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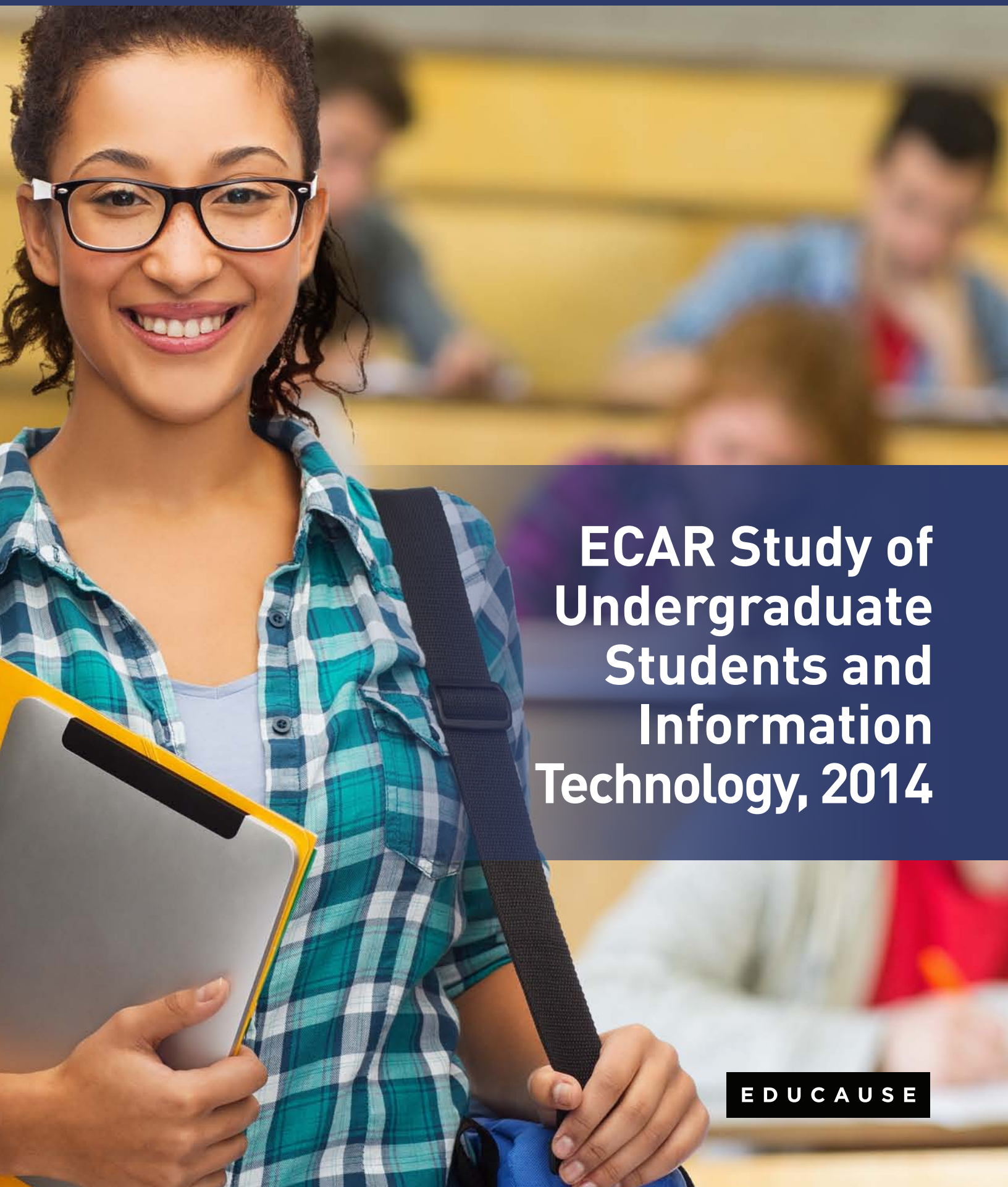

ECAR Study of Undergraduate Students and Information Technology, 2014

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Foreword

In this tenth anniversary of the ECAR student study, we find a thriving research program that is more worthwhile than ever. From 12 participating institutions to 213. From 4,123 students to 75,306. And from a time when students "expressed only a moderate preference for IT use in the classroom" to a time when "technology is omnipresent in the lives of students." Today students overwhelmingly prefer *and have experienced* courses with at least some online components. Oh, how things have changed.

The challenge now for institutions is not whether or how much technology to use but how to use technology in ways that are consonant with institutional culture and identity to help students succeed in individual courses, in their college experience, and in their educational objectives. The challenge is to meet students' expectations of functionality and performance and to support their preexisting technology environments while applying the right technologies to deepen their educational engagement. In some cases, institutions need to consider investing in or expanding their use of such student-preferred technologies as early-alert systems and other learning analytics, gaming and simulations, mobile devices, and more affordable alternatives to traditional textbooks such as e-textbooks or open content. In other cases, faculty and IT organizations need to consider how to better leverage the features in existing applications such as the learning management system.

These decisions will differ for each institution. One of the most valuable uses of the ECAR student study is not to mark the passage of time but instead to help institutions prepare for the future. Many higher education leaders are looking for guidance in how and whether to invest in online learning and in technologies to support student success. This study can help leaders frame and answer key questions about what their students need and hope for from technology, which can help immensely as an institution develops its strategic objectives for educational technology.

The stakes are high. MOOCs are only the most publicized of an expanding and evolving marketplace of alternatives to traditional higher education. At a time when that tradition is growing increasingly unaffordable, less expensive options look increasingly attractive to students from all walks of life. Technology is, paradoxically, both a potential solution—to make higher education more affordable and effective—and the potential substrate of new business models for higher education that may compete with today's colleges and universities. Institutions that harness technology in the service of their educational missions—and that cannily adapt their cultures to achieve optimal potential from technology—will stand the greatest chance of thriving in the decades to come. This study provides guidance to help higher education leaders make wise investments in technologies and support.

—Susan Grajek, EDUCAUSE

Executive Summary

Since 2004, ECAR has partnered with higher education institutions to investigate the technologies that matter most to undergraduate students. We do this by exploring students' technology experiences and expectations. In 2014, the ECAR technology survey was sent to approximately 1.5 million students at 213 institutions, yielding 75,306 responses across 15 countries. This year's findings are based on a stratified random sample of 10,000 U.S. respondents and shed light on a number of topics.

General student technology experiences and expectations

- Technology is embedded into students' lives, and students are generally inclined to use and to have favorable attitudes toward technology. However, technology has only a moderate influence on students' active involvement in particular courses or as a connector with other students and faculty.
- Students' academic use of technology is widespread but not deep. They are particularly interested in expanding the use of a few specific technologies.
- Most students look online or to family or friends for technology support. The minority who use institutional help desks report positive experiences.

Anytime, anywhere access to learning that is enabled by device proliferation

- More students own mobile devices now than ever. Although students rate network performance as generally good, projected increases in connected devices could soon challenge even the most robust campus networks.
- Many students use mobile devices for academic purposes. Their in-class use is more likely when instructors encourage such use; however, both faculty and students are concerned about their potential for distraction.

Learning environments

- More students than ever have experienced a digital learning environment. The majority say they learn best with a blend of online and face-to-face work.
- Undergraduates value the learning management system (LMS) as critical to their student experience but rarely make full use of it. Today's undergraduates want a mobile-friendly, highly personalized, and engaging LMS experience.
- Most students support institutional use of their data to advise them on academic progress in courses and programs. Many of the analytic functions students seek already exist in contemporary LMSs.

- Few undergraduates have taken a massive open online course (MOOC). Students still view traditional college degrees as the gold standard for résumés. Few students would include digital badges, e-portfolios, or competency credentials on their résumés.

Although technology is omnipresent in the lives of students, leveraging technology as a tool to engage students is still evolving. We know from looking at longitudinal data from past student studies that students still have a complex relationship with technology; they recognize its value, but they still need guidance when it comes to using technology in meaningful and engaging ways for academics. Students are still ready to use their mobile devices more for academics, but we haven't yet seen widespread application of this. Students also still prefer blended learning environments, and their expectations are increasing for these hybrid online/face-to-face experiences. These are all issues that ECAR will continue to address by surveying students (and other populations of the academic community) to contribute to the body of knowledge around end users' technology experiences and expectations.

Introduction

In 2014, the EDUCAUSE Center for Analysis and Research (ECAR) partnered with 213 higher education institutions across 45 U.S. states and 15 countries to investigate undergraduate information technology (IT) experiences and expectations (figure 1). In this 11th year of data collection, ECAR tracked long-term technology trends and asked students about contemporary and forward-looking (emerging) technology issues. More than 75,000 students responded to the survey, and the findings in this report were developed using a representative sample of students from U.S.-based higher education institutions and an opportunistic sample of non-U.S. responses (see the Methodology section for more details).[1]

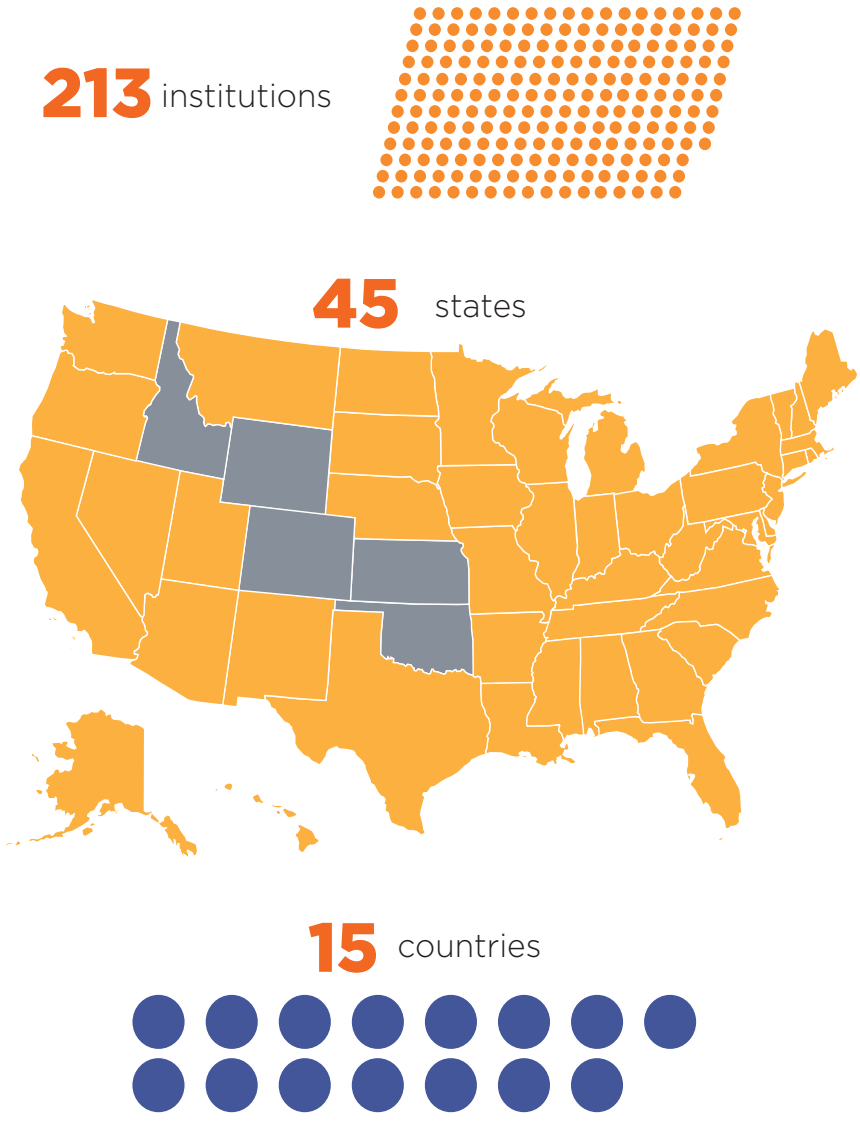

Figure 1. Student study participation overview

This research project was designed to gather information directly from students via an online survey about their experiences with technology. We asked them what devices they own, how they use them, and what their general perceptions of technology are at their respective colleges and universities. This research is important in gaining a better understanding of how students use technology, which aspects of technology are important to them and to their studies, and which technologies they would like to see used more often. This research also provides insight into individual differences in students' inclination toward technology, adding important data that contradict some stereotypes about students and technology. In addition, ECAR conducted a faculty technology study in 2014. By investigating both student and faculty perspectives on technology, ECAR is able to relate technology experiences in higher education from two vantage points. The faculty companion project used a methodology similar to that of the student study to collect data about faculty's technology experiences and expectations. Side-by-side results are offered for the most compelling findings, and a separate report about the faculty study responses is available from www.educause.edu/ecar.

The findings from this study can help institutions focus on technology issues that matter most to students. Any higher education institution can contribute data to this annual project by contacting study@educause.edu, and participating institutions receive the added bonus of seeing how their students' responses compare with responses from students at peer institutions in a personalized peer benchmarking report. These reports provide a framework for contextualizing the findings for an institution's students.

Findings

Technology is embedded into students' lives, and students are generally inclined to use technology. However, technology has only a moderate influence on students' active involvement in particular courses or as a connector with other students and faculty.

ECAR asked students to place themselves on a series of 100-point semantic differential scales (see appendix B) related to their IT **disposition** (e.g., enthusiastic versus reluctant, early versus late adopter, technophile versus technophobe); **attitude** (e.g., satisfied versus dissatisfied, pleased versus perturbed, useful versus useless, enhancement versus distraction); and **usage** patterns (e.g., always versus never connected, central versus peripheral, new versus old media, frequent versus infrequent). The resulting scores reveal that students in general consider themselves to be sophisticated and engaged with IT, averaging significantly above the neutral position (50) on the scales. On average, students reported positive dispositions toward IT (64), positive attitudes toward IT (71), and high levels of IT usage (70; figure 2).

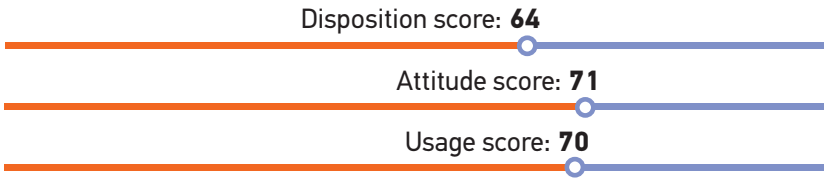

Figure 2. Mean scores of student semantic differential toward technology

ECAR averaged the scores on these three factors to derive a single score we call "tech inclination." Those with higher scores on the disposition, usage, and attitude factors are therefore more inclined toward technology than those with lower scores. (More information about students' tech inclination appears in appendix B.) There are large individual differences in tech inclination, with 95% of scores falling between 39 and 97. We can use these scores to inform our understanding of students' behaviors around technology use. The results of these analyses are infused throughout the findings of this report.

We did not find any large differences in tech inclination related to any of the demographic variables studied. Effect sizes for age, gender, ethnicity, enrollment (part-time versus full-time), and residence (on-campus versus off-campus) were small. Therefore, assumptions or stereotypes about these demographic factors (e.g., younger adults are more tech inclined than older adults) are not supported by our data; in fact, when it comes to age, older students rated themselves higher on this scale than did younger students.[2] Interestingly, the average student scores on the tech inclination factors (disposition, attitude, usage) are similar to those obtained from the faculty sample in ECAR's 2014 study of faculty and IT.[3] These results, then, challenge the stereotypical assumption that (younger) students are considerably more tech inclined than (older) faculty. Institutions that participated in both the student and faculty studies in 2014 can compare the results for *their* students and *their* faculty in a more meaningful way than our general findings here portray.

Given the degree to which technology is embedded in the lives of undergraduates, one might expect to find that students are more prepared to use technology or that they have higher expectations of technology to enhance the learning environment than they did a few years ago. ECAR didn't find overwhelming evidence that this is the case. Today's undergraduates feel no more prepared to use technology in higher education than did their counterparts from a few years ago. About two in three students (67%) in 2014 agreed or strongly agreed that they had adequate technology skills when they entered college, roughly the same percentage as in the 2012 and 2013 student study findings. To better understand the areas in which students feel deficient in their technology preparedness, ECAR specifically asked students if they wished they had been better prepared to use basic software programs and applications (34% agreed) or institutionally specific technology such as the LMS (44% agreed) when they first started college. These new data help explain why students are generally technologically confident but not necessarily comfortable with their institution's technology services and applications.

What does it mean to be tech inclined?

ECAR categorized students into low, medium, and high tech-inclined groups based on their responses to the items in the semantic differential questions. Because the mean response is well above the midpoint of the scale, the categorical distribution is asymmetric, with cutoffs as follows:

- 0–49 = technology inclination is low (9% of respondents)
- 50–79 = technology inclination is medium (68% of respondents)
- 80–100 = technology inclination is high (23% of respondents)

Students with high tech-inclination scores are those with the highest combined positive disposition toward, attitude about, and use of technology. Where applicable and appropriate, students' tech-inclination scores are included in the analysis and findings of this report.

Half of undergraduate students (49%) said they get more involved in courses that use technology. This is up from 37% in 2010 but has remained relatively flat since then (ranging from 49% to 54%). Although technology can sometimes be distracting, it also provides students the opportunity to stay connected with each other, their instructors, and the institution. ECAR has been tracking student perceptions of technology as a means to connect with others since 2011; whereas technology has waned as a connector between individual students and faculty, it has remained relatively consistent and has even grown stronger in connecting students to the institution.[4] In 2014, about half of undergraduates said that technology makes them feel more connected to other students (51%) and to their instructors (54%), whereas two in three said it makes them feel more connected to the institution (65%).

Students' academic use of technology is widespread but not deep. They are particularly interested in expanding the use of a few specific technologies.

Figure 3 shows students' experiences with various types of technologies and their expectations about being more effective students if they were better skilled at using the technology. Most students have used the learning management system in at least one course (83%), but only about half (56%) have used it in most or all of their courses. These numbers seem rather low, given that 99% of higher education institutions have an LMS in place and 86% of faculty say they use the LMS. A separate ECAR study, *The Current Ecosystem of Learning Management Systems in Higher Education*, explores this particular topic in greater detail.[5] It demonstrates that faculty and students value the LMS as an enhancement to their teaching and learning experiences, but relatively few use these systems to their full capacity. By looking at students' experiences with technology and their expectations of that same technology, we can see where opportunities exist to more fully use and holistically integrate a technology into the teaching and learning environment, and to better train users.

The majority of undergraduates said most or all of their instructors

- have adequate technology skills for carrying out course instruction (72% in 2014, up from 66% in 2013)
- effectively use technology to support academic success (68% in 2014, about the same as in 2013, 67%)

—ECAR student studies, 2013 and 2014

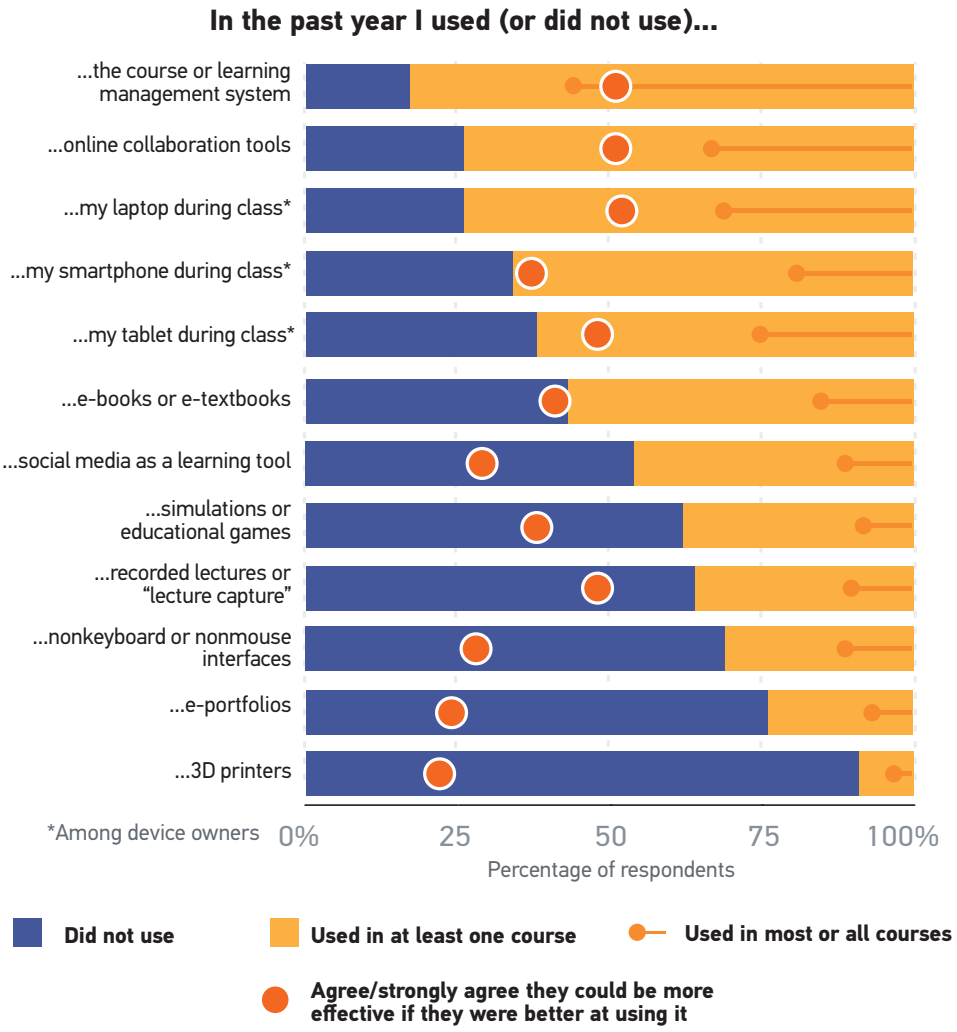

Figure 3. Extent of technology use and expectations that the technology can increase student effectiveness

In 2013, 49% of students said it was important to be better skilled at using technology. In 2014, 34% said they wish they had been better prepared to use basic software programs and applications, and 44% said they wish they had been better prepared to use institutionally specific technology when they entered college.

To better understand students' expectations for course technology, ECAR asked them which technologies they would like their instructors to use more…or use less (figure 4). Lecture capture, early-alert systems, and freely available course content top the list of what students want their instructors to use more.

Each of these technologies also has a low "use it less" companion percentage. Two technologies, social media as a learning tool and e-portfolios, had "use it less" rates that exceeded the "use it more" rates. Comparing these data with data from previous years, we see small but noticeable declines in nearly all "use it more" rates. E-portfolios and simulations/educational games were the only two technologies whose "use it more" rates increased (by 3 and 2 percentage points, respectively). Tech inclination is positively related to all items in the "use it more/use it less" question ($r = .153–.297$). In other words, the more tech inclined students are, the more they wish their instructors would use these resources/tools.

A student's advice to faculty: "Have more online content to support course content."

—Anonymous ECAR 2014 student survey respondent

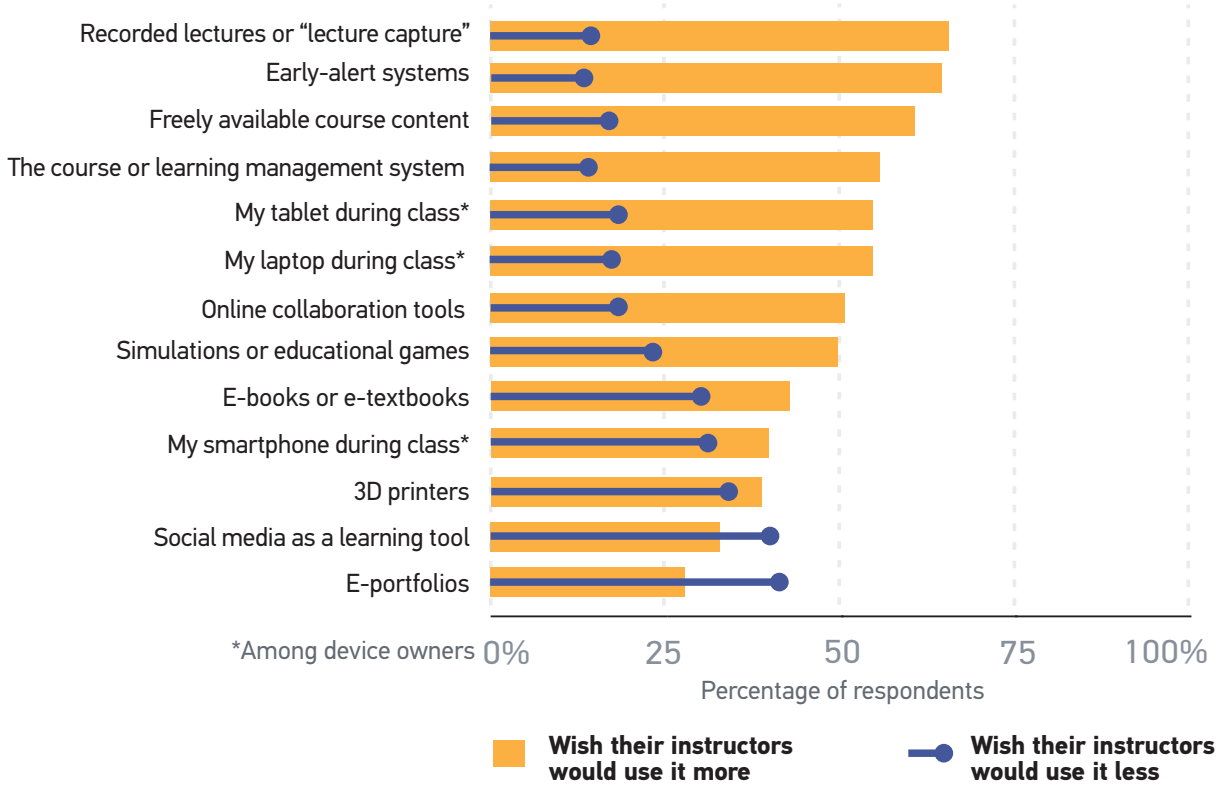

Figure 4. Percentage of students saying they wish their instructors would use a technology more…or less

Most students look online or to family or friends for technology support. The minority who use institutional help desks report positive experiences.

When they need technology support or assistance for school-related activities, students most frequently search online resources such as Google or YouTube (71%; figure 5). This is not surprising, since the Internet has changed the way in which questions are asked and answered. In a 2012 study by the Pew Research Center's Internet & American Life Project, 94% of the teachers surveyed said their [teen] students are "very likely" to use Google or other online search engines in a typical research assignment.[6] It makes sense that these teens (now older) would transfer this skill set to the way they seek tech support. Next to "Googling it," students most frequently look to those closest to them for immediate technology assistance (69%). Younger students (76%) are more likely than older students (54%) to look to peers, family, and friends or to look online for support. Older students (31%) are more likely than younger students (19%) to use the help desk. Females, part-time students, upperclassmen, and students who are highly tech inclined are also more likely to use the help desk.

In 2014, 73% of students agreed or strongly agreed that they like to keep their academic and social lives separate. This is up from 60% in 2013 and provides context for why just one in three students said they wish their instructors would use social media as a learning tool more, fewer than those who said they wish their instructors would use it less.

—ECAR student studies, 2013 and 2014

Among the one in five students who said they use the college or university help desk, 76% rated their experience as good or excellent, 9% rated the experience as fair or poor, and the remaining students had a "neutral" experience. Help desk ratings by service modality are displayed in figure 5, with the greatest percentage of positive ratings (good/excellent) going to services that require personal interaction, such as walk-in service (79%) and e-mail or phone help (both about 70%). Impersonal activities, such as using a self-service FAQ (52%) or a web-based form (54%), received some of the lowest service ratings.

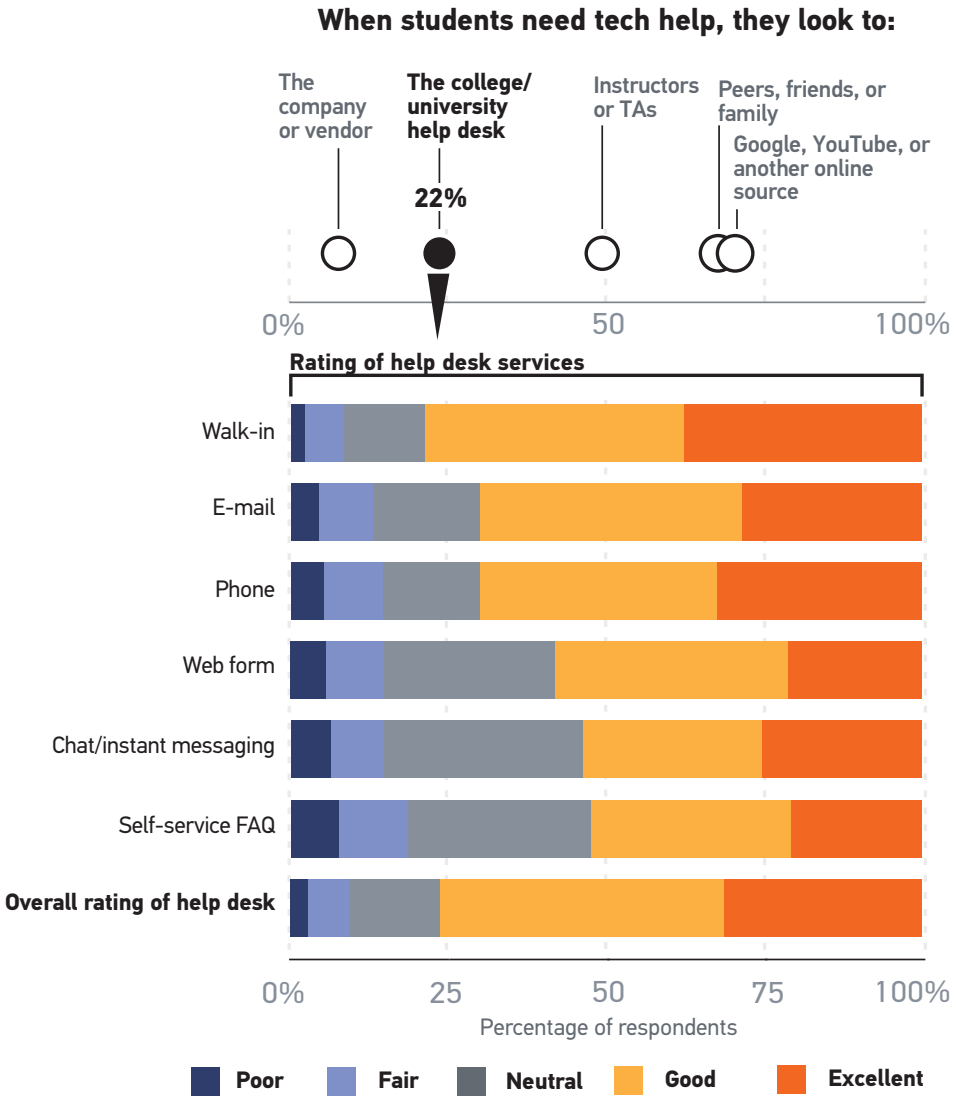

Figure 5. Students' experiences with technology support networks

Students who are **highly tech inclined (as measured by their tech-inclination score)** are more likely to agree that

- They get more actively involved in courses that use technology*
- They felt adequately prepared to use the technology needed in their courses when they entered college
- Technology makes them feel more connected to the institution, faculty, and other students

Students **lower in tech inclination** are more likely to agree that

- The in-class use of mobile devices is distracting
- They wish they had been better prepared to use both institutionally specific technology (e.g., the LMS) and basic software programs (e.g., MS Office)

** Notably, students who are more tech inclined agree that they get involved in courses that use technology at five times the rate of less tech-inclined students.*

More students own mobile devices now than ever. Although students rate network performance as generally good, projected increases in connected devices could soon challenge even the most robust campus networks.

Mobile device ownership continues to increase, with 86% of undergraduates owning a smartphone in 2014 (up from 76% in 2013) and nearly half of students (47%) owning a tablet (up from 31% in 2013). Laptop ownership has leveled off, with 90% of students owning one in 2014 (up 1% from 2013). Figure 6 depicts device ownership history, 2015 projections, and relative comparisons with the current adult population. ECAR stopped tracking desktop computer ownership in 2014, but projections from past data suggest that it is about half of the undergraduate student population.

In 2013, ECAR began asking students who didn't yet own specific devices about their intentions to purchase those devices in the next year. We overestimated first-time laptop purchases by 5 percentage points, our estimate for tablets was spot on at 16%, and new-to-market smartphone purchases were underestimated by 3 percentage points. Projected device ownership for 2015 is depicted in figure 6. Comparing undergraduate student device ownership with Pew's media and technology trend data, undergraduates own laptops and smartphones at much higher rates than the general adult population. Pew estimates that 61% of all adults own a laptop and 58% own a smartphone. (According to Pew, 83% of adults ages 18–29 have a smartphone.) Student tablet ownership is only slightly higher than Pew's general population estimate (47% versus 42%).[7]

Percentage of all students saying they use these devices in class for class-related purposes:

70%
laptops

59%
smartphones

35%
tablets

Among device owners, in-class use is

74%
laptops

66%
smartphones

62%
tablets

—ECAR student study, 2014

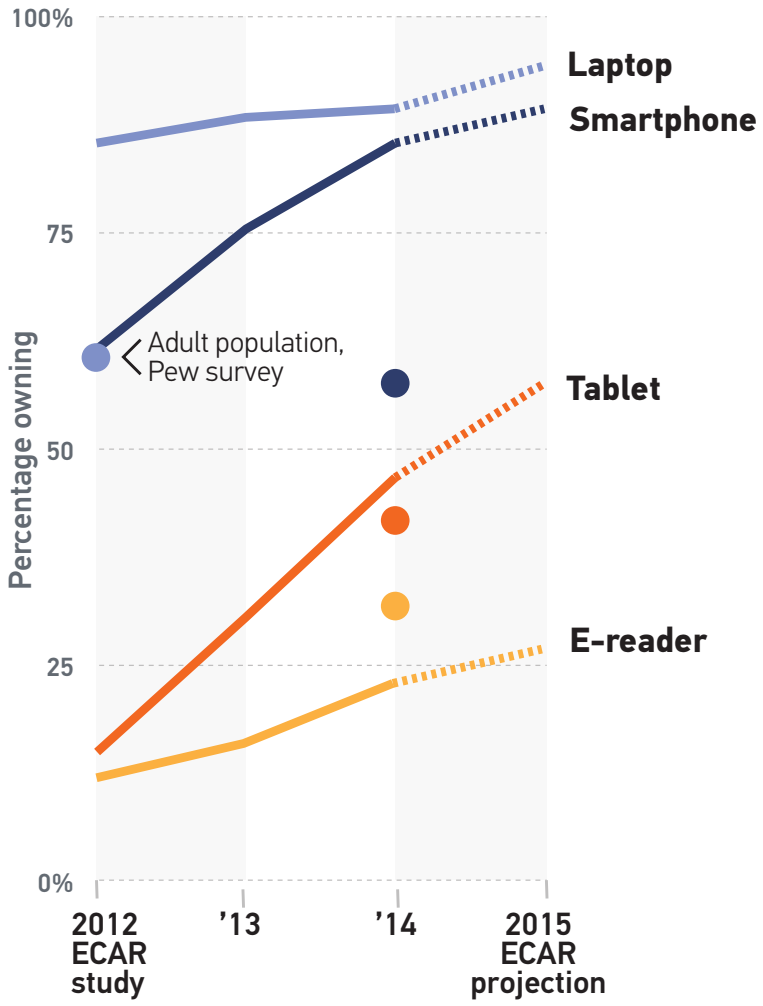

Figure 6. Device ownership history and 2015 projections

Undergrads and smartphones

Smartphone ownership for undergraduates doesn't vary much by student demographics or institution type, but those who rank high on ECAR's tech-inclination classification are more likely to own smartphones.

Smartphone ownership by students' tech inclination:

90%
high

87%
medium

69%
low

—ECAR student study, 2014

** Tech inclination is measured by students' semantic differential scores, displayed in figure 2.*

The consumerization of technology and the bring your own device (BYOD—or even bring your own everything [BYOE]) trend means that students have a highly competitive market from which to choose their device brand and operating system. Fewer students own Windows laptops in 2014 (69%) than in 2013 (75%), but Windows still dominates the laptop market. Among tablet owners, iPads have 58% of the undergraduate market share (down from 63% in 2013). The smartphone market share was stable from 2013 to 2014, with 54% of smartphone owners having an iPhone and 43% having an Android phone this year. Compared with older students (ages 25-plus), younger students (ages 18–24) favor Mac/iOS products. In countries other than the U.S. and Canada, the Android OS is more popular. Students operate in a diversified, consumer-oriented market for technology, and an institutional mobile strategy that is device agnostic will prove to be robust yet adaptable as more products pour into the market.

Today's campus networks need to accommodate different types of devices and operating systems, as well as growing numbers of devices per student. More than half of undergraduates (54%) say they typically connect at least two devices to the college/university network at the same time. Younger students are the power users of college/university networks; nearly twice as many students under 25 years of age connect two or more devices at a time to the network (61% compared with 35% for students 25-plus). About 1 in 10 students (8%) try to connect three or more devices to the network at the same time,[8] and this will likely increase as wearable technology and the Internet of Things[9] matures into everyday devices that students can use and afford.[10] Figure 7 shows that a majority of students rate their network experience as good or excellent. Though younger students (the power users) are more critical of their network experience than older students, the majority of them still rate network experiences as good or excellent.

Among the 99% of students who own an Internet-capable device,

8%
own just one device

92%
own at least two devices

59%
own three or more devices

—ECAR student study, 2014

Internet of Things to challenge network capacity

It is important to note the extent to which experts forecast the rapid growth of Internet of Things technologies in order to prepare for the potential impact on campus networks and the potential opportunities for administrative or pedagogical applications. A recent International Data Corp (IDC) forecast projects wearable technology will exceed more than 19 million units in 2014, with smart device breakthroughs occurring through 2016, and Gartner projects the installed base of the Internet of things to reach 26 billion units by 2020.[1]

1. *Ramon T. Llamas, Worldwide Wearable Computing Device 2014–2018 Forecast and Analysis, IDC Report, March 2014; Peter Middleton, Peter Kjeldsen, and Jim Tully, Forecast: The Internet of Things, Worldwide, 2013, Gartner Report, November 2013.*

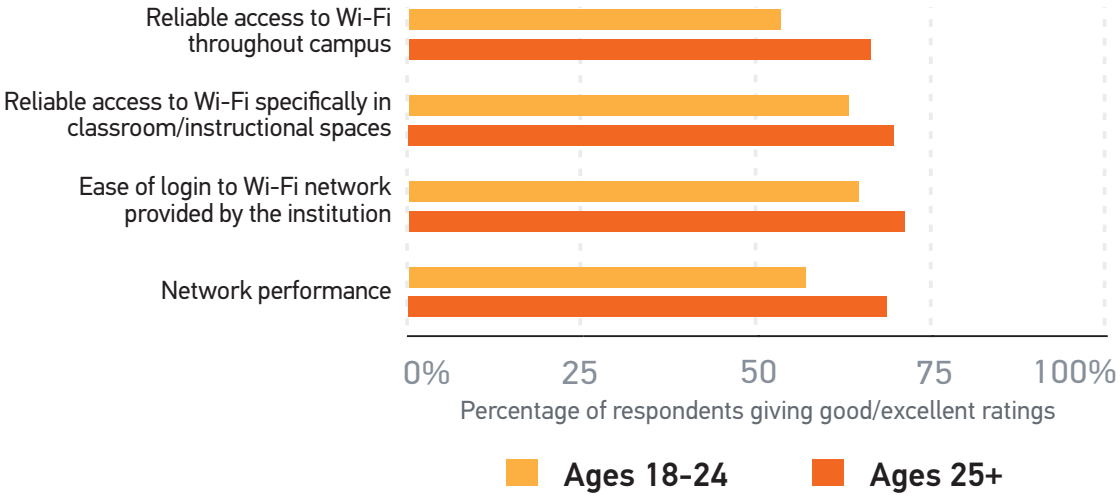

Figure 7. Percentage of students rating wireless network experiences as good or excellent

Many students use smartphones or tablets for academic purposes, although in-class use is still uncommon. Students are more likely to apply mobile devices to academics when instructors encourage their use in class.

Noticeably more students used their smartphones, tablets, and e-readers for academics in 2014 than in previous years, a finding that corresponds with the general trend in increased device ownership. Among students who use these devices for academic work, attitudes about the importance of these devices hasn't changed much during this same time period (figure 8). The importance students place on these devices is directly related to their tech-inclination level. In other words, the more tech inclined students are, the more likely they are to use the devices for academic purposes[11] and the more important they rate the devices to their academic success.

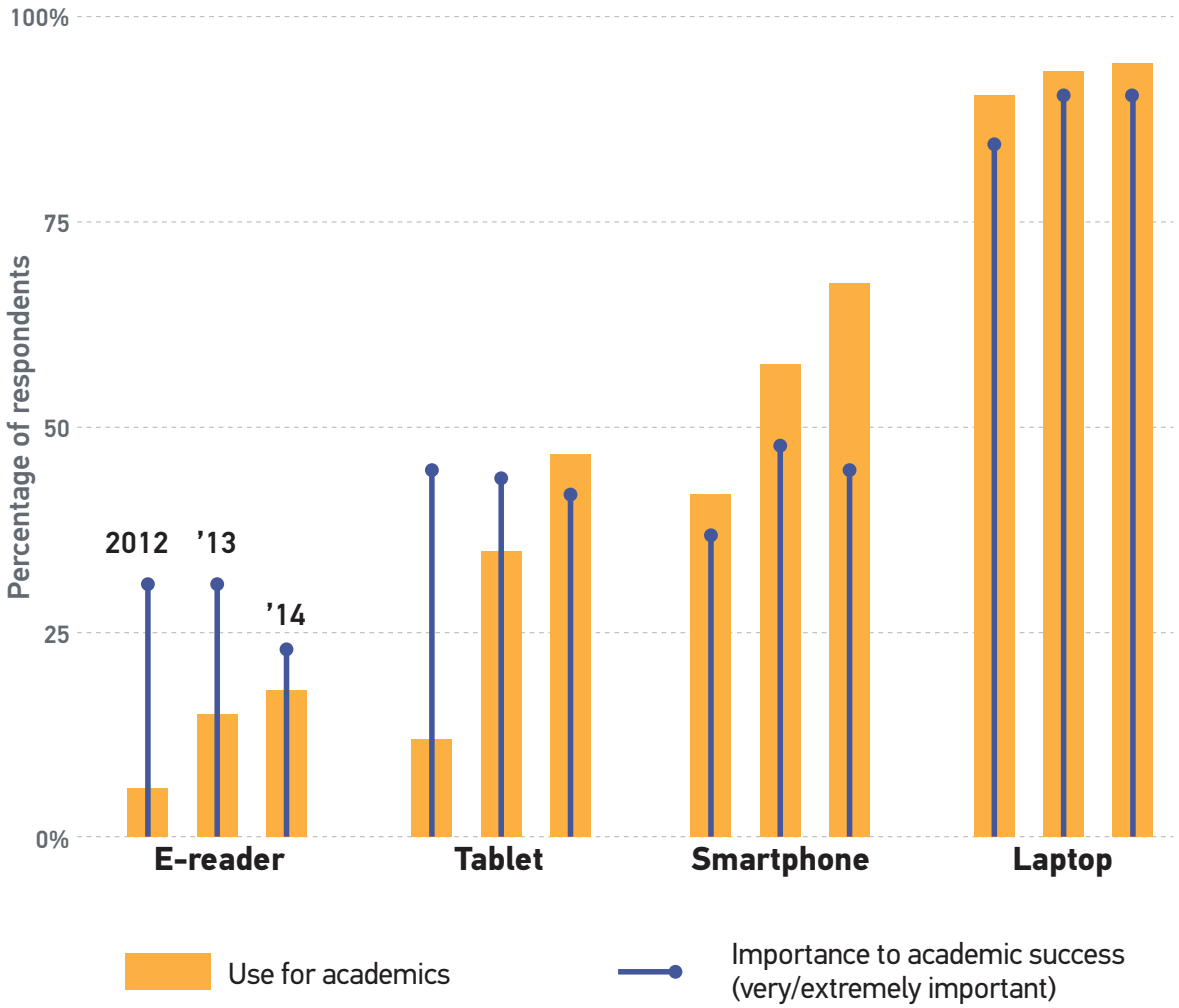

Figure 8. Changes in use and importance of devices for academics[12]

Mobile devices for academics

Although increased use of personal digital devices for academics corresponds with trend increases in device ownership, attitudes about the importance of these devices for academic success haven't changed much. A few data points help to explain this:

- Few instructors (30%) create assignments that incorporate mobile technology, suggesting there is not a widespread strategy for leveraging personal mobile technology in the classroom.
- Many instructors (67%) agree that in-class use of mobile devices is distracting, with over half (55%) banning or discouraging their use.
- About half of undergraduates (47%) are also concerned that in-class use of mobile devices can be distracting.
- Few undergraduates have experience using personal devices with regularity across courses (31% of laptop owners, 19% of smartphone owners, and 25% of tablet owners use their devices in most or all of their courses), suggesting either they are not allowed to use these in class (see figure 9) or don't see the value in using these devices.

Given this context, it is not at all surprising to see flat or decreasing trends in students' attitudes about the importance of these devices for their academic success. Mobile devices in particular have not been embraced by faculty as engaging teaching and learning tools, and students have yet to see the value in using them for their academic work.

Figure 9 shows students' 2014 in-class BYOD experiences.[13] Comparing this year's data with the 2013 student study results, we see almost no growth toward embracing personal mobile device use in the classroom. Though twice as many students were encouraged or required to use a smartphone in class this year compared with last year, this was still only 6% of students. Smartphones are still the most likely devices to be discouraged or banned from in-class use, with 69% of students reporting so in 2014 (down from 74% in 2013).

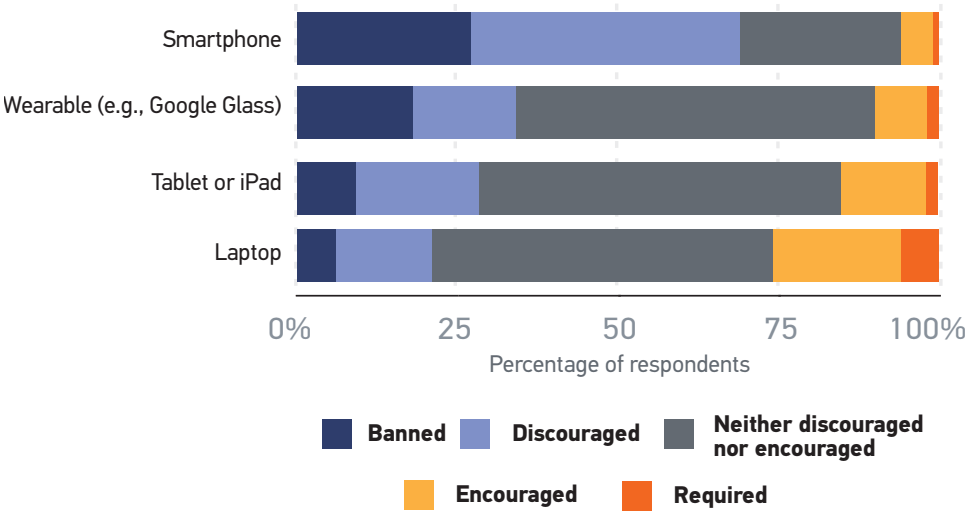

Figure 9. Students' in-class BYOD experiences

Concerns that mobile devices are unwanted distractions rather than critical learning tools are justified by recent literature showing that multitasking is less productive rather than more productive[14] and that nearly all students will use mobile devices for non-class-related purposes when given the opportunity.[15] In addition, research has shown that taking handwritten notes enables learning more than taking notes via laptop.[16] However, these types of studies often focus on the pitfalls of replacing manual activities (such as taking notes) with technology rather than using technology in meaningful ways to engage students in the learning process. Laptops and mobile devices can be used in certain types of class activities to form additional connections with material, thereby also enhancing learning.[17] Designing course activities and assignments that use mobile devices to deepen engagement for students is one way to harness the power of these tools as academic resources rather than distractions.

Some devices are encouraged or required more often than others. ECAR found a large difference (20 percentage points) in the percentage of students using tablets for academic purposes and a small difference (7 percentage points) in the percentage of students using smartphones for academic purposes when students are encouraged or required to use these in class as opposed to when their use is discouraged or banned. There is almost no difference in the percentage of students using laptops when they are encouraged or required, likely because of a ceiling effect of laptop use for academic purposes. In other words, most students use laptops for academic purposes regardless of whether their use in class is encouraged.

Handheld mobile devices are important multipurpose tools for students. Among students who said they use a smartphone or tablet, the percentage reporting each of various activities as at least moderately important appears in figure 10. The top 5 issues are a mix of administrative tasks (checking grades and accessing the LMS) and engagement activities (communicating with other students outside class and looking up information while in class).

Students who own each of these devices say they could be more effective if they were better skilled at using...

52%
my laptop

48%
my tablet

37%
my smartphone

...in class

—ECAR student study, 2014

Instructors say they could be more effective if they were better skilled at integrating...

45%
students' laptops

45%
students' tablets

34%
students' smartphones

...in their courses

—ECAR faculty study, 2014

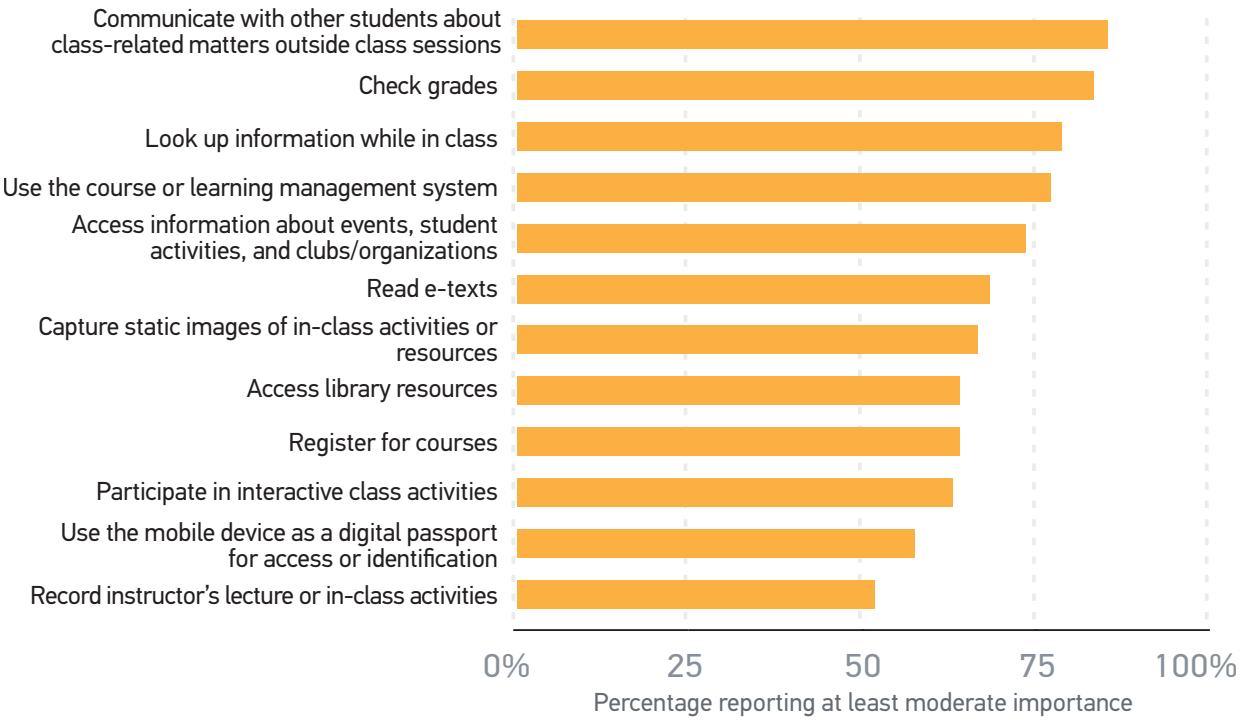

Figure 10. Importance of using a handheld mobile device for various student-related activities

Institutions are responding to the demand for student-facing mobile-enabled services. Nearly all students (92–96%) reported that they can access enterprise-level systems from their handheld mobile devices. Figure 11 shows the mobile-enabled services students use and their assessments of them. Younger students (18–24) consume mobile-enabled services at higher rates than older students (ages 25-plus) and are more critical of the service. These data could be an indicator that student-facing college and university services and applications are not as mobile friendly as they could be. Looking to younger students to predict expectations of tomorrow's students will help higher education IT units develop and prioritize mobile-friendly services and activities. With continued increases in mobile device ownership and more consumer experience with transaction-oriented mobile device activities in other areas of their lives (e.g., banking and shopping), students' expectations for mobile access will likely increase.

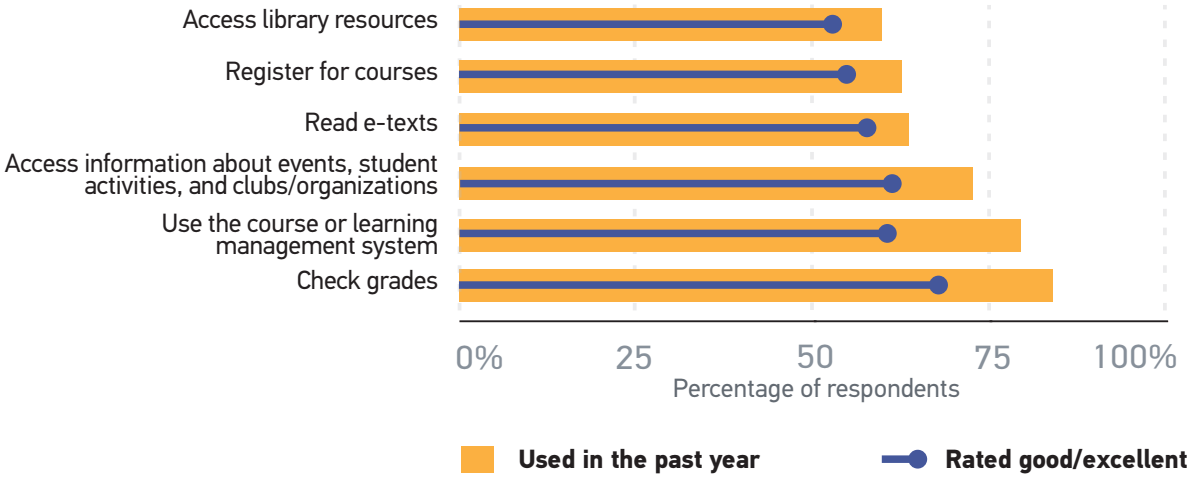

Figure 11. Use of and experience with institutional services on mobile devices

More students than ever have experienced a digital learning environment. The majority say they learn best with a blend of online and face-to-face work.

More than four in five students (85%) took at least a few courses that were blended (contained at least some online components and some face-to-face components) in the past year, up from 79% in 2013. Students are more likely to experience blended courses at public than private institutions. Additionally, almost half (47%) have taken a completely online course during this same time period. This is similar to 2013 (46%).

When asked in which type of environment they tend to learn most, 72% of students said that courses with some online components are preferred for learning. Only 18% of students said they learn most in courses with no online components, down from 25% in 2013. The number of online components students say is best for learning in their courses depends on their age (figure 12). Whereas more younger students (ages 18–24, 74%) than older students (ages 25-plus, 66%) say having *some* online components is better for learning, older students (19%) are more likely than younger students (6%) to say they learn best when a course is *completely* online. In addition, part-time students (16%) are more likely than full-time students (9%) to say that they learn most in completely online courses, and off-campus students (12%) are more likely than on-campus students (3%) to say they learn most in completely online courses. Older, part-time, and off-campus students are also more likely to have taken an entirely online course in the past year. These data align with other research showing that older, nontraditional students are more likely to take online courses and MOOCs.[18] Note that taking an online course (which may be a matter of convenience) is a separate issue from stating that one learns better in such courses.

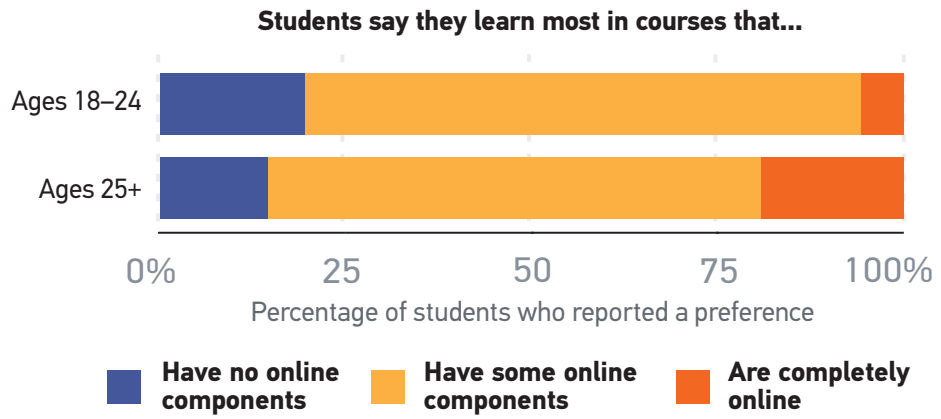

Figure 12. Students' learning environment preference for online components in courses, by age

Students who say they prefer completely online classes have higher mean technology inclination scores (75) than students who say they prefer no online components at all in their classes (61). In fact, students who are the most tech inclined prefer completely online courses at more than three times the rate of the least tech-inclined students (17% to 4%). Those who are less tech inclined prefer fewer online components in their courses.

Undergraduates value the LMS as critical to their student experience but rarely make full use of it. Today's undergraduates want a mobile-friendly, highly personalized, and engaging LMS experience.

The learning management system is a staple in higher education. Nearly all higher education institutions (99%) have at least one.[19] These systems are multifaceted. They function as digital learning environments, administrative systems for course management, and enterprise systems for institutional analytics and other purposes. Seven in 10 faculty (72%) say the LMS is a very useful tool for student learning, and the LMS as a digital learning environment has great potential to extend the traditional classroom space into the boundless Internet.

Because of the functional importance of the LMS to higher education, ECAR asked students a series of questions about their experiences with and expectations of the LMS. Despite the systems' ubiquity and the fact that 58% of institutions preload the LMS with basic course content, only about one in two students use the systems in most or all of their courses (56%). Students who are more tech inclined use the LMS to a greater extent ($r = .132$). Though the LMS might not be applicable for every assignment in every class, these data suggest the LMS could be underused as an anytime, anywhere digital learning environment. Figures 13–16 show four dimensions of students' typical experience with the LMS.

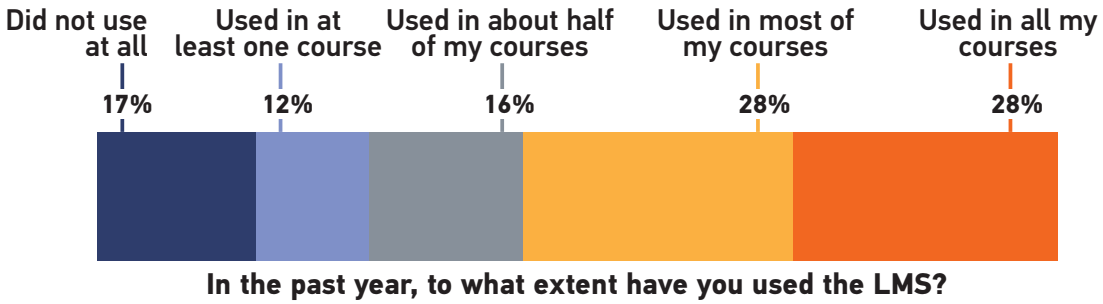

Figure 13. Students' use of the LMS

The majority of students (61%) who used the LMS from a mobile device rated their institution's support for this activity positively (as good or excellent). This still leaves room for an improved experience for about two in five students. Note that few (8%) gave the lowest rating of "poor," so LMS improvements may not need to be epic overhauls.

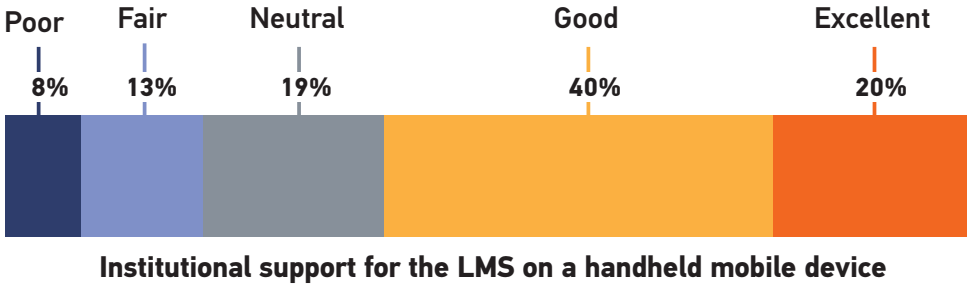

Figure 14. Students' ratings of institutional support for the LMS

Half of students (51%) said they could be more effective if they were better at using the LMS (figure 15). This finding was nearly universal among different types of students and institutions. The exception was that students who ranked highest on the ECAR tech-inclination scale agreed or strongly agreed at higher rates than students on the lower end of the scale that they could be more effective if they were better at using the LMS (57% versus 42%). Perhaps students with greater tech inclination see the potential for using the LMS in more engaging ways and aspire to do so, whereas students with less tech inclination are more likely to take the LMS at face value. Regardless of the explanation, these data are evidence that there is misalignment between the ways always-connected students (many with a lifetime of technology exposure) use technology to connect socially or for entertainment purposes and the ways they use technology in educational activities.[20]

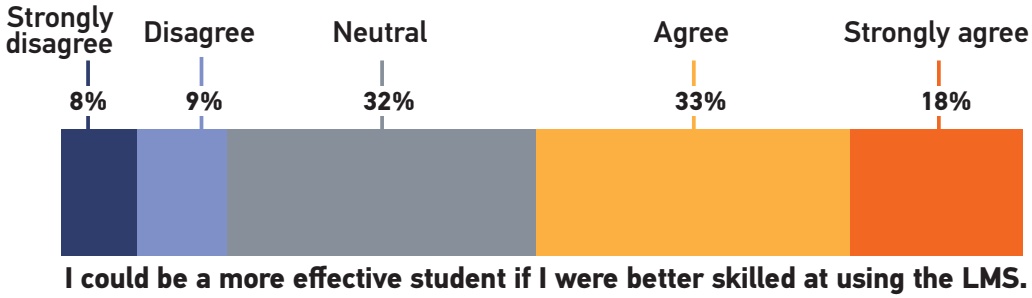

Figure 15. Students' assessment of their need for additional LMS skills

Three in four students (78%) said it was at least moderately important to access the LMS from a handheld mobile device; it was extremely important for 33% of respondents (figure 16). This supports the longitudinal findings from previous ECAR student studies in which we reported that students hold high expectations for anytime, anywhere access to course materials and for leveraging the use of their personal digital devices inside and outside class.

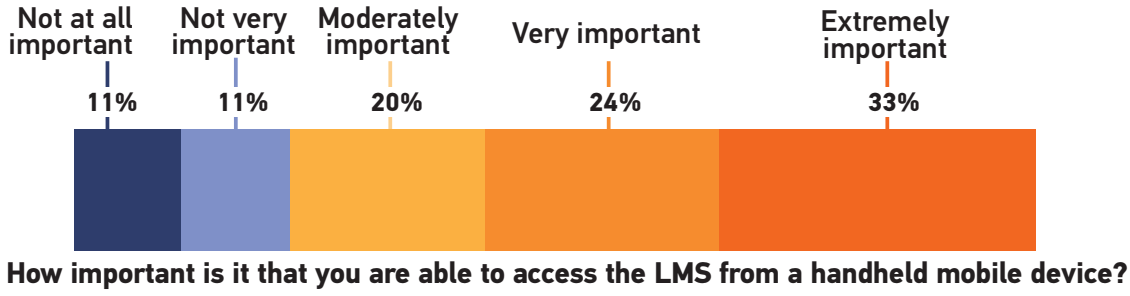

Figure 16. Students' expectations of LMS access from handheld mobile devices

ECAR also asked students about their satisfaction with various features and operational functions of the LMS. Satisfaction levels were highest for basic features such as accessing course content; they were lowest for advanced features such as using the LMS in engaging or collaborative ways (figure 17). ECAR found similar results in the 2014 faculty study, with only about half of faculty (51%) saying they were satisfied with the LMS as a way to engage in meaningful interactions with students.

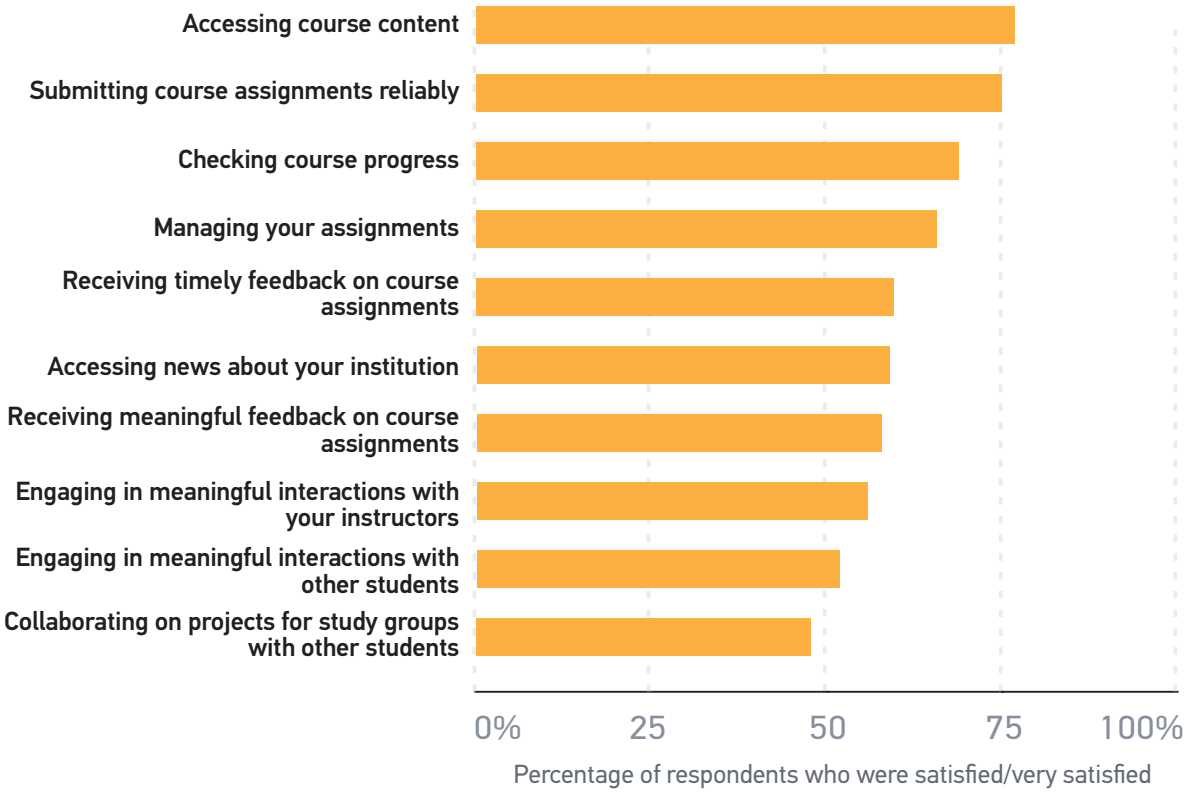

Figure 17. Overview of student satisfaction with LMS features and operational functions

Students were asked what features they would add if they could design the LMS from scratch. The top 5 issues they noted for improvement were:

1. Better features for interaction and communication
2. A more user-friendly interface
3. More (or better) instructor participation
4. Ease of access to journals or other resources
5. Better functionality, e.g., having the LMS function on a touchscreen environment

As published in the recent report on the future of learning management systems,[21] ECAR also asked students how interested they are in their institution's providing them with various aspects of personalization to the LMS, with the majority (about three in five) showing enthusiasm for each personalized feature suggested (figure 18). The majority of students (69%) are very or extremely interested in having the LMS provide personalized support and information about progress toward their degree goals.

Transitioning from independent administrative and enterprise systems to systems that are interoperable is a general trend in higher education. With the maturation of learning analytics in higher education, interoperability between the LMS and other administrative systems (such as the student information system and planning and advising systems) is increasingly important. Although many LMS products have built-in analytics capabilities such as early alerts and progress tracking, many institutions are not yet taking full advantage of them, nor are they using them to support student success initiatives. This gap is due in part to the complexities of the data and systems-integration processes. Addressing this gap is important because a majority of students have an interest in real-time feedback about their course progress through personalized dashboards in the LMS (60% of students were very or extremely interested in this feature). These are features that help students visualize how they are doing in individual courses. An additional area of interest concerns adaptive learning functions of the LMS, whereby students are provided with personalized quizzes or practice questions oriented to their specific strengths or weaknesses so that they (or their instructors) know what help they need (62%).

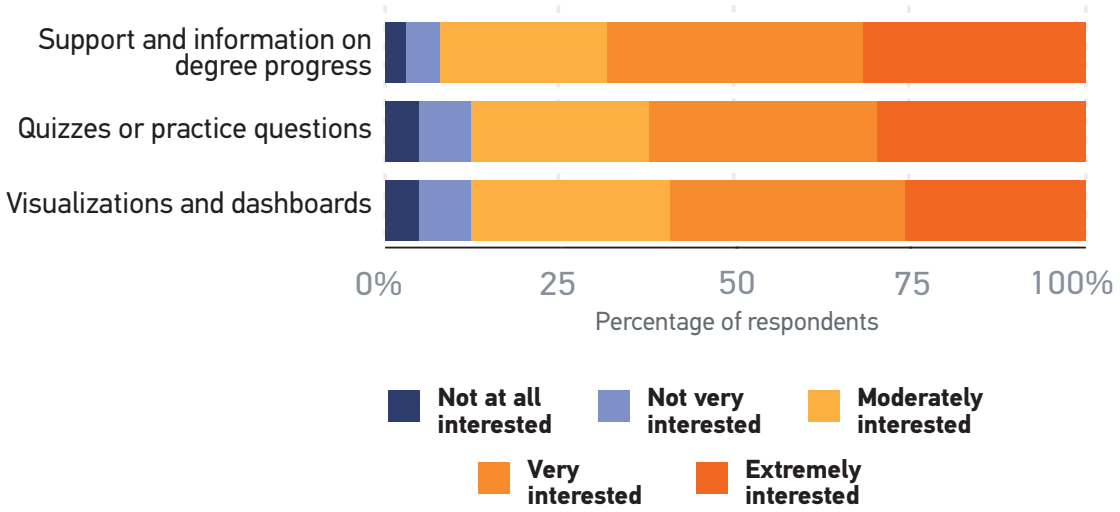

Figure 18. Student interest in personalized LMS features

Most students support institutional use of their data to advise them on academic progress in courses and programs. Many of the analytic functions students seek already exist in contemporary LMSs.

Students were given the following background information about learning analytics in higher education and asked to provide their opinion:

> Many colleges/universities are starting to use the data they collect from/about students to create individualized messages about academic progress, training, and guidance opportunities. These data could come from transactional records (e.g., logging in/out of a campus website/application/service), tracking activities from your student ID/smart card, or direct input from your advisors, counselors, or instructors. Which statement best describes your opinion of this practice?

The majority of students are supportive of analytics, with two in three (68%) saying they think the above explanation of learning analytics "sounds positive" or that it is "great" (figure 19). Fewer than 1 in 10 (9%) expressed a negative point of view, and about 1 in 4 (23%) were neutral about the topic. Students who ranked higher on the ECAR tech-inclination scale tended to support analytics; the more tech inclined the student, the higher their opinion of this practice (r = .177).

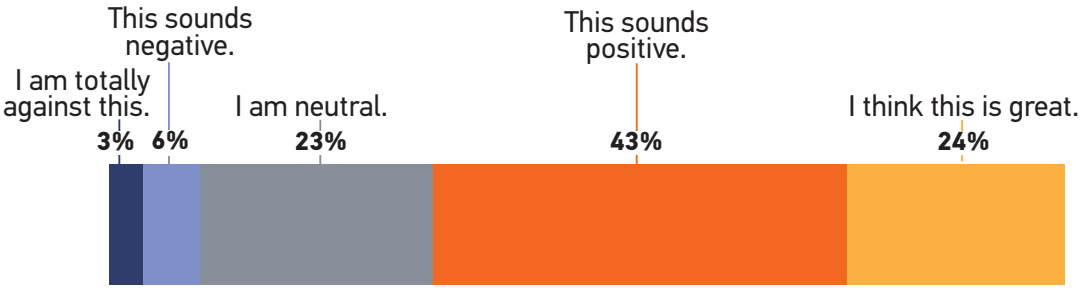

Figure 19. Student opinions about data collection for learning analytics

ECAR also solicited opinions about specific learning analytics features that could be "…made available through the LMS or through an integrated planning and advising system (IPAS)." In 2013, 76% of students said they were at least moderately interested in their institution's providing guidance about course offerings , such as "you may also like" or "we recommend" suggestions; this year, 89% of students said they were at least moderately interested in guidance about courses they might consider taking in the future. Nearly 9 in 10 students (89%) in 2013 were at least moderately interested in their institution's using information about them to alert them to new or different academic resources.

This year's study had similar results (figure 20). The vast majority of students are at least moderately interested in learning analytics, with automated tracking of course attendance being something of an outlier. Only two in three students (65%) said they were interested in this. Tech inclination is positively related to all items in figure 20 (r = .148–.232). In other words, the more tech inclined students are, the greater their interest in these analytics features. Though the effect size across all students is small, the spread between students scoring high on tech inclination and those scoring low on tech inclination is at least 19 percentage points for each item.

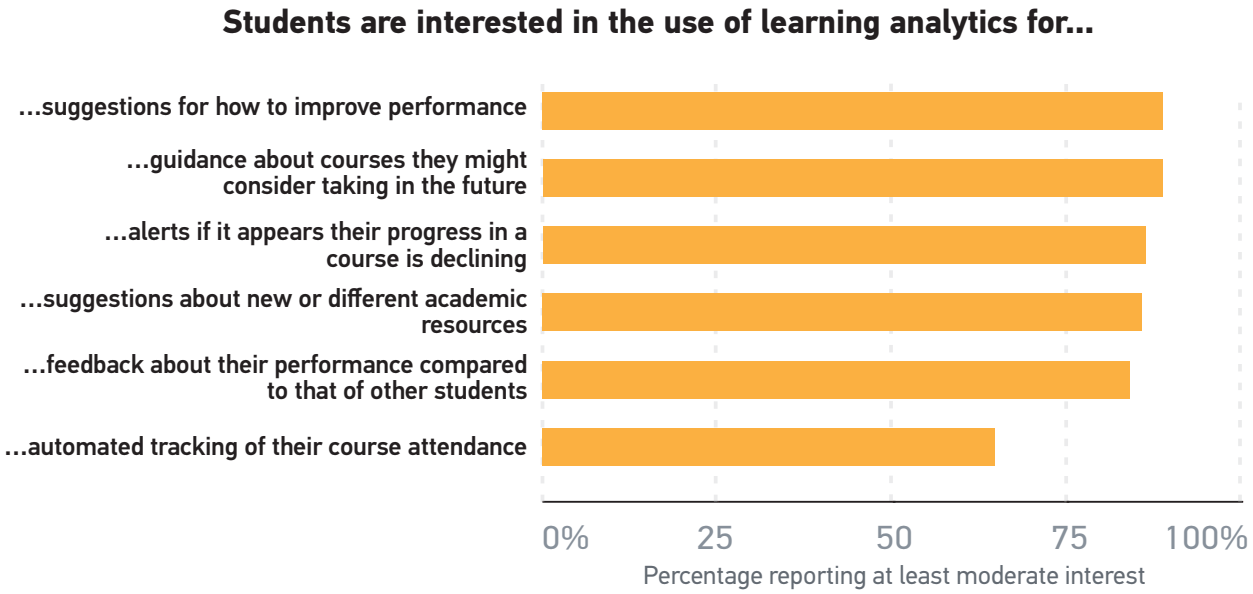

Figure 20. Student interest in automated learning analytics features

According to the EDUCAUSE Core Data Service, 49% of U.S.-based institutions have early-alert systems, 72% have academic advising systems, and 78% have education planning/academic progress tracking systems. As academic leaders make decisions about deploying, improving, or replacing these systems, they can point to strong student interest in exploring analytics for academics.[22] Eight in 10 faculty are at least moderately interested in early-alert and intervention notification systems for students, as reported in the ECAR study of faculty and IT.

Because higher education is still trying to understand the role of learning analytics to improve academic performance, ECAR asked students an open-ended question about what other alerts to consider or what advice they have for their institutions concerning alerts. The top 4 answers among a random sample of 400 respondents within the U.S.-based weighted sample of respondents are as follows:

Students are enthusiastic about their instructors' use of early-alert systems to notify them of course progress issues:

65%
say use it more

22%
say use it about the same

13%
say use it less

—ECAR student study, 2014

1. Posting grades, class participation, attendance, and performance comparisons (23%). Students are inherently interested in how they are doing in classes with respect to their peers.

   "Feedback about your performance compared to that of other students in your class or your major."

   —Anonymous student comment

2. Calendar and schedule information. Event demarcations and reminders of when assignments, quizzes, and other assessment items are due (22%). Students want to leverage technology to keep them on task and on target for submitting assignments on time.

   "Definitely a time management one, giving you personalized deadlines for readings and assignments so that you always knew what to keep on top of."

   —Anonymous student comment

3. Supplemental information to enhance lecture and textbook material, practice quizzes, and additional content-related workshops (17%). Students are interested in supplementing (not supplanting) course content with online resources.

   "Ways to enhance your learning experience, build on material you've learned, direction to off-campus opportunities for learning (such as colloquia, conferences, or even MOOCs), etc."

   —Anonymous student comment

4. Early alerts, course and program guidance, and other personalized outreach in the form of one-to-one communication with students (14%).

   "It would be nice to be alerted on what you need to improve and maybe get some type of e-mail link of some practice test or an instructional media on how to improve."

   —Anonymous student comment

The first three items on this list can easily be accommodated by basic features of the LMS: current status (grades, new assignments posted) notifications, upcoming reminders (a calendar that would alert students to upcoming assignments/tests), and ways to improve (alerts that let students know about supplemental information such as practice tests and workshops). The fourth item includes more holistic educational planning approaches wherein IPAS systems and services would come into play.

Few undergraduates have taken a MOOC. Students still view traditional college degrees as the gold standard for résumés. Few students would include digital badges, e-portfolios, or competency credentials on their résumés.

Only 6% of student respondents took a MOOC in the past year, which is twice the rate of the previous year. Of those, half completed a MOOC (in 2013 the completion rate was about 33%; figure 21). Males (8%) were more likely than females (4%) to have taken a MOOC. Asians were more likely than other ethnicities to have taken a MOOC. This breakdown was true for the previous year's data as well.

Three in four students (76%) in 2014 said they do not know what a MOOC is. It is not surprising that MOOCs are not getting a lot of traction in the undergraduate student population, since this is not really the target audience of most MOOC providers. Although undergraduates are no more aware of MOOCs than in 2013, more are taking them and even more are completing them. However, whereas nearly half of students took an online class in the past year (47%), very few have taken a MOOC (6%) or knowingly earned a competency-based digital badge (7%). Students who take MOOCs and earn digital badges have higher mean tech-inclination scores than students who don't.

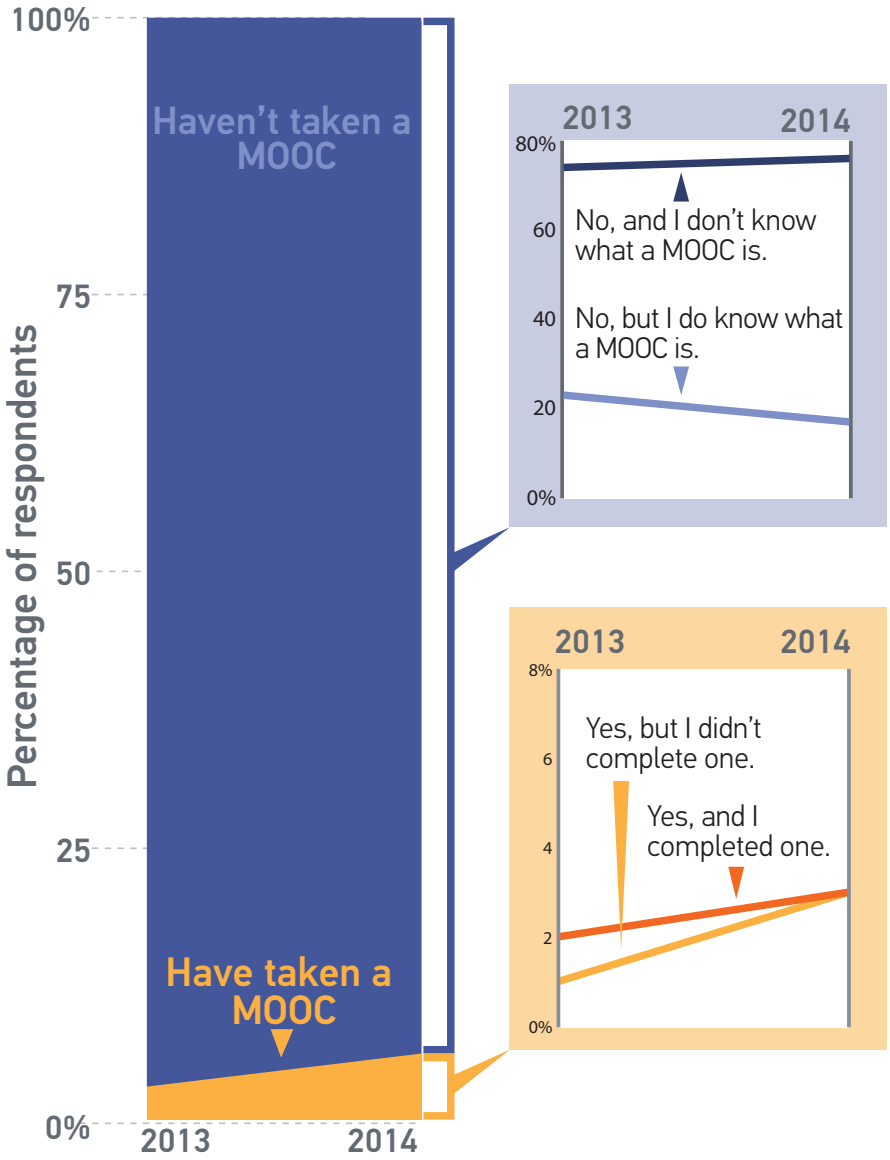

Figure 21. Students' experience with MOOCs[23]

> Badges are emerging as a way for individuals to digitally document ongoing community engagement, professional development, and accomplishments, and they recognize incremental learning in highly visible ways. Badges help create a learning path and can benefit a career portfolio. Microcredentialing is quickly emerging as a way for professionals to document ongoing development and accomplishments.[24]

Despite this emerging trend for microcredentialing, only 7% of student respondents earned a digital badge or other type of digital credential that certifies their competency in a topic, activity, or subject area in the past year. More notably, 27% of students in the 2014 study didn't know whether they had earned a digital badge, suggesting that digital badges are not yet salient indicators of success or progress

for students. Males (9%) were more likely than females (5%) to earn a digital badge. MOOC completers were more inclined to have received a digital credential than students who didn't complete a MOOC (37% versus 6%). Most students (90%) would include an undergraduate degree on their résumé, and a majority (53%) would include a certificate from an accredited college or university. However, only a minority of students would include an industry-based training program certificate (35%), a certificate resulting from freely available course content work (26%), a digital badge (21%), or an e-portfolio (18%) on their résumé (figure 22).

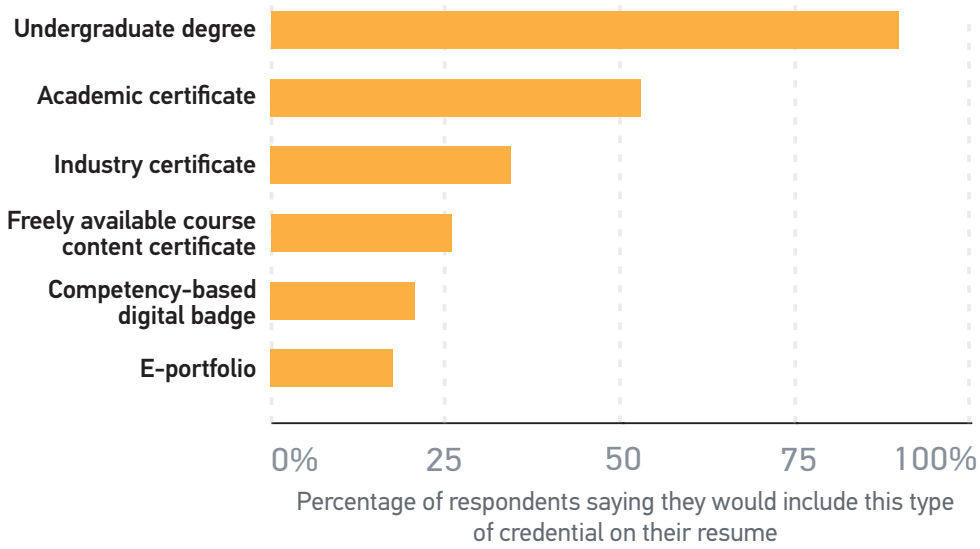

Figure 22. Student intent for using degrees, certificates, badges, and other credentials on their résumé

Conclusions

Although technology is omnipresent in the lives of students, leveraging technology as a tool to engage students in meaningful ways and to enhance learning is still evolving. It is incongruous that 9 in 10 students rate themselves as having favorable technology inclinations, yet their technology experiences and expectations suggest they lack the motivation, opportunity, or aptitude to use the full potential of technology for academic purposes. For example, we see widespread use of technology among the student population, but a surprisingly high number of students said they could be more effective in their student role if they were better skilled at using different types of technologies. This includes institutional technologies such as the learning management system and personal technologies such as in-class use of laptops or tablets. These findings challenge the notion that students inherently know how to use technology, and they compel us to find learning-centric opportunities in the application of 21st-century technology to 21st-century education. Moving in this direction will require experienced and thoughtful IT leadership to help institutions optimize the impact of IT on academics. The future of technology in higher education has less to do with the technology and more to do with the leadership guiding the strategic use of technology.[25] Strong IT leadership can help bridge the gaps between student expectations and their classroom experiences (and experiences with faculty technology use).

We live in an era in which technological innovation is so prolific that it is nearly impossible to keep up with all of the options students (and faculty) have as technology consumers. It is also nearly impossible to predict the next new technology innovation and how it will replace, integrate with, or supplement current technology. Successful technology leaders will be those who have invested in a robust yet nimble IT infrastructure that can adapt to the growing possibilities technology brings to the teaching and learning universe. We also need to promote a culture of innovation and experimentation among students and faculty. Both populations are tech inclined enough to figure out most of what needs to be done to leverage the technologies available to them. Support, encouragement, and (research-driven) guidance will go a long way in closing the gap between the promise that technology brings to education and the reality of technology being used in meaningful ways to promote student learning.

Recommendations

Although students are generally tech inclined, they do not necessarily use technology to the full extent in supporting or enhancing their academic endeavors.

- Do not assume that all students are tech inclined; assess incoming students' technology literacy as it applies to institutional services and applications, and direct those who are less tech inclined to supplemental or more personalized help features for those services and applications.
- Use research on effective learning strategies to offer programs that help students connect with technology in ways that enhance engagement, promote learning, and help students stay connected with others.
- Support and encourage faculty in using technology as a tool to enhance teaching and learning, and offer guidance on how to do so while minimizing the potential for distraction.

Students' academic use of technology is widespread but not deep.

- Measure the extent to which students use the technologies the college or university has deployed.
- Calibrate usage metrics of these technologies with institutional priorities; implement policies, systems, or training programs that align with institutional priorities to increase technology use in key areas.
- Benchmark against initial usage metrics to assess progress toward meeting institutional priorities.
- Provide students (and faculty) with specific guidance on productive uses of technology in the classroom.

Students look to diverse sources for technology support.

- Have clear and accessible service-level options for students who look to the college and university for tech support.
- Champion the paradigm shift to the DIY support (e.g., using Google or YouTube and asking friends or family) that accompanies the bring-your-own-everything culture, but be prepared to refer students in finding and using this support.

Students operate in a diverse, consumer-oriented market for technology, and institutions must provide infrastructure for the bring-your-own-everything culture.

- Work on developing an agile, device-agnostic institutional mobile strategy that will prove robust yet adaptable as more products come to market. Start by assessing the current architecture for gaps in mobile agility.
- Create a scalable infrastructure and support the proliferation of mobile devices.
- When new products or services come to market, look to your campus IT thought leaders or innovative faculty or staff for ideas and opportunities to adapt the technology for administrative and pedagogical applications.

Increased use of personal digital devices for academics corresponds with trend increases in device ownership among undergraduates over the past few years, yet attitudes about the importance of these devices haven't changed much.

- Design course activities and assignments such that students' personal mobile devices can be used to deepen engagement.
- Look to students who consume mobile-enabled services at higher rates as a way to predict expectations for tomorrow's students. Develop and prioritize BYOD and mobile-friendly services and activities.
- Assess the mobile-friendly nature of student-facing college and university services and applications.

The majority say they learn best with a blend of online and face-to-face work.

- Assess local student demand for mixed-modality learning environments and reconcile student demand with current offerings.
- Develop programs, services, and support to meet students' expectations for blended learning opportunities. Start by evaluating whether current services and support practices are adapted for blended modalities.

Undergraduates value the LMS as critical to their student experience but rarely make full use of it; tomorrow's digital learning environment will need to bridge this gap.

- Raise user awareness of LMS features.
- Provide training and support that are integrated into the LMS.
- Prioritize the user-friendliness of system interfaces when making new LMS purchases or when making suggestions for upgrades to the current LMS.

Students are open to institutional use of their data for advisement on academic progress in courses and programs, and many of these personalizing features exist in contemporary LMSs.

- Consider employing features that allow for immediate and integrated course assessment feedback to students.
- Deploy features that allow students to share or view information about their assessment metrics in comparison with other students' performance.
- Look for ways to allow students to customize their view of their course progress.
- Encourage students to use the calendar, schedule, and reminder features of the LMS for task management.
- Use the LMS to curate supplemental information from course lectures, quizzes/tests, textbooks, and other content-related information.
- Deploy LMS features or an integrated planning and advising system that provides students with early alerts, course and program guidance, and personalized outreach of one-to-one communication to students.

Undergraduates still view the traditional college degree as the gold standard for résumés but are experimenting with digital badges and competency-based credentials. MOOCs are still novel for undergraduates.

- Experiment with microcredentialing (e.g., digital badges) to help familiarize faculty and students with the process and potential value.
- Consider whether MOOCs fit into the institution's overall e-learning strategy. If so, educate students about MOOCs and their potential value as possible supplemental learning activities.

Methodology

In 2014, 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 securing local approval to participate in the 2014 study (e.g., successfully navigating the IRB process) and submitting sampling plan information, ECAR shared the link to the current year's survey with each participating institution. An institutional representative then sent the survey link to students in the institution's sample. Data were collected between February 10 and April 11, 2014, and 75,306 students from 213 institutional sites responded to the survey (see table 1). 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. In exchange for distributing the ECAR-deployed survey to their undergraduate student population, participating colleges and universities received files containing anonymous, unitary-level (raw) data of their students' responses, along with summary tables that compared their students' aggregated responses with those of students at similar types of institutions. Participation in this annual survey is free, and any higher education institution can sign up to contribute data to this project by e-mailing study@educause.edu.

Table 1. Summary of institutional participation and response rates

Institution Type*	Institution Count	Invitations	Response Count	Group Response Rate	Percentage of Total Responses	U.S. Subsample (n = 10,000)**
AA	49	332,503	13,899	4%	18%	46%
BA public	8	18,226	1,884	10%	3%	3%
BA private	18	25,126	3,282	13%	4%	3%
MA public	35	188,248	14,645	8%	19%	15%
MA private	22	84,835	7,828	9%	10%	5%
DR public	42	324,969	20,755	6%	28%	24%
DR private	11	42,608	3,337	8%	4%	4%
Total U.S.	185	1,016,515	65,630	6%	87%	100%
Canada	12	62,684	3,198	5%	4%	–
Other countries	16	76,674	6,478	8%	9%	–
Overall	**213**	**1,155,873**	**75,306**	**7%**	**100%**	**–**

**U.S. institutions not falling into the listed types were reclassified.*
*** Via a stratified random sample*

Countries represented in the non-U.S. sample:

- Canada
- Egypt
- Finland
- France
- Greece
- Hong Kong
- Ireland
- Italy
- Kazakhstan
- Kyrgyzstan
- Lebanon
- Morocco
- South Africa
- United Arab Emirates

The quantitative findings in this report were developed using a representative sample of students from 185 U.S.-based higher education college and university sites. A stratified random sample of approximately 10,000 respondents was drawn from the overall response pool to proportionately match a profile of current U.S. undergraduates. This sample was based on IPEDS data on age, gender, ethnicity, Carnegie class, and institutional control (public/private) for U.S. undergraduates. (A similar methodology was used for the 2013 sample.) The 2014 representative U.S. sample results in an approximate 1% margin of error for percentages estimated for the whole population. Margins of error are higher for subsets of the population. The international respondents were neither sampled nor weighted, but comparison data from Canada and other countries are included in the report to highlight differences and similarities between U.S. and non-U.S. results (see participant listing, appendix A). Findings from past ECAR studies were also included, where applicable, to characterize longitudinal trends. All findings in this report refer to the U.S. representative sample unless otherwise noted. All findings are statistically significant at the 0.001 level unless otherwise noted.

Table 2. Demographic breakdown of survey respondents

	U.S. Full Sample	U.S. Subsample	Canada	Other Countries
Basic Demographics				
18–24	73%	70%	70%	91%
25+	27%	30%	30%	9%
Male	36%	45%	37%	52%
Female	64%	55%	63%	48%
White	68%	55%	–	–
Black	5%	12%	–	–
Hispanic	10%	16%	–	–
Asian	8%	8%	–	–
Other/Multiple	9%	9%	–	–
Student Profile				
Freshman	24%	27%	43%	35%
Sophomore	24%	28%	25%	22%
Junior	22%	20%	15%	19%
Senior	23%	18%	11%	19%
Other	6%	7%	6%	5%
Part time	19%	27%	9%	5%
Full time	81%	73%	91%	95%
On campus	31%	21%	15%	27%
Off campus	69%	79%	85%	73%
Academic Goal				
Digital badges that certify my skills	8%	10%	15%	25%
Vocational/occupational certificate	8%	10%	23%	15%
Associate's degree	17%	30%	14%	9%
Bachelor's degree	79%	73%	56%	78%
Master's degree	37%	35%	25%	59%
Doctoral degree	13%	13%	8%	23%
Another professional degree	9%	8%	9%	10%
Other	2%	2%	9%	2%
Major				
Agriculture and natural resources	1%	1%	2%	2%
Biological/life sciences	7%	6%	5%	6%
Business, management, marketing	14%	14%	19%	17%
Communications/journalism	4%	3%	2%	2%
Computer and information sciences	6%	8%	6%	8%
Education, including physical education	7%	6%	5%	2%
Engineering and architecture	7%	7%	8%	27%
Fine and performing arts	3%	3%	2%	1%

Cont'd

Table 2. Demographic breakdown of survey respondents *(continued)*

	U.S. Full Sample	U.S. Subsample	Canada	Other Countries
Health sciences, including professional programs	14%	14%	11%	6%
Humanities	3%	2%	3%	6%
Liberal arts/general studies	3%	4%	2%	1%
Manufacturing, construction, repair, or transportation	0%	1%	1%	0%
Physical sciences, including mathematical sciences	3%	3%	2%	4%
Public administration, legal, social, and protective service	2%	3%	5%	2%
Social sciences	8%	7%	8%	4%
Other	15%	15%	17%	10%
Undecided	3%	3%	2%	1%

Acknowledgments

This study was made possible by the collective efforts of survey administrators from the 213 college/university sites that participated in the 2014 student study (see appendix A). Each representative secured institutional approval to participate in the study, provided sampling-plan information to our team, and distributed the ECAR student survey link to their institution's students. This research is an example of a symbiotic partnership between ECAR and higher education institutions; it could not happen without your contributions. Thank you for joining us in this exploration of student views of technology in higher education. This work was supported by the project's subject-matter experts. Thank you for your insights about what matters most to higher education with regard to the questions we asked in the survey and the interpretation of the findings:

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Appendix A: Participating Institutions

Aalto University
Abilene Christian University
Al Akhawayn University
Alma College
The American College of Greece–Deree College
The American University in Cairo
American University of Central Asia
The American University of Paris
American University of Rome
American University of Sharjah
Appalachian State University
Auburn University
Baldwin Wallace University
Ball State University
Bellevue University
Blue Ridge Community College
Brandman University
Brazosport College
Bridgewater State University
Brown University
Bucks County Community College
Butler University
California Lutheran University
California State Polytechnic University, Pomona
California State University, Dominguez Hills
California State University, Fresno
California State University, Northridge
California State University, Sacramento
Canadian University College
Castleton State College
Catawba College
Cecil College
Central Connecticut State University
Central Virginia Community College
Chadron State College
Chandler-Gilbert Community College
Chatham University
Clemson University
College of the Desert
College of Saint Benedict/Saint John's University
College of Wooster
Collin County Community College District
Community College of Vermont
Concordia University Texas
Confederation College
Coppin State University
Cornell University
Dabney S. Lancaster Community College
Danville Community College
DeVry University
Drexel University
Dublin City University
Durham College
Eastern Illinois University
Eastern Kentucky University
Eastern Shore Community College
Elon University
Emory University
Estrella Mountain Community College
Fleming College
Fordham University
Franklin W. Olin College of Engineering
Fullerton College
GateWay Community College
Geneva College
Georgetown College
Georgia College & State University
Georgia Gwinnett College
Georgia Southern University
Germanna Community College
Glendale Community College
Grace College and Seminary
Grand Canyon University
Hamilton College
Harvey Mudd College
Hawaii Pacific University
Hollins University
Humber College Institute of Technology & Advanced Learning
Hunter College/CUNY

Cont'd

Illinois Central College
Indiana University Bloomington
Indiana University-Purdue University Indianapolis
Ithaca College
J. Sargeant Reynolds Community College
John Tyler Community College
Johnson State College
Joliet Junior College
Juniata College
Keene State College
Kent State University
Lambton College of Applied Arts & Technology
Lawrence Technological University
Lebanese American University
Lethbridge College
LeTourneau University
Lipscomb University
Lord Fairfax Community College
Louisiana State University
Lourdes University
Loyalist College
Loyola Marymount University
Lyndon State College
Marietta College
McGill University
Mesa Community College
Messiah College
Michigan State University
Montgomery County Community College
Moreno Valley College
Mountain Empire Community College
Nazarbayev University
New Jersey Institute of Technology
New River Community College
Northern College
Northern Virginia Community College
Northwestern University
Oakland University
The Ohio State University
Old Dominion University
Oregon State University
Palo Alto College
Paradise Valley Community College
Patrick Henry Community College
Paul D. Camp Community College
The Pennsylvania State University
Philadelphia University
Phoenix College
Piedmont Virginia Community College
Pima County Community College District
Pitzer College
Purdue University
Rappahannock Community College
Rio Salado College
Saint Mary's University
Saint Michael's College
Salt Lake Community College
Salve Regina University
San Jose State University
Sauk Valley Community College
School of the Art Institute of Chicago
Scottsdale Community College
Seneca College of Applied Arts and Technology
Seton Hall University
Sonoma State University
South Dakota State University
South Mountain Community College
Southern Methodist University
Southern New Hampshire University
Southside Virginia Community College
Southwest Virginia Community College
St. Norbert College
Tampere University of Technology
Tarleton State University
Thomas College
Thomas Nelson Community College
Tidewater Community College
Truman State University
Tufts University
University College Dublin
University of Alaska Anchorage
University of Alaska Kenai
University of Alaska Kodiak
University of Alaska Mat-Su
The University of Arizona
University of Arkansas
University of Cape Town

Cont'd

University of Cincinnati
University of Delaware
University of Florida
University of Hong Kong
University of Houston
University of La Verne
University of Maryland
University of Massachusetts Dartmouth
The University of Memphis
University of Michigan–Ann Arbor
University of Minnesota
University of Minnesota–Crookston
University of Minnesota–Duluth
University of Minnesota–Morris
University of Minnesota–Rochester
University of Mississippi
University of Montana
University of Nebraska at Kearney
University of Nebraska at Omaha
University of Nevada, Las Vegas
University of New Hampshire
University of New Mexico
University of North Dakota
University of North Texas at Dallas
University of Northern Iowa
University of Oregon
University of Pretoria
University of South Carolina Upstate
The University of South Dakota
University of Texas–Pan American
University of Washington
University of West Georgia
University of Wisconsin–Madison
University of Wisconsin–Milwaukee
University of Wisconsin–Superior
University of Wisconsin–Whitewater
Vermont Technical College
Virginia Commonwealth University
Virginia Highlands Community College
Virginia Western Community College
Washington University in St. Louis
Wayne State College
Wayne State University
West Virginia University
Western Carolina University
Winona State University
Wytheville Community College

Appendix B: Validity and Reliability of Semantic Differential Constructs

We asked respondents to place themselves on a series of semantic differential scales designed to measure their disposition toward technology, their attitudes toward technology, and their usage of technology. On a 100-point slider scale, lower numbers indicated certain characteristics about disposition, about attitudes, and about usage.

In contrast, higher numbers on the scale indicated opposite characteristics for disposition (enthusiast, early adopter, technophile, cheerleader, experimenter, supporter, radical), for attitude (satisfied, content, pleased, beneficial, useful, enhancement), and for usage (always connected, central, new media, frequent, insatiable).

A principal components analysis (using varimax rotation and Kaiser normalization) on the 18 slider-scale items revealed three primary factors that reflected the preconceived factors of disposition, attitude, and usage. These three factors accounted for 64% of the variance in the semantic differential responses. Cronbach's alphas (reliability) for each factor were .85 (disposition), .86 (usage), and .91 (attitude), indicating these constructs have sufficient reliability.

In terms of disposition, students were on average significantly more positive than negative on every scale in this series. They were more likely to refer to themselves as IT enthusiasts, early adopters, technophiles, cheerleaders, experimenters, supporters, and radicals (see figure B1).

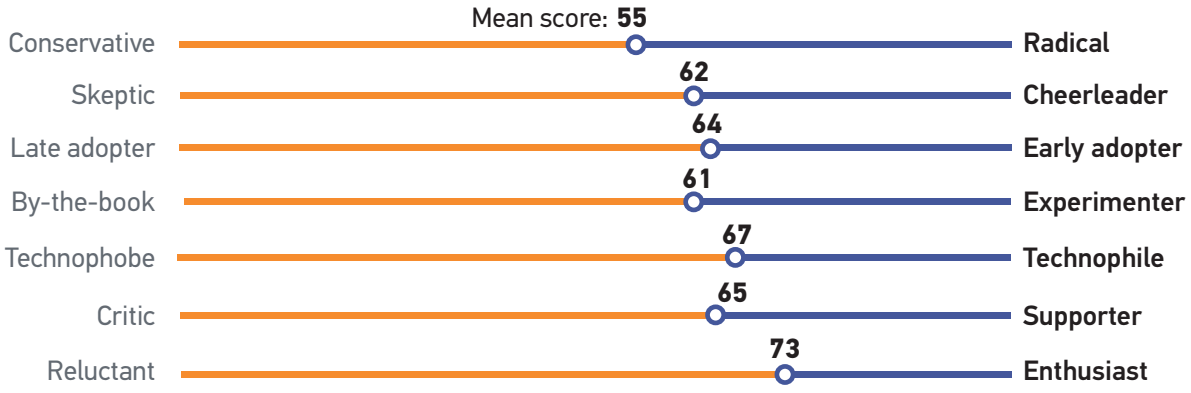

Figure B1. Student disposition toward technology

Students also had significantly more positive than negative attitudes toward IT, claiming to be more satisfied, content, and pleased than dissatisfied, discontent, and perturbed. Furthermore, they were much more likely to see IT as beneficial, useful, and an enhancement than as burdensome, useless, and a distraction (see figure B2).

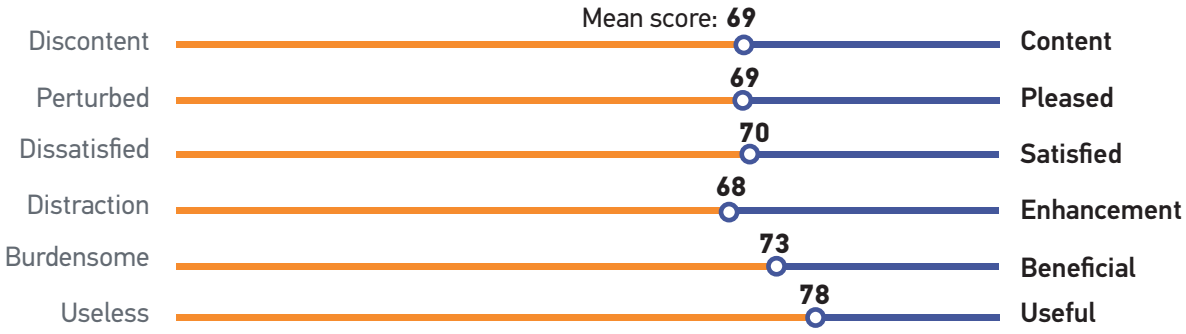

Figure B2. Student attitudes toward technology

In terms of usage, students reported on average being more connected than not, using technology frequently and voraciously, and tending to have technology and new media central to their lives (see figure B3).

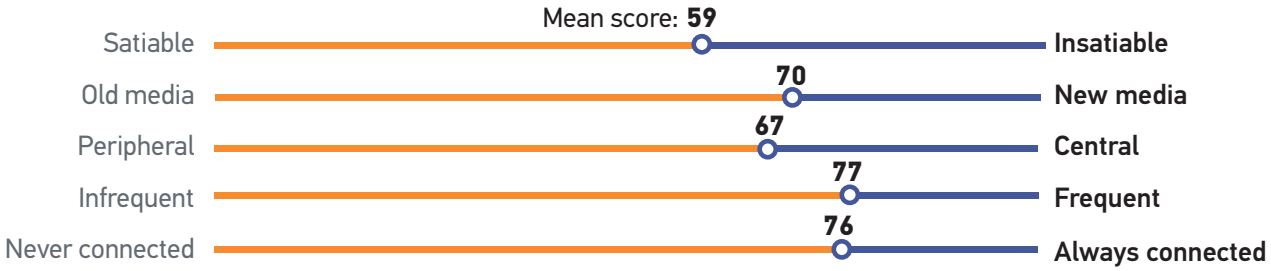

Figure B3. Student usage of technology

The histogram below (figure B4) shows the normal distribution curve for overall technology inclination scores, which were calculated as the mean of each student's disposition, attitude, and usage score. There are large individual differences in tech inclination, with 95% of scores falling between 39 and 97.

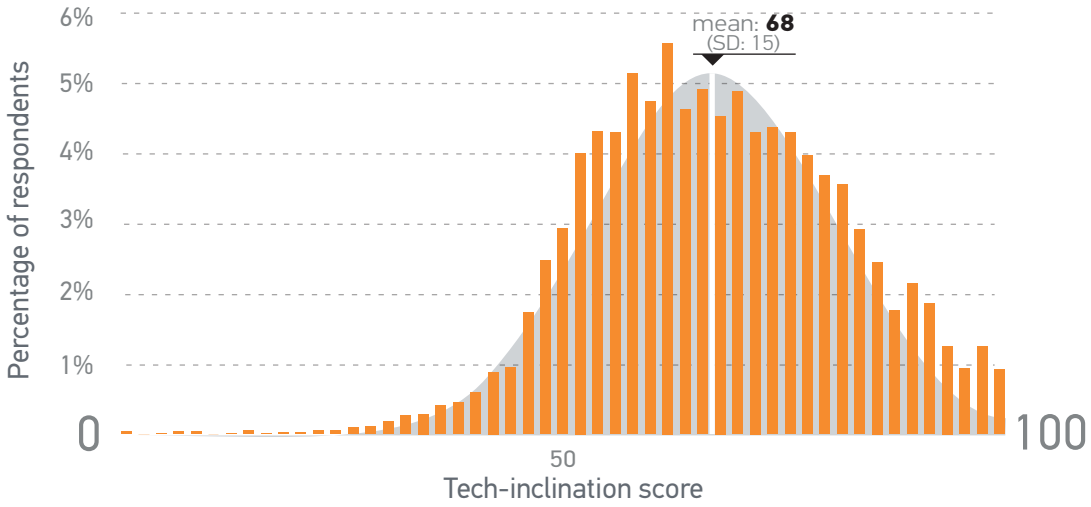

Figure B4. Histogram of semantic distribution mean scores for "tech inclination"

Additional details about this statistical analysis are available upon request through study@educause.edu.

Notes

1. A stratified random sample of 10,000 respondents was drawn from the overall response pool of U.S. respondents to proportionately match a profile of current U.S. undergraduates (based on IPEDS demographics and institutional data). See the Methodology section for more about the sampling process and institution details.
2. Students ages 25-plus rated themselves an average of 71 on the tech-inclination scale, which was higher than students younger than 25 years of age (67 on the scale). This is a significant ($p < 0.001$) difference.
3. Eden Dahlstrom and D. Christopher Brooks, with a foreword by Diana Oblinger, *ECAR Study of Faculty and Information Technology, 2014*, research report (Louisville, CO: ECAR, July 2014), available from http://www.educause.edu/ecar.
4. The 2014 survey instrument updated the survey question language from "professors" (2011–2013) to "instructors" (2014), and the scale changed from "Neither agree nor disagree" to "Neutral" and from "Agree" to "Somewhat agree" during this same period. "Don't know" was added in 2013. Because these items are linguistic synonyms, we don't expect these changes to have a substantial effect on the longitudinal analysis; we are noting the changes nevertheless.
5. Eden Dahlstrom, D. Christopher Brooks, and Jacqueline Bichsel, *The Current Ecosystem of Learning Management Systems in Higher Education: Student, Faculty, and IT Perspectives*, research report (Louisville, CO: ECAR, September 28, 2014), available from http://www.educause.edu/ecar.
6. Kristen Purcell et al., *How Teens Do Research in the Digital World*, Pew Research Internet Project, November 1, 2012.
7. Pew Research Internet Project: Ownership estimates for cell phones, smartphones, tablets, and e-readers (as of January 2014) and for laptops (as of April 2012).
8. More than twice as many younger students (9%) than older students (4%) try to connect three or more devices to the college/university network at the same time.
9. "7 Things You Should Know About the Internet of Things," EDUCAUSE Learning Initiative, October 6, 2014.
10. Gartner's 2014 Hype Cycle for Emerging Technologies places the Internet of Things at the apex of the "inflated expectations" curve and wearable user interfaces just past the apex.
11. Because of the nearly universal ownership and use of laptops, we don't see much difference in use between students with high versus low tech-inclination ratings. However, the differences are particularly noticeable for smartphones and tablets, with greater than 20 percentage point spreads in "use for academics" between high versus low tech inclination.
12. The percentage reporting very/extremely important to academic success is among students reporting academic usage (rather than all survey respondents).
13. Although the percentages of students and faculty reporting bans and requirements on in-class use of digital devices are more or less consistent with each other, students see faculty as more discouraging and less encouraging than faculty see themselves. This is particularly true for laptops, tablets, and smartphones. Wearables differ, but these devices may be too novel to academic use to get a good read on experiences and expectations.
14. Anne Curzan, "Why I'm Asking You Not to Use Laptops," *Chronicle of Higher Education*, August 25, 2014.

15. Bernard R. McCoy, "Digital Distractions in the Classroom: Student Classroom Use of Digital Devices for Non-Class Related Purposes," *Journal of Media Education* 4, no. 4 (2013).

16. Pam A. Mueller and Daniel M. Oppenheimer, "The Pen Is Mightier than the Keyboard: Advantages of Longhand Over Laptop Note Taking," *Psychological Science* 25, no. 6 (January 16, 2014), 1159–1168.

17. D. C. Rubin and W. T. Wallace, "Rhyme and Reason: Analyses of Dual Retrieval Cues," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 15, no. 4 (1989): 698–709; Allan Paivio, *Mental Representations: A Dual Coding Approach* (Oxford, England: Oxford University Press, 1986).

18. Ezekiel J. Emanuel, "Who Takes MOOCs? For Online Higher Education, the Devil Is In the Data," *New Republic*, January 4, 2014; Jozenia Torres Colorado and Jane Eberle, "Student Demographics and Success in Online Learning Environments," *Emporia State Research Studies* 46, no. 1 (2010), 4–41.

19. Core Data Service, 2013, Module 8.

20. Jamie S. Switzer and Ralph W. Switzer, "The Myth of the Tech-Savvy Student: The Role of Media Educators in a Web 2.0 World," *Journal of Media Education* 4, no. 4 (October 2013): 15–27.

21. Dahlstrom, Brooks, and Bichsel, *The Current Ecosystem of Learning*.

22. For more information on integrated planning and advising services, see Ronald Yanosky, *Integrated Planning and Advising Services: A Benchmarking Study*, research report (Louisville, CO: ECAR, March 2014); and D. Christopher Brooks, *IPAS Implementation Issues: Data and Systems Integration*, research report (Louisville, CO: ECAR, June 2014); both available from the ECAR IPAS Research Hub.

23. Clarifying survey language from "No" to "No, but I do know what a MOOC is" could account for some of the decrease in the percentage of students knowing what a MOOC is but not having taken one in the last year.

24. See the EDUCAUSE Badging Program.

25. Stephen diFilipo, "Connecting the Dots to the Future of Technology in Higher Education," *EDUCAUSE Review* 46, no. 4 (July/August 2011).