Chronicle of Higher Education*, September 9, 2013.

59. Tara Wood and Shannon Madden, "Suggested Practices for Syllabus Accessibility Statements," *Kairos* 18, no. 1.

60. See "Web Content Accessibility Guidelines Overview," W3C Web Accessibility Initiative.

61. Students who reported they were aware of tools in figure 10 were then asked to rate the usefulness of the tool or whether they had used the tool.

62. Hoori Santikian Kalamkarian and Melinda Mechur Karp, "Student Attitudes toward Technology-Mediated Advising Systems," Community College Research Center, August 2015.

63. "7 Things You Should Know About IPAS," EDUCAUSE Learning Initiative, November 5, 2014.

64. Peace Bransberger, *Fewer Students, More Diversity: The Shifting Demographics of High School Graduates*, Western Interstate Commission for Higher Education, July 2017.

65. "Completing College – National by Race and Ethnicity – 2017," NSC Research Center, April 26, 2017.

66. Ronald Yanosky and D. Christopher Brooks, *Integrated Planning and Advising Services (IPAS) Research*, ECAR, August 30, 2013; iPASS Grant Challenge.

67. Cheung, "Optimizing Student Learning with Online Formative Feedback," 2016.

68. Nancy Millichap and Ana Borray, "How iPASS Worked in Supporting Student Success—The Two Sides of the Coin: Technology & People," *eCampusNews*, August 6, 2018.

69. Pomerantz and Brooks, *ECAR Study of Faculty and Information Technology, 2017*.

70. "Integrated Planning and Advising Services," infographic (Louisville, CO: ECAR, 2013).