

A man with glasses, wearing a blue button-down shirt and a dark blazer, is smiling and holding a tablet. He is in a classroom setting with other students blurred in the background.

# Educational Technology and Faculty Development in Higher Education

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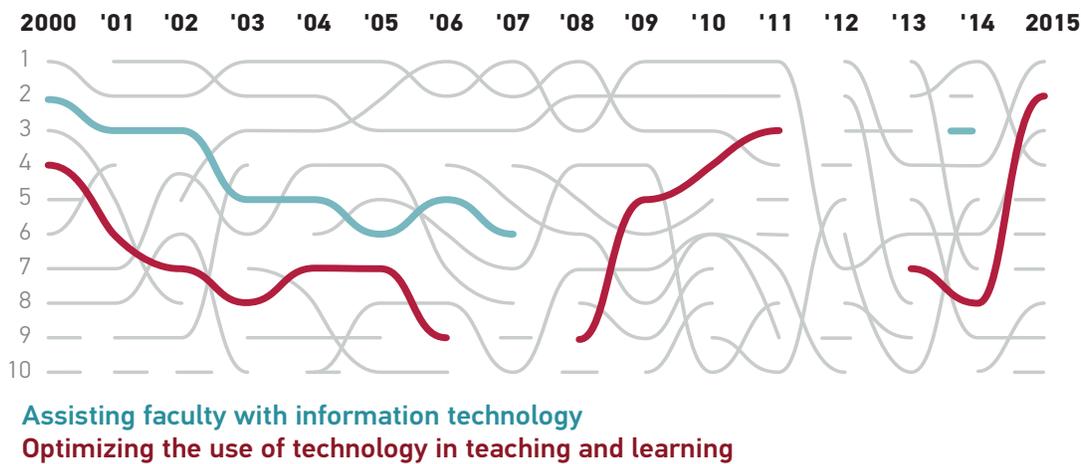
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## EDUCAUSE

EDUCAUSE is a nonprofit association and the foremost community of IT leaders and professionals committed to advancing higher education. EDUCAUSE programs and services are focused on analysis, advocacy, community building, professional development, and knowledge creation because IT plays a transformative role in higher education. EDUCAUSE supports those who lead, manage, and use information technology through a comprehensive range of resources and activities. For more information, visit [educause.edu](http://educause.edu).

## Introduction

Assisting faculty with the instructional integration of information technology and optimizing the use of technology in teaching and learning are enduring themes in the top 10 IT issues in higher education (figure 1). The importance of these issues is also reflected in the community-based, crowd-sourced EDUCAUSE Learning Initiative (ELI) Content Anchors project, in which faculty development is the no. 1 thematic issue for 2015.<sup>1</sup> These two sources demonstrate that institutional priorities for investing in technologies in support of teaching and learning are aligned with community interests to help faculty understand the value and potential impact of these technologies.

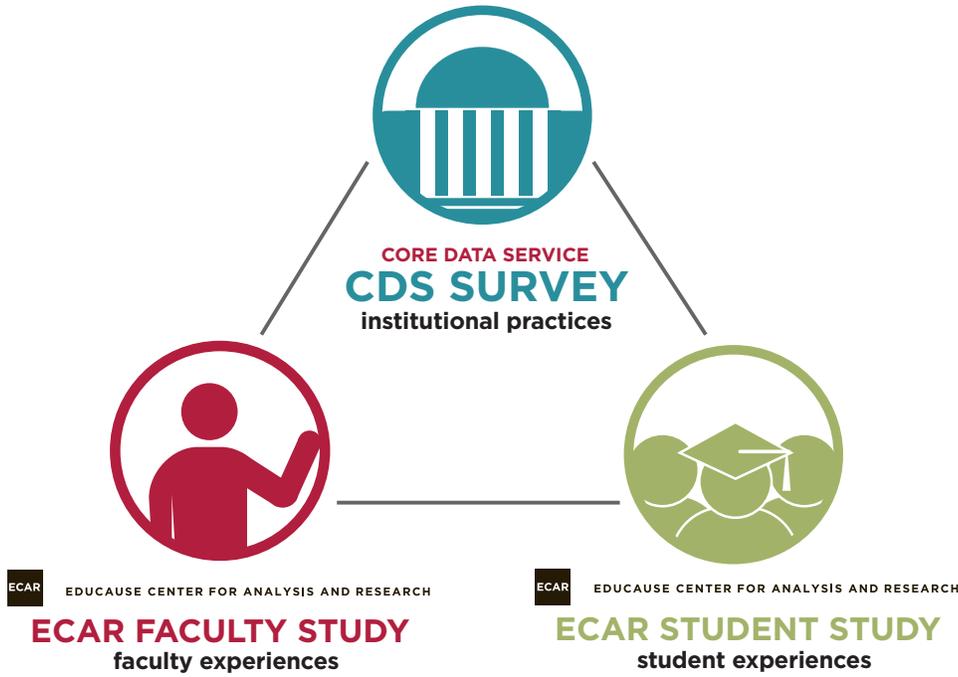


**Figure 1. Historic top 10 IT issues trends for faculty development and optimizing technology for teaching and learning**

But how can an institution know if its tactics to optimize technology in teaching and learning are the right ones or whether they are effective? One way is to align institutional practices with student and faculty perceptions about their technology experiences and expectations. The EDUCAUSE Center for Analysis and Research (ECAR) annual surveys of students and faculty bring the respective experiences and expectations of these populations to the table. The results of these studies show areas where students think technology could be better used or integrated into courses they take, and the ways in which faculty think they could be more effective instructors if they were better skilled at integrating various kinds of technology into courses they teach.

This report looks across EDUCAUSE Core Data Service (CDS) and ECAR resources to tell the story about how faculty use technology, how students experience technology, and how institutional practices support educational technology. Together, the findings from these sources provide a three-dimensional perspective for how

technologies in the teaching and learning environment are used by faculty, consumed by students, and supported by institutions. This report uses the data sources shown in figure 2 to tell this story.



**Figure 2. Complementary data sources about institutional practices and user experiences**

Whereas each source can independently help IT professionals make data-informed decisions about optimizing technology in teaching and learning, combining the findings from these three sources provides evidence for associations between institutional practices and user experiences.

## Findings

### General Landscape of Educational Technology Support and Training

The EDUCAUSE CDS Almanacs include an annual overview of IT support for educational technology services in higher education. Figure 3 depicts an excerpt from the almanac produced in 2014 for all nonspecialized institutions in the United States (those that fall into the basic Carnegie Classifications of associate's, bachelor's, master's, and doctoral institutions). Central IT spending and staffing were consistent from 2013 to 2014, with U.S. institutions spending about 10% of central IT funding on educational technology services and reporting 1.0 full-time-equivalent (FTE) central IT educational technology services staff per 1,000 institutional FTEs. (Reported almanac statistics are either an estimated proportion of the population or an estimated median, except for the last two items, which are means.)

#### EDUCATIONAL TECHNOLOGY SERVICES

- 10% Educational technology services spending as a percentage of central IT spending
- 1.0 Central IT educational technology services FTEs per 1,000 institutional FTEs
- 18 Student FTE per lab/cluster workstation provided by central IT
- 519 Student FTE per kiosk workstation provided by central IT
- 101 Student FTE per virtual lab/cluster workstation provided by central IT
- 184 Student FTE per laptop/tablet provided by central IT for checkout or loan
- 81% Institutions with collaborative spaces
- 54% Institutions with team-based classrooms
- 16% Institutions with makerspaces
- 3.6 Organizational capacity to deliver e-learning services (1 = low, 5 = high)
- 3.6 Organizational capacity to deliver student success technologies (1 = low, 5 = high)

**Figure 3. General landscape of IT support for educational technology services**

*Note: The last two items in figure 3 are part of the EDUCAUSE Higher Education IT Assessment and Benchmark Project. See sidebar on next page for more information about this work.*

“So far my instructors this semester are all doing an excellent job with giving us links to the important class discussions that we’ve gone over in class. The material tends to stay in my memory more when I’m in class discussing the material with the teacher and other students.”

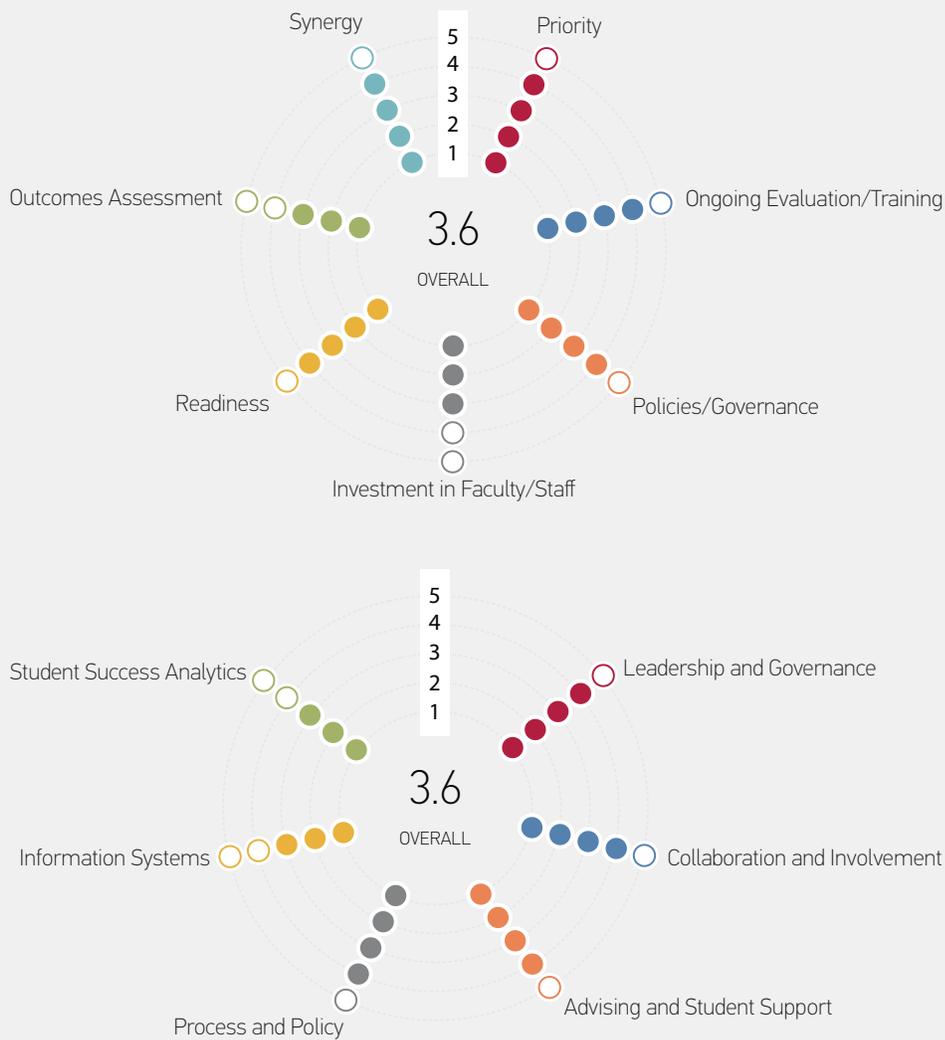
—Anonymous ECAR 2014 student survey respondent

“My instructors are pretty thorough with their technology assignments. They know what they’re doing, and the students know what is expected from them.”

—Anonymous ECAR 2014 student survey respondent

### EDUCAUSE Maturity Indices for E-Learning and Student Success Technologies

The Core Data Service (CDS) benchmarking service is used by colleges and universities to inform their IT strategic planning and management. Institutions can use CDS to make the case for additional resources, to evaluate organizational structure and governance, or to calibrate or justify performance. Data about institutional maturity on e-learning and student success technologies are collected through the annual CDS survey. The last two items depicted in figure 3 were derived from the e-learning and student success technology maturity indices. Figure A shows these two types of maturity indices. Maturity indices measure the capability to deliver IT services and applications in a given area. They examine multiple dimensions of progress, technical and nontechnical—such as culture, process, expertise, investment, and governance. They enable institutional leaders to determine where they are in delivering a service, and where they aspire to be.



**Figure A. (Top) E-learning and (bottom) student success technology maturity index composite scoring matrices**

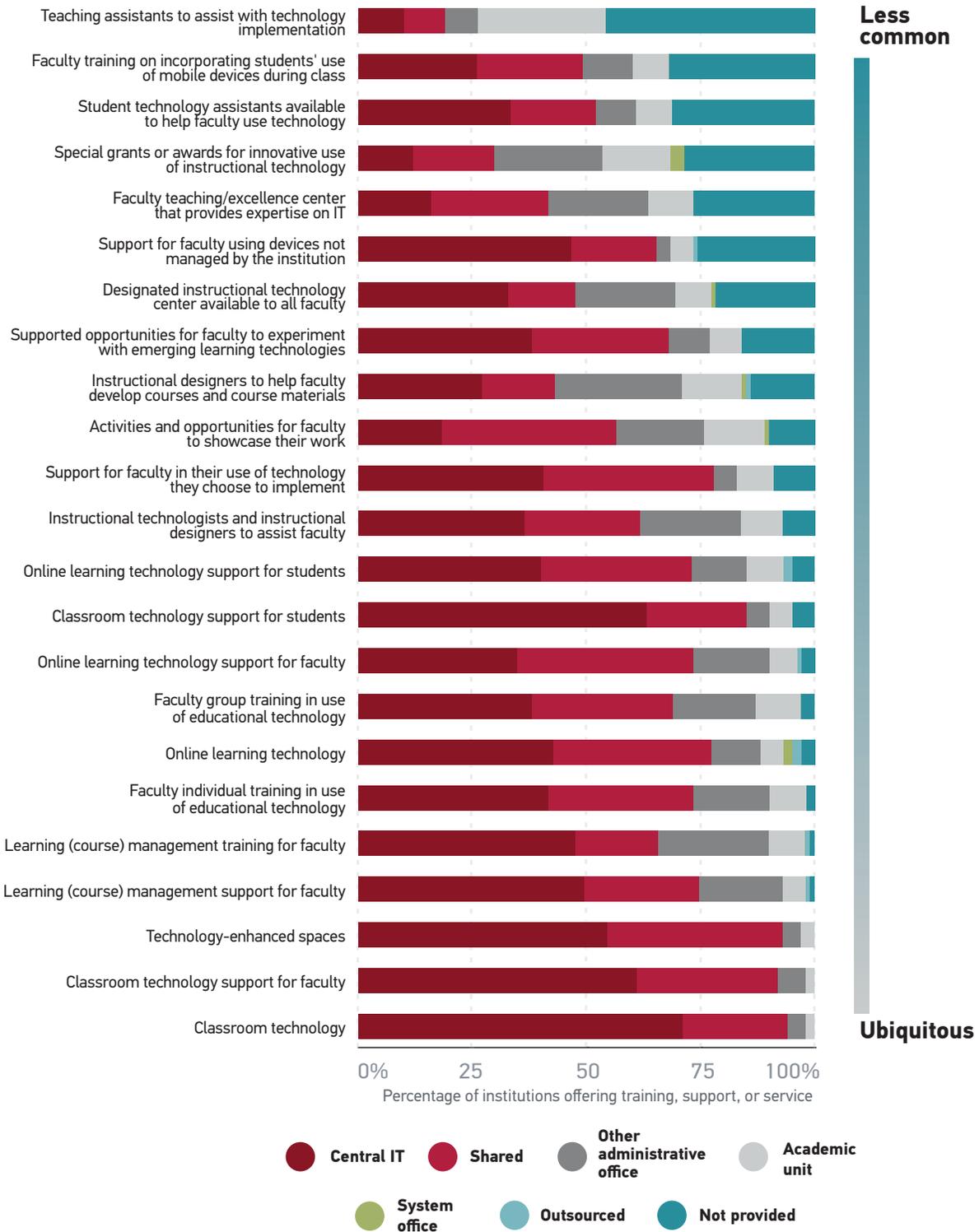
For more information visit the [Higher Education IT Assessment and Benchmarking project hub](#).

Data from the CDS Almanac (figure 3) paint a broad picture of the educational technology services landscape based on institutional practices. Figure 4 shows the specific technology services institutions provide to support technology-enhanced teaching and learning. These services are both widespread and diverse. Central IT plays a significant role in offering these services on its own or in conjunction with another administrative or academic unit. Central IT is the main service provider for all but five educational technology services: offering special grants or awards (e.g., for innovative use of instructional technology), providing teaching assistants to help with technology implementation, supporting teaching/excellence centers to provide faculty with expertise on IT, providing instructional designers to help faculty develop courses and course materials, and offering activities and opportunities for faculty to showcase their work. In each of these areas, an administrative or academic unit more commonly offers the service. In most cases, it is the items that scale well across an institution that are exclusively part of central IT's domain; more specialized or personalized services are better offered as shared services or by an academic or administrative unit.

Four in five institutions (80%) say they align faculty educational technology requests with classrooms that “best match” the requests.

—*EDUCAUSE Core Data Service, 2014*

## Educational Technology and Faculty Development



**Figure 4. Management responsibility for educational technology support services, by organizational unit**

## Faculty and Student Attitudes about Technology

The majority of students (about 72%) said that most or all of their instructors have adequate technology skills for carrying out course instruction (up from 66% in 2013), and 68% said their instructors effectively use technology to support academic success (about the same as in 2013, 67%). In two recent presentations of this material to faculty-centric audiences, attendees were surprised by how high these numbers were.<sup>2</sup> While the ensuing dialogue suggested that students have low expectations of faculty technology use (which would skew students' perspectives of "adequate" and "effective" uses of technology), ECAR data show that faculty technology use is more sophisticated and prevalent than popular opinion would suggest.<sup>3</sup>

Most faculty have a positive inclination toward technology and rate their usage as rather sophisticated.<sup>4</sup> When faculty rated themselves on a 100-point scale, the mean scaled scores about their personal technology usage (72), attitude (70), and disposition (65) were all quite high. We asked students to rate themselves using the same semantic differential scales; their mean ratings were almost identical to those of the faculty self-assessment (usage = 70, attitude = 71, and disposition = 64). Faculty and students have similar views of their own technology savviness, thus challenging the stereotype that students are advanced technology consumers and faculty are technology detractors. The data also show that faculty and student attitudes about, usage of, and disposition toward technology are similar, so it is not surprising that students would think faculty, for the most part, use technology adequately and effectively.

### The Faculty Tech Detractor—Fact or Fiction?

Faculty members' classroom policies are related to their technology inclinations.\* ECAR found that faculty who are less open to technology (lower semantic differential scores) are the ones who more often ban or discourage the use of mobile technology in class. Conversely, faculty who are more open to technology are the ones who more often encourage or require the use of mobile technology in class.

*\*When we looked at these faculty semantic differential ratings by in-class mobile device policies, we found highly significant ( $p < .0001$ ) but moderate effect size (around .2) pairwise correlations between each scale and the technologies (laptops, smartphones, and tablets) evaluated.*

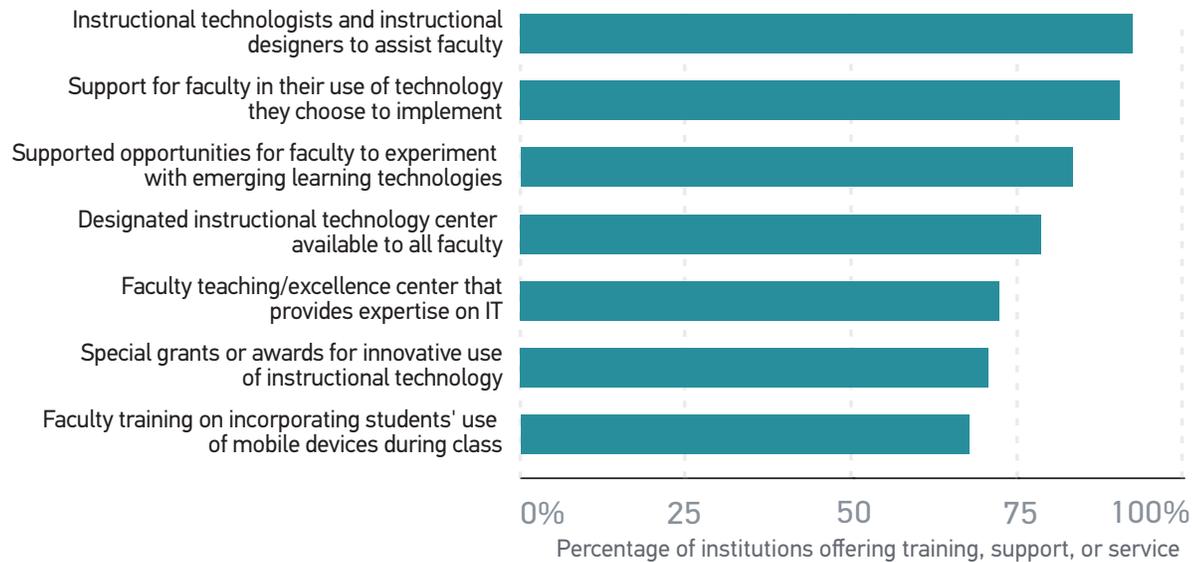
Figure 5 shows the types of educational technology services that are associated with more positive faculty or student technology perceptions about the integration of technology into the learning environment. These specific support services are profiled here because faculty at institutions providing these services were slightly more likely than other faculty to agree that their institution generally assists them with the integration of IT.

"I think the instructors I currently have are doing a pretty good job of balancing the technology. I find it really beneficial for the instructor to have how-to videos posted in case someone is unaware of how to do something."

—Anonymous ECAR 2014 student survey respondent

"Audio and video lessons can supplement the course well and provide a wider range of learning. Online work can be completed outside of the class and tested inside. I enjoyed this as part of a module."

—Anonymous ECAR 2014 student survey respondent



**Figure 5. Institutional educational technology support associated with positive faculty attitudes about integrating technology into their classes**

By looking at student and faculty study results by institution for which we have CDS data, we can begin to assess the relationships between offering particular types of educational technology training or services and students' and/or faculty's perceptions of technology.<sup>5</sup> While we are not able to report causal relationships (there are too few institutions providing support in substantially different ways to make 1:1:1 connections among the three data sources), we do have some general observations that are noteworthy.

- At institutions that provide support for faculty to use the technologies *the faculty chooses to implement*, students are more positive about their instructors' integrated use of technology. Students reported that more of their instructors use technology effectively to support academic success and more have adequate technological skills for teaching at institutions that support faculty choice in technology use. Faculty at those same institutions were slightly but not significantly more likely than faculty at other institutions to indicate that their institutions assist them with the integration of IT.
- Six educational technology support services were associated with higher levels of faculty agreement about their institution's assisting with technology integration. Faculty were more likely to agree that their institution assists them with the integration of technology when any of the following services, support, or training activities were provided:
  - ▶ A faculty teaching/excellence center that provides expertise on IT (10 percentage points more faculty agree)
  - ▶ Supported opportunities for faculty to experiment with emerging learning technologies (9 percentage points more faculty agree)

**61%**

of faculty agreed that their institution generally assists them with the integration of IT.

**54%**

of faculty rated their institution as good/excellent for professional development around integrated use of technology.

—ECAR Faculty Study, 2014

- ▶ Instructional technologists to assist faculty and instructional designers with integration of IT into teaching and learning (7 percentage points more faculty agree)
- ▶ Training on incorporating students' use of mobile devices during class (6 percentage points more faculty agree)
- ▶ Special grants or awards for innovative use of instructional technology (5 percentage points more faculty agree)
- ▶ A designated instructional technology center available to all faculty (5 percentage points more faculty agree)<sup>6</sup>
- When central IT is responsible for a faculty teaching/excellence center that provides expertise on IT, faculty are more positive about their institution's support for assisting them with integrating technology. Teaching/excellence centers provide pedagogical and technological support to promote good teaching and learning practices. Central IT is strongly positioned to scale this service across an institution by providing technology resources and staff with professional expertise (e.g., instructional designers and instructional technologists who are immersed in current and emerging technologies).
- Faculty and student impressions about technology integration are more positive at institutions that provide faculty with individual or group educational technology training. Providing educational technology training to faculty is associated with more positive impressions about technology, especially for the percentage of students reporting that "all" or "almost all" faculty use technology effectively or have adequate technology skills. Although we can't link student responses directly with faculty who experienced technology integration training, we can say that students' perceptions of faculty technology use at those institutions are more positive than at institutions not providing such faculty training.<sup>7</sup>
- The relationship between educational technology spending and student/faculty technology experiences is complicated. More spending doesn't necessarily result in higher technology experience ratings.<sup>8</sup> The unintended price tag of technology innovation may include situational peaks and valleys of user satisfaction as technologies are introduced and adopted (or not) and then utilized (or dismissed).
- The association between educational technology staffing and student/faculty technology experiences is complicated; student technology assistants may hinder rather than optimize technology for teaching and learning. Increased staffing levels that include student technology assistants were negatively associated with student technology experiences. When student technology assistants were omitted from the metric, student perceptions didn't change much, but faculty technology experiences were significantly more positive at institutions with more educational technology staff.<sup>9</sup> See the sidebar "Student Technology Assistants."

**69%**

of students think most of their instructors use technology to support academic success.

**72%**

of students say most instructors have adequate technology skills.

—ECAR Student Study, 2014

"Honestly, the best technological tool is e-mail correspondence. It's the most personal and effective. If instructors are intentional about answering e-mails completely and in a reasonable amount of time, then I feel greatly supported."

—Anonymous ECAR 2014 student survey respondent

## Student Technology Assistants: How May I Help/Hinder You?

Nearly 7 in 10 institutions (69%) provide student technology assistants to help faculty use technology. Serving as ed tech assistants can be a great professional development opportunity for students, and it can leverage the more tech-savvy students' skills as an institutional resource. That said, there are also some cautionary considerations when creating student assistant positions to help faculty use technology. When ECAR looked at the relationship between educational technology staffing patterns and faculty and student impressions of their technology experiences, we found that educational technology staffing has a significant effect on student perceptions. However, the effect is negative: Institutions reporting fewer educational technology staff had more-positive student technology experience perceptions. When student workers were omitted from the staffing metric, student perceptions didn't change much, but faculty agreement that their institution assists faculty with technology integration was highly significant and positive; that is, institutions reporting more educational technology staff had more positive technology integration impressions by faculty.\* A few hypotheses to consider:

- *Central IT departments achieve a higher ratio of staff to institutional FTE by employing students, yet more staff does not necessarily translate to better service to faculty and better technology impressions from students. If student technology assistants are employed as a community service or to supplant professional IT staff rather than supplement staff services, adding these assistants to the IT staff may hinder rather than help the optimization of technology in teaching and learning.*
- *Increased staffing could reflect a reactive circumstantial situation for increased need to support implementation of new or unfamiliar technologies. Student technology assistants are a more flexible workforce than permanent IT staff positions and could be brought in to support these situational needs for faculty support. Institutions that are more proactive with faculty training and support may not rely so much on student assistants if their support infrastructure is dense and pervasive and their programs are agile.*
- *Institutions that provide more student assistants may do so in response to a need from a large number of non-tech-savvy faculty. Non-tech-savvy faculty have more-negative impressions about technology experiences than those who are more technology inclined. Negative impressions about student technology assistants could be a simple carryover of this larger, contextualized technology experience.*
- *Faculty may be more comfortable sharing their lack of knowledge about a technology with an instructional designer or an instructional technologist than with a student. Although students might understand how certain technologies work, professional IT staff can offer support that goes beyond that. *Instructional designers can help faculty develop courses and course materials that match pedagogical approaches with technologies. Instructional technologists can assist faculty with integrating IT that best matches learning outcomes.**

\* Specifically, for every one-third of an FTE increase in total educational technology staff (non-student technology assistant), the likelihood that faculty agree that their institution supports technology integration increases by 18%.

## Community Voices on Leveraging Educational Technology Opportunities

These findings suggest that while faculty and student attitudes about technology integration into teaching and learning are generally positive, there is room to cultivate even more positive perspectives in this area. To optimize technology in teaching and learning (no. 2 on the EDUCAUSE Top 10 IT Issues list in 2015), institutions will need to align their training and service offerings (which are prolific) with faculty professional development needs. ECAR asked institutions that participated in the 2014 faculty study to explain why their faculty were significantly inclined to agree that “My institution generally assists faculty with the integration of technology.”



Hank Radda, University Provost and the Academic Leadership Team

—Grand Canyon University (MA I; Master’s Colleges and Universities organization with 20,106 FTE)

**At GCU, leadership is intentional about promoting a culture of group collaboration and creative**

**thought when setting priorities and making decisions for the university.** Management works hard at making sure a large group with key constituents across the institution is involved in the brainstorming and decision-making process, including making sure everyone has an understanding of the how and why behind initiatives. From a faculty perspective, this collaborative environment has provided faculty with opportunities to share opinions, innovations, and best practices in the classroom that lead to better-informed group decision making.

**GCU encourages faculty to experiment with and integrate technology into their pedagogical practices in the classroom.** Through ongoing training and development workshops, faculty are introduced to technological approaches that emphasize best practices in online, traditional, and blended-model teaching and learning environments. **Traditional campus faculty receive training and continual enrichment opportunities on how to embed technologies** such as SMART Podium, Turnitin, and Poll Everywhere in their classrooms, while online faculty are trained and encouraged to use video and whiteboard technology to improve their pedagogical approach in the nontraditional classroom.

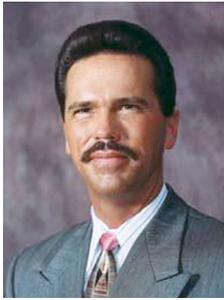
“I have found that my instructors who use technology to communicate with us and teach us are more accessible to the students. For example, we can use online collaboration tools to help each other and get feedback from our teachers. In a normal face-to-face class, I would not be able to speak to other students. Having taken so many online classes has really helped me to further achieve conceptual understanding.”

—Anonymous ECAR 2014 student survey respondent

Two semesters ago a few of our on-ground faculty began piloting a blended learning format that combines elements from the online and traditional classroom. In this pilot, faculty are eliminating one day of face-to-face instruction per week and replacing that day with asynchronous learning activities using the LMS. The pilot has been well received by instructors and has expanded to include more courses across multiple colleges within the university. **Deans, faculty, and leadership meet regularly to share best practices in their classrooms that foster student engagement and improve the pedagogical approach.** Some participating faculty are collecting data and intend to publish and share their research with practitioners within their field of study.

**Leadership also encourages technology for pedagogical and student communication purposes.** One particular product that has been widely accepted and utilized by full-time online faculty is Remind, a one-directional texting technology that allows instructors to text reminders, tips, and announcements directly to their students' mobile phones.

In an effort to reach all GCU faculty, **workshops are offered in multiple learning modalities, which include online, asynchronous facilitated workshops; face-to-face synchronous workshops; and on-demand, self-paced, fully online workshops. Faculty are evaluated annually on their application of classroom assessment techniques.** The online and traditional faculty have become increasingly creative in their use of technology to assess student learning in the traditional and online classroom. An added incentive for faculty piloting technology in the classroom is the **opportunity to collect data on the impact this technological approach is having in their classroom and submit the data for publishing or conference proposals.** Additionally, faculty are recognized and applauded for their efforts through the Annual Online Teaching Showcase, hosted by GCU's Center for Integration of Research and Teaching.



Peter Heineman, Director, Quality Assurance Programs; Mary Dobransky, Dean, College of Science and Technology; Clif Mason, Dean, College of Arts and Sciences; and Pamela Imperato, Dean, College of Business

—Bellevue University (a privately controlled BUS; Schools of Business and Management organization with 7,162 FTE)



Bellevue University has developed a **variety of interwoven practices to integrate information technology into our curriculum and to foster a culture supportive of collaboration** among our faculty, teaching and learning specialists, and instructional designers situated in various units across our university.

This collaboration occurs at the onset of development in every academic program at the university.



**Partnering with our Center for Academic Excellence, faculty develop and map the objectives of a program.** Summative performance-based assignments—and how theoretical concepts will be introduced, reinforced, and mastered within a student’s academic program—are architected up front, prior to the design of individual courses. **From program ideation to the design and delivery of individual courses within a program, faculty partner with our Center for Learning Innovation to ensure that course design features support and enhance a student’s ability to reach program and course goals.**



**In addition to providing an infrastructure supportive of innovation, Bellevue believes that an investment in its full-time and adjunct faculty is vital.** Monthly faculty workshops developed and conducted by faculty, the

Center for Academic Excellence, and/or the Center for Learning Innovation have been institutionalized into the culture of Bellevue University. These sessions are open to all at the university, allowing for support departments to also share their expertise or better understand the innovative educational practices that can be or are embedded into our educational approach. Our adjunct faculty are welcome to attend these sessions and our biannual Adjunct Faculty Days to hone their skills as educators. **A culture that thinks first of**

**the student experience and those performance-based skills required to be professionally successful—and one receptive to experimentation and respectful of our faculty’s subject matter and instructional expertise—is a hallmark of a creative environment that spurs educational innovation.**



Maureen McCreadie, Associate Provost, Learning Resources; Andrew Lawlor, Vice President, Information Technology Services and CIO; Jacqueline Fritz, Learning Technologies Faculty Liaison

—Bucks County Community College (a publicly controlled AA; Associate’s Colleges organization with 5,669 FTE)

**At Bucks County Community College, we have a long-standing commitment to taking the fear out of integrating technology into teaching and learning by providing support for faculty.** From quick how-to questions and online tutorials to one-on-one guidance through instructional design, conveniently scheduled workshops, required professional development for faculty scheduled to teach online, and compensated professional development institutes on topics such as digital media literacy or solutions for assuring accessibility, **we offer a range of options and safety nets that support faculty in feeling confident as they risk new approaches and tools.**



Debbie Schroeder, Assistant Vice Chancellor of Information Technology Services

—University of Nebraska at Kearney (a publicly controlled MA I; Master’s Colleges and Universities I organization with 5,857 FTE)

**At the University of Nebraska at Kearney we know our students expect technology to be integral to and integrated with their educational experience.**

**Support starts at the top.** Our chancellor and our senior vice chancellor for academic affairs believe technology has the power to transform the way we teach and learn. They are executive sponsors of our successful Mobile Learning Initiative, which started three years ago to encourage faculty to incorporate technology into the teaching and learning environment.

**Over 120 faculty have completed two days of intensive training to learn to teach courses in which an iPad is assigned to every student. Our instructional technology specialists offer multiple training sessions every week on lecture capture, desktop video conferencing, Blackboard tools, the use of mobile devices in the classroom, and a variety of multimedia solutions and applications. Faculty can also work directly with an instructional technologist and receive personal and discipline-specific assistance. Our network specialists make sure that our wireless network supports the thousands of devices used by our students, faculty, and staff.**

Needless to say, we are pleased that 82% of our faculty survey respondents agreed or strongly agreed that they receive assistance with the integration of information technology. We offer opportunities for our faculty to learn and use technology, and we encourage innovation. **Our faculty take advantage of the opportunities, and they are transforming the way we teach and learn.**



### Ken Graetz, Director of Teaching, Learning, and Technology Services

—Winona State University (a publicly controlled MA I; Master's Colleges and Universities organization with 7,918 FTE)

At Winona State, several factors contribute to faculty satisfaction and success with instructional technology. First, our 1:1 eWarrior Digital Life and Learning Program puts **a tablet and laptop in the hands of every student and faculty member, along with core applications and continuous support.** This creates a very stable, predictable environment in which teachers can experiment and innovate. Second, teaching and learning are at the forefront of strategic planning in all divisions of IT. I have never experienced an environment where there is more collaboration across the major functional areas of IT and a sharper focus on the primary mission of higher education. Third, **our Teaching, Learning, and Technology Services group is mature, well supported, active, knowledgeable, approachable, and trusted by faculty.** It includes former educators and media professionals who understand the rigors of academic life and work with faculty where they live and on their terms. Finally, **our faculty know that they work in a supportive environment** where they are not going to be stranded on an island if they decide to try something new. I think all of these things combine to create a rather unique, fertile, and exciting environment at WSU.

## Alignment between Student and Faculty Needs and Institutional Practices

Many faculty think they could be more effective instructors if they were better skilled at integrating certain kinds of technologies into their courses. Figure 6 displays faculty professional development interests in educational technology, along with students' interests in faculty's use of the particular technology *more*, and institutional practices of providing either support or having the technology in place. Faculty and student perspectives are generally aligned when it comes to identifying training/support needs for incorporating a particular educational technology into the teaching and learning environment. Institutional practices, however, don't always align with what faculty say they want and what students say faculty need. It is important for faculty to be aware of the areas in which educational technology services, training, and support are widely available (e.g., in-class use of students' personal devices and use of the LMS). It is also important to make sure that the training and support offered are meaningful to faculty.<sup>10</sup> For areas in which educational technology support is less widely available (e.g., simulations and gaming, free web-based content, and e-texts), understanding student and faculty interest in particular educational technologies can help institutions prioritize whether, how much, and when to invest in broader deployment of services, training, and support.

The majority of IT leaders (78%) recognize that faculty have a growing interest in incorporating technology into teaching.

—ECAR *E-Learning Study*, 2013

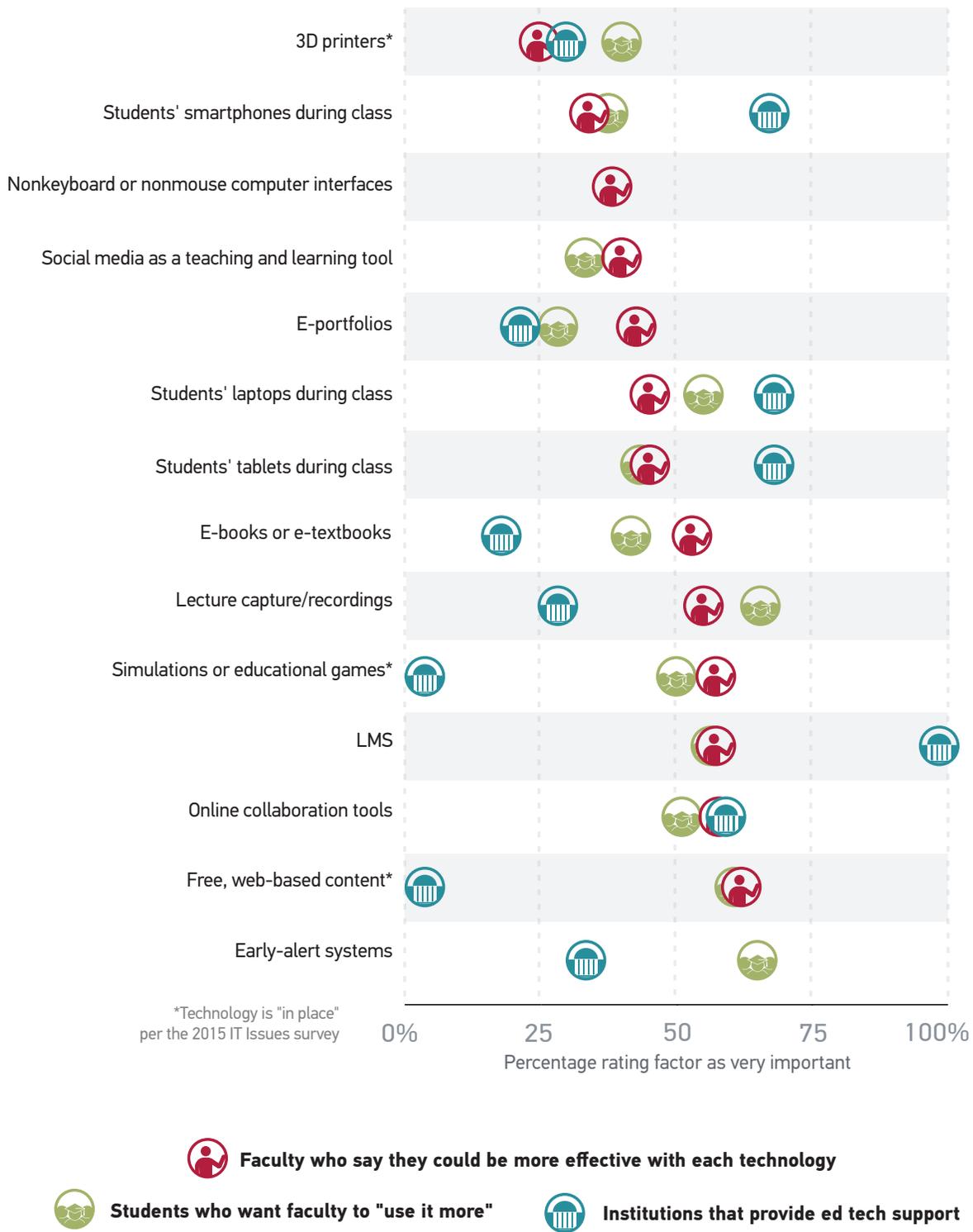
**68%**

of institutions offer faculty training on incorporating students' BYOD in class.

**41%**

of institutions encourage faculty to incorporate students' BYOD in class.

—EDUCAUSE *Core Data Service*, 2014



**Figure 6. Professional development interests and opportunities for integrating various technologies into courses**

We asked faculty an open-ended question so that they could share one point of interest, concern, or advice about institutional support for faculty when it comes to technology. The most frequent responses were about needing more or better-maintained equipment; assistance with software, service updates, and purchases; and time and resources dedicated for training and development. Faculty were not demanding innovative or disruptive technologies to improve their roles; they have basic technology needs that can be met by improving current equipment, systems, and services.

## The Potential of Mobile Devices for Teaching and Learning

The 2015 NMC *Horizon Report* stated that the time for BYOD in higher education is now—the time-to-adoption horizon is one year or less.<sup>11</sup> The report points out that BYOD is not new; in fact, the term was coined by Intel in 2009, just two years after the release of the first iPhone. ECAR published a comprehensive report about BYOD in higher education in 2013, and that information is even more relevant today, for several reasons: expanding diversity of devices, continued proliferation of the devices themselves, and advancements in the apps/tools available for these devices.<sup>12</sup> While half of faculty believe that mobile devices have the potential to enhance learning (52%), balancing in-class mobile device use with the potential distractions mobile devices bring to the classroom is a key issue to address in higher education (67% of faculty think the devices are distracting).

Laptop ownership is pervasive (90% in 2014) for undergraduates, and longitudinal ECAR student study data reveal an upward trend in ownership of smartphones (86% in 2014, up from 76% in 2013) and tablets (47% in 2014, up from 31% in 2013). Colleges and universities are updating and upgrading IT infrastructure to support this new and continued proliferation of Internet-capable mobile devices on campus to prepare for the future.<sup>13</sup> Students have the tools—mobile devices and apps—and institutions have the infrastructure—dense and ubiquitous Wi-Fi and/or cellular coverage. Yet ECAR found that only about one in three faculty (30%) create assignments that take advantage of mobile technologies. Many faculty (52%) ban or discourage the use of smartphones in class; although faculty are less opposed to students using tablets, few encourage or require these devices in their classes (31% and 39%, respectively; see figure 7). Regardless of in-class policies, the majority of students report using these devices anyway—for class-related, not personal, purposes (74% of students who own smartphones, 66% of students who own tablets, and 62% of students who own laptops say they've used these devices in class) (figure 8).

18%

of institutional leaders say incorporation of mobile devices in teaching and learning was in place in 2014.

—*Higher Education's Top 10 Strategic Technologies, 2015*

Institutional practices for offering BYOD training or encouraging faculty to incorporate BYOD in class did not result in any significant differences in faculty interest in professional development in BYOD or students saying they want faculty to do more with BYOD. Despite the near ubiquity of student laptops and smartphones, in-class BYOD is still an emerging practice.

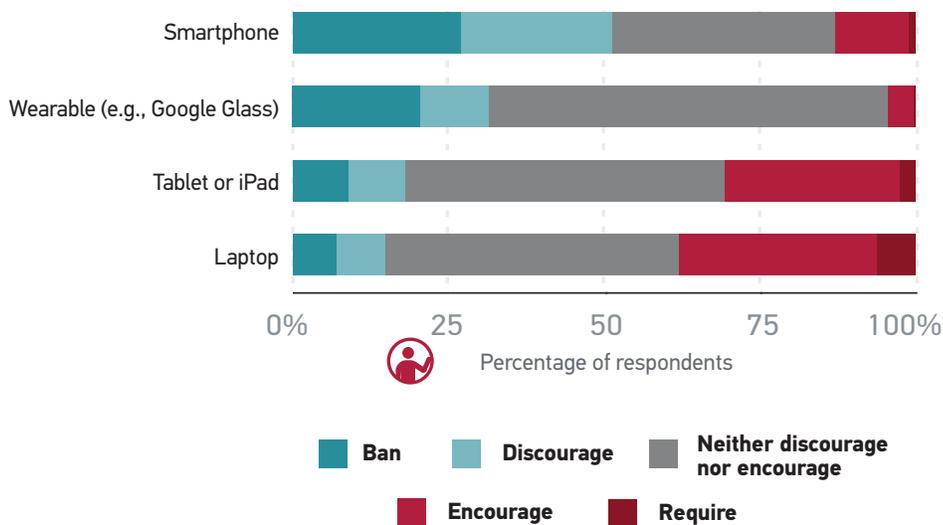


Figure 7. Faculty's in-class BYOD policies and practices

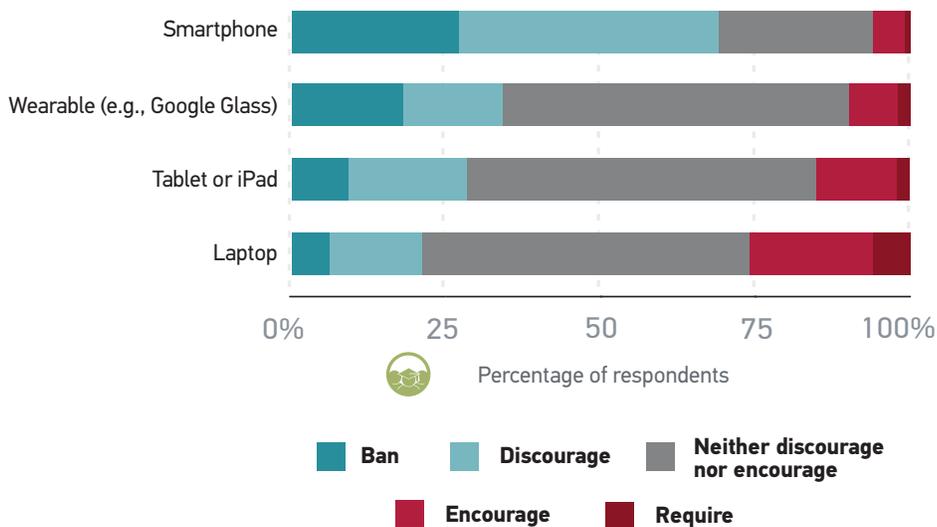


Figure 8. Students' in-class BYOD experiences

74%

of students who own smartphones, 66% of students who own tablets, and 62% of students who own laptops say they've used these devices in class.

—ECAR Student Study, 2014

According to the 2013 ECAR study on BYOD, what excites IT leaders most about the BYOD trend is not potential cost savings or increased employee productivity but the opportunities for an expanded and diversified teaching and learning environment.<sup>14</sup> Leveraging the power of BYOD in teaching and learning has been more about promise and exemplary use-case scenarios than about scalable practice. Institutions are addressing the need to facilitate in-class BYOD, with 68% reporting that they offer faculty training on incorporating students' use of mobile devices during class and 41% reporting that they encourage faculty to incorporate in-class use of mobile devices. Despite these efforts, only 18% of institutional leaders said incorporation of mobile devices in teaching and learning was in place in 2014.<sup>15</sup> Given the gap between opportunity and practice here, we are likely still a few years away from seeing mainstream use of students' devices as tools for creative, engaging, and interactive learning in class. In the meantime, educators, academic leaders, CIOs, and IT professionals can learn a lot from listening to students when they say they just want to be able to look up information in class, capture static images of in-class activities and resources, and record lectures. These are rather pedestrian uses of mobile technology—safe and easy ways to welcome mobile technologies into the classroom.



## How Might Faculty Use Mobile Devices in Classes to Engage Learners?

*ECAR asked Scott Hamm, Director, Online Education, Hardin-Simmons University (a privately controlled MA I; Master's Colleges and Universities organization with 2,033 FTE) to share his experienced insight about this matter.*

A conceptual iPandora's box has been activated. Despite best intentions, banning the use of mobility in class is not working. If students are using these tools to augment their learning outside the classroom, then the effective integration and use of mobility in the teaching/learning process will have benefits inside and outside the formal class time.

An intentional approach for faculty can engage students, decrease their own angst, and earn the credibility to maintain times when "devices off" is the best approach. Legacy classroom practices can be accomplished without a steep learning curve for faculty while providing a way for students to engage with the devices. Live polling allows faculty to check comprehension and allows students a low-stakes self-assessment of their own understanding. Results can be projected and are displayed live as students participate. Socrative is an app that provides formative assessments during class. Both faculty and students can create quizzes, learning games, and short-answer responses to instantly assess learning. As with polling, responses can be anonymous, and all assessments can be saved for future use. Questionmark is another quizzing function that allows for in-class use and the embedding of quizzes into an LMS, a blog, a website, etc.

Tweeting to a class hashtag extends engagement opportunities and incorporates social media. Live tweeting can be used by students and teachers to create backchannel communication that engages the subject matter. Faculty can use the live tweet to harvest student questions, ask for responses to ascertain comprehension levels, and allow groups to take turns monitoring the Twitter feed during class. These groups or individuals can take on a role similar to what has been coined "Google jockeying."

Google jockeying allows one person in the class to be the fact checker, either searching on a projection screen or waiting until the teacher cues him/her to provide an update to terms and searches. This engages a member or a small group to live-search during class to practice researching and potentially add to the knowledge base of the presenter.

Mobility additionally affords ways to extend the classroom. Instagram can allow students to add to the class by submitting artifacts before or after a class that allows for a visual representation of the content. Pictures can be displayed while students are entering class, resulting in an added learning experience.

As new technologies emerge, so do new opportunities. Live streaming applications such as Meerkat and Periscope offer exciting possibilities for learning. Live streaming using the mobile device camera allows faculty members to live broadcast themselves from a museum or an archeological dig, or to live interview back to a large lecture class while responding to answers being tweeted by engaged students.

The NMC prediction that BYOD is a near-term technological issue for higher education suggests that BYOD in the classroom might be hitting an inflection point, a time for change, that will help it move beyond what Gartner calls the “trough of disillusionment” and onto the “slope of enlightenment.”<sup>16</sup> Academic and scholarly literature about rethinking pedagogy in the digital age, tech-savvy teaching, and “schools going mobile” is proliferating as researchers begin to test what works and what doesn’t work for BYOD to enhance learning. The crux of BYOD is really about the “Y”—*your*. The consumerization of technology allows students (and their instructors) to create their own personal computing environments, which include devices, software, apps, and cloud-based services. “The BYOD movement is enabling students to learn [and instructors to teach] using technology with which they are already familiar and comfortable.”<sup>17</sup> So BYOD for teaching and learning is not about finding a single app, tool, platform, etc., that could be used in the classroom; it is really about creating a personalized experience for the user. “For higher education institutions, often BYOD is less about the devices and more about the personalized content that users have loaded on them.”<sup>18</sup>

### **Motivating Faculty to Integrate Technology into Teaching and Learning Activities**

The top motivator for faculty to integrate more or better technology into their teaching practices or curriculum is evidence that doing so would benefit students (figure 9). Faculty want to see technology work, and they want evidence that it is making an impact on student learning. Only one of the top 5 motivators, “release time to design/redesign my course,” is related to compensation.<sup>19</sup> This could, however, be attributed to faculty’s desire for institutions to value the time needed to develop new materials and approaches that integrate IT into their courses. One in three institutions (33%) reported in CDS that they provide release time to faculty to design/redesign courses. There are no meaningful differences in faculty motivation to integrate technology into teaching and learning activities by institutional type.

BYOD for teaching and learning is not about finding a single app, tool, platform, etc., that could be used in the classroom; it is really about creating a personalized experience for the user.

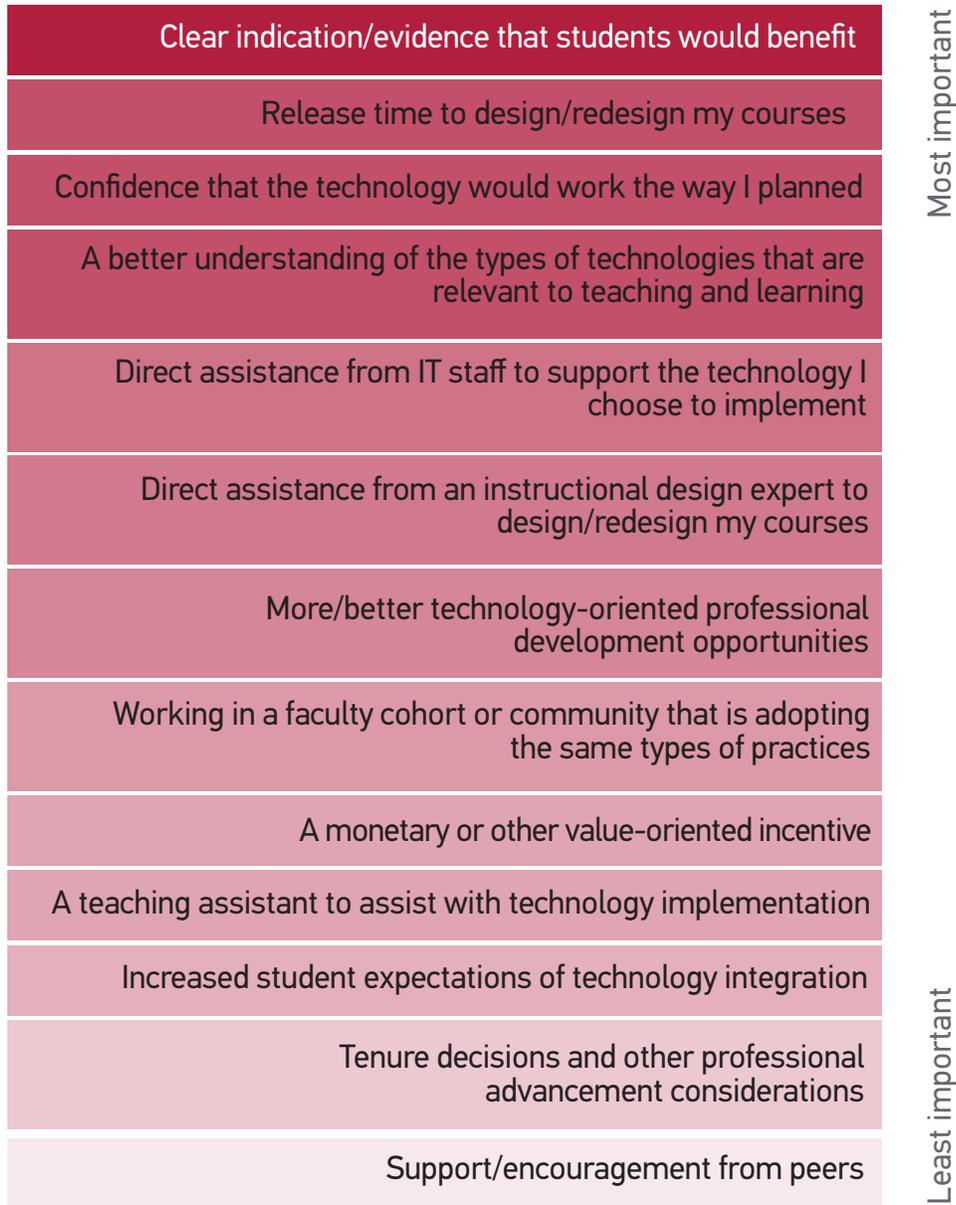
**71%**

of institutions offer special grants or awards for innovative use of instructional technology.

**90%**

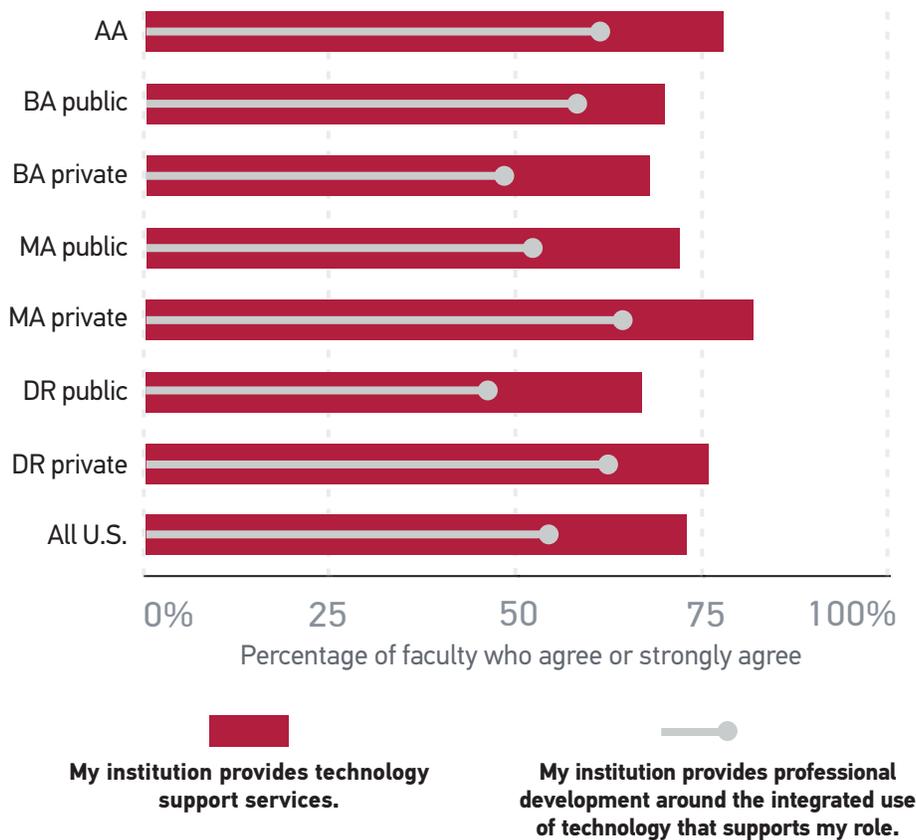
of institutions offer activities and opportunities for faculty to showcase their work (e.g., tech fairs, brown-bag lunches, communities of practice, learning communities).

—EDUCAUSE Core Data Service, 2014



**Figure 9. Relative importance of factors that motivate faculty to integrate technology into teaching and curriculum**

Just over half of all faculty (54%) rate professional development experiences provided by their institution to integrate technology into their courses as good or excellent, and almost three in four (73%) rate institutional technology support (e.g., desktop support, classroom technology support, course media production support) as good or excellent. Figure 10 summarizes faculty professional development and support services experiences by institution type.



**Figure 10. Faculty experiences with professional development and technology support, by institution type**

Faculty perceptions of central IT in the area of faculty technology support are strongest when central IT supports a culture of innovation. Two activities—providing special grants or awards for innovative use of instructional technology and activities, and creating opportunities for faculty to showcase their work—were related to higher faculty ratings of their technology-focused professional development opportunities. Academic units have the strongest positive impact on faculty perceptions in the area of training strategies—both group and individualized technology training. Administrative units seem most effective (according to faculty) at activities such as providing student technology assistants to help faculty use technology.



Finding proof or definitive evidence that students will benefit when institutions integrate technology into teaching and the curriculum is a tricky endeavor. The EDUCAUSE Learning Initiative has a “Seeking Evidence of Impact” program that supports practices that enable institutions to measure impacts, produce data, and provide a richer, evidence-based picture of innovative teaching and learning programs. For more information visit <http://www.educause.edu/eli/programs/seeking-evidence-impact>.

Central IT's technology support and professional development ratings are both more likely to improve with increased central IT educational technology spending, even after adjusting for institution type. Institutions spending in the top quartile received good/excellent ratings for their technology support from 73% of faculty, while those in the third and second quartiles received only 70% and 63%, respectively. Institutions in the lowest quartile of educational technology spending or staffing, including those with no central IT staffing/spending in educational technology, likely employ different models of support. These institutions are probably spending/staffing for educational technology but in a distributed fashion that is not reported through CDS. Hence, it is difficult to compare these institutions with those having a primarily or strongly centralized model for these services. Increased staffing didn't yield higher good/excellent ratings, but the inclusion of student technology workers in the overall educational technology services budget makes drawing a definitive conclusion here tricky.

Central IT's technology support and professional development ratings are both more likely to improve with increased central IT educational technology spending.

## Conclusions and Recommendations

Technology is neither inherently good nor bad. Advocating for more technology use in teaching and learning is ineffectual without the context of *how* it could result in better learning outcomes, *why* it could result in a less effortful teaching or learning experience, and/or *if* it would result in better communication with or engagement of students. These are not easy questions to answer empirically. However, data about institutional investment, student interests, and faculty opinions regarding their technology experiences and expectations can provide proxy evidence to guide an institution's decisions about optimizing technology in teaching and learning. The key findings of this report and related key questions may help catalyze local conversations about helping faculty integrate technology into their teaching and improving the use of technology to enhance student experiences and outcomes.

**Central IT plays a significant role in providing educational technology support services.** This is especially true for services that scale across an institution; the responsibility for more specialized or personalized services may be shared between central IT and another unit, or those services might be offered exclusively by an administrative or academic unit. Supporting educational technology services includes providing (or providing access to) the technologies themselves as well as the pedagogical training necessary to effectively use those technologies. There is no single “right way” to offer educational technology support services, but each institution should assess which unit is best positioned to have the management responsibilities for each service on the basis of leadership, funding, staffing, and institutional culture.

- Determine whether the assignment of educational technology support services to a unit is based on strategy (i.e., by design) or opportunity (i.e., by default, habit, or circumstance) and work to match services with the appropriate management unit on the basis of leadership, funding, staffing, and institutional culture.
- Participate in establishment surveys (e.g., via the EDUCAUSE CDS) to compare your institution's educational technology support practices with those of your peer institutions or those with the most educational technology maturity.

**Faculty and students have similar perceptions of their own technology savviness,** thus challenging the stereotype that students are advanced technology consumers and faculty are technology detractors. We still find gaps between faculty use of technology and students' expectations of technology use, however, which means that higher education needs to get better at aligning technology (both BYOD technology and institutionally provided technology) with pedagogy.

- Measure faculty and student technology experiences and expectations (e.g., via the ECAR student study and faculty study) to assess the gaps between these two populations.
- Offer technology training to faculty that is grounded in good pedagogy first and how to use the technology second.

**Students are more positive about their instructors' integrated use of technology at institutions that provide support for faculty to use the technologies they (*the faculty themselves*) choose to implement.** While most institutions say they do support faculty in using the technology they choose, there could be great diversity in the level of support different institutions offer to faculty, ranging from the basics such as loading specialized software onto a computer to helping faculty experiment with a new technology tool.

- Evaluate the kinds (and levels) of support your institution offers faculty with regard to helping them implement technologies of their choice. Use the gaps in support services identified in this assessment to build out more effective faculty support and professional development opportunities.
- Assess the extent to which the institution is meeting faculty needs for technology experimentation and integration through direct inquiry (e.g., via the ECAR faculty study) and view those results in relation to institutional priorities, the achievements of peers, or internal self-improvement benchmarks.

**Some technology support services were associated with higher levels of faculty agreement about their institution's assistance with technology integration.**

- The six educational technology support services that matter most are:
  - A faculty teaching/excellence center that provides expertise on IT
  - Supported opportunities for faculty to experiment with emerging learning technologies
  - Instructional technologists to assist faculty and instructional designers with integration of IT into teaching and learning
  - Training on incorporating students' use of mobile devices during class
  - Special grants or awards for innovative use of instructional technology
  - A designated instructional technology center available to all faculty
- Align the services above with the IT management unit best positioned to offer the service on the basis of leadership, funding, staffing, and institutional culture.
- Explore opportunities at your institution to grow or mature those services that have the greatest impact on faculty technology integration. Use evidence of faculty and student experiences and expectations (e.g., via the ECAR student study and faculty study) to help prioritize how IT resources are spent to optimize technology in teaching and learning.

**When central IT is responsible for a faculty teaching/excellence center that provides expertise on IT, faculty are more positive about their institution's support for assisting them with integrating technology.** Teaching/excellence centers provide pedagogical and technological support to promote good teaching and learning practices—regardless of the organizational unit responsible for managing the service. Central IT is strongly positioned to scale this service across an institution by providing technology resources and staff with professional expertise (e.g., instructional designers and instructional technologists who are immersed in current and emerging technologies).

- Determine whether your teaching/excellence center is assigned to a unit on the basis of strategy (i.e., by design) or opportunity (i.e., by default, habit, or circumstance) and work to match services with the appropriate management unit on the basis of leadership, funding, staffing, and institutional culture. Because of its scope and scale, central IT may be best positioned to provide the service.
- Ensure that the faculty teaching/excellence center has a core mission to provide both pedagogical and technological support.
- Provide the staff working in these centers with the resources necessary to become immersed in the available and emerging technologies that support innovation and experimentation.
- Staff the center with professional instructional designers and instructional technologists, rather than student workers, to support faculty's technology integration.

**Faculty and student impressions about technology integration are more positive at institutions that provide faculty with individual or group educational technology training.** While this finding is somewhat intuitive, the data that support it can help justify funding and staffing to support training activities for faculty.

- Determine if the current training opportunities for faculty are pervasive, relevant, and diverse enough to meet their training needs and interests (e.g., via the ECAR faculty study).
- Evaluate the efficacy of the campaign to raise faculty awareness of training opportunities; make sure faculty know about the training opportunities.
- Offer formal incentives to faculty to engage in technology training activities.
- Create a plan to regularly evaluate the efficacy or impact of technology use on teaching and learning. Use the evidence collected in this process to build a case for specific technologies that might benefit students through their integration into the teaching/learning process.

**The association between educational technology staffing and student/faculty technology experiences is complicated: Student technology assistants may hinder rather than optimize technology for teaching and learning.** Employment as educational technology assistants can be a great professional development opportunity for students, and it can leverage the more tech-savvy students' skills as an institutional resource. That said, there are also some cautionary considerations when creating student assistant positions to help faculty use technology.

- Revisit the reasons why student technology assistants are employed by the institution; determine whether they supplement or supplant professional IT staff. Assess whether the opportunity for students to gain experience in an entry-level IT job outweighs the possible challenges they pose to faculty optimization of technology.

- Determine whether student assistant positions are a function of proactive or reactive hiring; develop a plan to create a proactive, agile workforce that supports a proactive educational technology support environment.
- Assess the extent to which your faculty are comfortable sharing their technology training needs with students; determine whether those needs are best met by student assistants or by instructional designers. Instructional designers have the training to match pedagogical approaches with technologies, and instructional technologists have the expertise to assist faculty with integrating technology to best match desired learning outcomes.

**Faculty and student perspectives are generally aligned when it comes to identifying training/support needs for incorporating a particular educational technology into the teaching and learning environment.** Institutional practices don't always align with what faculty say they want and what students say faculty need.

- Assess the alignment of current training opportunities with what faculty say they need and with what students say they want their faculty to do (e.g., via the ECAR student study and faculty study).
- Make sure faculty know about training opportunities and that the training activities are meaningful to faculty. Determine if faculty are aware of training opportunities by evaluating the efficacy of campaigns to raise faculty awareness of training opportunities.
- Evaluate faculty trainings to determine if they are rooted in research that shows evidence that using the technology can improve student outcomes.

While half of faculty believe that mobile devices have the potential to enhance learning, **balancing the use of in-class mobile devices against their potential distractions is a key issue to address in higher education.** The majority of students report using these devices anyway—for class-related, not personal, purposes—regardless of formal in-class policies.

- Encourage the use of student devices in class via department-level (or institutional) policies.
- Assess the training opportunities (or advice) for faculty to incorporate assignments/activities into their classes that leverage students' own devices.
- Determine whether the training or support for incorporating students' devices into classes is focused on a single app, tool, or platform or on helping the student create a personalized learning experience. The latter reinforces how students use these devices to enhance other aspects of their lives.

**The top motivator for faculty to integrate more or better technology into their teaching practices or curriculum is evidence that doing so would benefit students.** Faculty want to see technology work, and they want evidence that it is making an impact on student learning.

- Root faculty trainings in research that ties the technology to improved student outcomes.

- Communicate messages about technology’s potential to improve student outcomes to faculty in a way that motivates them to want to try it.
- Offer formal incentives to faculty to engage in technology training activities.
- Curate a portfolio to demonstrate the evidence of the impact of technology-enhanced curricula on student learning.
- Create a targeted approach to professional development (for faculty and for instructional technology staff) that includes matching specific faculty and specific technologies with the intent to integrate technology into coursework.

“Optimizing the use of technology in teaching and learning depends on the ability of the institutional and academic leadership to help faculty develop their digital competency and then to continue to provide learning opportunities to keep their competencies current. Faculty need ongoing digital literacy opportunities that enable them to better understand not only educational technologies but also the social technologies that are affecting their everyday lives and the everyday lives of their students. Those students expect engagement in their instruction [and technology can mediate engagement very powerfully]. Faculty need to understand instructional narrative and the implications of media as part of their technological introduction. This is more than just training on a particular technology. It is, as the saying goes, the difference between giving a man a fish and teaching him how to fish.”<sup>20</sup>

## Methodology

The data for this report came from three EDUCAUSE resources:

- A 2014 ECAR study that collected data about faculty experiences and expectations with technology and included 17,451 U.S. respondents (from 151 institutions) who have used technology for teaching; a subset of 15,160 U.S. respondents (from 133 institutions) is used in this analysis.
- A 2014 ECAR study that collected data about student experiences and expectations with technology and included 75,306 respondents (from 213 institutions); a subset of 10,000 U.S. respondents (from 185 institutions) is used in this analysis.
- The 2014 Core Data Service (CDS), which collected data about finances, staffing, and services from 828 institutions; a subset of institutions that overlap with the student study (118 institutions and 6,262 students) and faculty study (86 institutions and 10,301 faculty) is used in this analysis.

When the faculty study and CDS data or the student study and CDS data were merged, a subset was used for institutions that participated in all the studies contained in the analysis. The list of institutions included in this analysis follows:

Abilene Christian University	Drexel University
Appalachian State University	Eastern Illinois University
Auburn University	Eastern Shore Community College
Ball State University	Elon University
Blue Ridge Community College	Fordham University
Bridgewater State University	Franklin W. Olin College of Engineering
Bucks County Community College	Georgia College & State University
California Polytechnic State University, San Luis Obispo	Georgia Gwinnett College
California State Polytechnic University, Pomona	Georgia Southern University
California State University, Fresno	Germanna Community College
California State University, Sacramento	Hamilton College
Catawba College	Harvey Mudd College
Central Connecticut State University	Hawaii Pacific University
Central Virginia Community College	Illinois Central College
Clemson University	Ithaca College
College of Saint Benedict/Saint John's University	J. Sargeant Reynolds Community College
College of Wooster	John Tyler Community College
Collin County Community College District	Juniata College
Cornell University	Keene State College
Dabney S. Lancaster Community College	Kent State University
Danville Community College	Lipscomb University
	Lord Fairfax Community College
	Louisiana State University

Lourdes University	Thomas Nelson Community College
Loyola Marymount University	Tidewater Community College
Lyndon State College	Truman State University
Messiah College	Tufts University
Michigan State University	University of Arkansas
Montgomery County Community College	University of Cincinnati
Mountain Empire Community College	University of Florida
New Jersey Institute of Technology	University of Houston
New River Community College	University of Maryland
Northern Virginia Community College	University of Massachusetts Dartmouth
Northwestern University	University of Michigan–Ann Arbor
Oakland University	University of Minnesota
Oregon State University	University of Minnesota–Crookston
Paradise Valley Community College	University of Minnesota–Duluth
Patrick Henry Community College	University of Mississippi
Paul D. Camp Community College	University of Montana
Pennsylvania College of Technology	University of Nebraska at Omaha
Philadelphia University	University of New Hampshire
Phoenix College	University of New Mexico
Piedmont Virginia Community College	University of Northern Iowa
Pima County Community College District	University of Oregon
Purdue University	University of Texas–Pan American
Rappahannock Community College	University of Washington
Rio Salado College	University of West Georgia
Saint Michael's College	University of Wisconsin–Madison
School of the Art Institute of Chicago	University of Wisconsin–Milwaukee
Scottsdale Community College	University of Wisconsin–Superior
Seton Hall University	Virginia Commonwealth University
South Dakota State University	Virginia Highlands Community College
Southern Methodist University	Virginia Western Community College
Southside Virginia Community College	Washington University in St. Louis
Southwest Virginia Community College	Wayne State College
St. Norbert College	Wayne State University
Tarleton State University	West Virginia University
The Ohio State University	Western Carolina University
The Pennsylvania State University	Western Washington University
The University of Arizona	Winona State University
The University of Memphis	Wytheville Community College
The University of South Dakota	

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## Notes

1. See the [ELI Content Anchors](#).
2. EDUCAUSE Learning Initiative (ELI) annual meeting (February 10, 2015) and SXSWedu (March 10, 2015).
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); and Eden Dahlstrom and Jacqueline Bichsel, *ECAR Study of Undergraduate Students and Information Technology, 2014*, research report (Louisville, CO: ECAR, October 2014).
4. The semantic differential scales reveal that faculty are generally sophisticated and engaged with IT, averaging significantly above the neutral position (50) on the scales.
5. We cannot directly identify which faculty respondents utilized a particular educational technology service or training opportunity offered by an institution; we can only identify that an institution offered a particular service or training opportunity. We cannot directly identify which student respondents took classes from faculty who benefited from an institutionally provided educational technology service or training opportunity; we can only identify that the institution offered the service or training to faculty.
6. Although the availability of these support services had a positive influence on faculty perceptions, we didn't find a corresponding positive result in student perceptions of faculty tech savviness. In fact, for each support service that was provided, students perceived fewer instructors as having effective or adequate technology skills. Perhaps this indicates that institutions are providing these services when they are noting they are most needed. Or faculty who say their institution provides such support are the ones more likely to have used (and thus needed) it. Students, on the other hand, could only be indirectly exposed to the impact of services provided to instructors; therefore, no effect is found here.
7. "Positive responses" refers to higher percentages of agreement with the statement that an institution assists faculty with integration of information technology.
8. The educational technology spending metric used here was central IT ed tech services spending as a percentage of total central IT spending, from the EDUCAUSE CDS.
9. When student technology assistants are omitted from the educational technology staffing metric, increased ed tech staffing (as a percentage of central IT staffing) continues to exert a negative influence on *student* perception of faculty's use of and skills with technology. When institutions with zero ed tech staffing are omitted, the significance disappears in the case of technology use and becomes marginal in the case of skills. The effect on *faculty* perception goes from insignificant to positive and highly significant when student workers are excluded.
10. Investigation about which educational service functions have the greatest impact on faculty and student perceptions of technology did not yield any meaningful findings. Specific investigation about classroom technology support for faculty was not fruitful either. Although there were some significant differences, those differences didn't have practical importance.
11. L. Johnson et al., *NMC Horizon Report: 2015 Higher Education Edition* (Austin, TX: The New Media Consortium, 2015).

12. Eden Dahlstrom and Stephen diFilipo, *The Consumerization of Technology and the Bring-Your-Own Everything (BYOE) Era of Higher Education*, research report (Louisville, CO: ECAR, March 25, 2013), available from the [ECAR BYOD Research Hub](#).
13. Ibid.
14. Ibid.
15. Susan Grajek and Betsy Reinitz, *Higher Education's Top-Ten Strategic Technologies for 2015*, research report (Louisville, CO: ECAR, January 23, 2015), available from the [ECAR Strategic Technologies Hub](#).
16. Johnson et al., *NMC Horizon Report*; Gartner's 2014 Hype Cycle for Education showed "BYOD Strategy" sliding into the trough of disillusionment.
17. Johnson et al., *NMC Horizon Report*.
18. Ibid.
19. Dahlstrom and Brooks, *ECAR Study of Faculty*.
20. Susan Grajek and the 2014–2015 EDUCAUSE IT Issues Panel, "[Top 10 IT Issues, 2015: Inflection Point](#)," *EDUCAUSE Review* 50, no. 1 (January/February 2015).