

Trend Watch 2017: Which IT Trends Is Higher Education Responding To?



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Citation

Alexander, Bryan, Susan Grajek, and Joanna Lyn Grama. *Trend Watch 2017: Which IT Trends Is Higher Education Responding To?* Research report. Louisville, CO: ECAR, September 2017.

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Introduction

How is higher education information technology changing? What forces are reshaping the work of campus IT?

The past year has seen the advent of new technologies and surprising practices. Self-driving cars hit the roads. Pokemon Go swept the world, sending millions of players into the real world to chase down digital objects via augmented reality. A massive hack attack used Internet of Things devices to shut down significant chunks of North America's Internet presence. A growing chorus of experts argue that Russia used digital technology to skew the 2016 U.S. presidential election. Adobe Flash has been sent to hospice care, and automation is threatening to overhaul the world. Blockchain technology keeps rattling from project to project, its inventor still unknown.

Education has been through some changes as well. Students increasingly study online and internationally. The for-profit sector continues to slide downhill, as does total enrollment in American higher education.¹ Open education grew, as did the number of classes that use learning management systems. Americans demonstrate increasingly partisan attitudes toward higher education, possibly exacerbated by recent policy moves.²

Such is the context for campus information technology and also for the Trend Watch 2017. This report identifies major trends reshaping campus IT, organized thematically and by their prevalence in the opinions of campus leaders. Many of these change drivers are technological, from mobile devices to emerging standards. Others stem from such institutional priorities as inclusion, sustainability, and, above all, helping students succeed. Each represents a force nudging IT departments in a certain way; taken together, the trends offer a map to the transformation of education and technology.

This Trend Watch 2017 report serves as a companion to the popular EDUCAUSE top 10 strategic technologies in higher education report.³ Together with the EDUCAUSE yearly analysis of the top 10 IT issues,⁴ these three resources can provide more complete and nuanced context and insight to guide IT strategy.

Summary

- The three trends exerting the most influence on higher education's IT strategy are (1) continued complexity of security threats, (2) student success focus/imperatives, and (3) data-driven decision making. Each of these trends is influential at 61% or more of colleges and universities surveyed.
- Nine trends are taking hold, meaning they were influential in 41–60% of institutions: (1) increasing complexity of technology, architecture, data; (2) IT as an agent of institutional transformation and innovation; (3) compliance environment; (4) institution-wide data management and integrations; (5) campus safety; (6) business process redesign; (7) diversity and inclusion; (8) changing enterprise system architectures, integrations, and workflows; and (9) incorporating risk management approaches into IT strategy and service delivery.
- Fifteen trends, influential at 21–40% of institutions, may be worth understanding and monitoring with respect to emerging IT strategy.
- Nine trends had limited impact, meaning they were influential in 20% or fewer institutions: (1) institutional international strategies (international campuses and partnerships, internationalization of student body, etc.); (2) cross-institutional and international research collaborations; (3) DevOps movement to bring development and operations staff together to better manage an end-to-end view of an application or IT service; (4) green technology/sustainability; (5) bimodal IT (managing two separate IT delivery modes, one focused on stability and the other on agility); (6) platform-agnostic vulnerabilities; (7) adaptive learning; (8) the Internet of Things; and (9) access for all kinds of endpoints and objects, including RFID- and GPS-based devices. The Internet of Things and access for all kinds of endpoints and objects were also on last year's list of trends with limited impact.

Covered in This Report

This is the third year that EDUCAUSE has tracked the influence of major trends on the IT strategy of colleges and universities. Our research has moved from tracking 15 IT trends (2015), to 29 (2016), to 36 in 2017. The 2017 trends apply across a number of different IT domains.⁵

Access for all kinds of endpoints and objects, including RFID- and GPS-based devices. Internet connectivity is already built into many mobile devices, most notably cell phones and tablets. The Internet of Things is bringing even more embedded computing devices to our networks, including RFID- and GPS-based devices, with implications for data management strategies that will be needed to handle the increased volume of data from a complex mix of disparate devices. Not only do institutions need to consider data management and integration strategies, but they also need to ensure that their networks and their service desks are adequately provisioned to support this large variety of devices and that their information security policies and practices evolve to reflect this increase in volume and types of data.

Adaptive learning. Adaptive learning is typically made possible in digital or technologically mediated environments, although it can also be applied to face-to-face learning environments. In adaptive learning models, when a learner interacts with instructional material, the software modifies the content and method according to the student's learning needs. In this way, adaptive learning provides learners with individualized instruction and, in some cases, improved learning outcomes. A unique feature of adaptive learning is that with some software applications it has the ability to analyze the learning history of the individual using it and provide interactive adjustments based on the student's understanding and ability to learn.

Agile approaches to change. Agile software development calls for adaptive planning, continuous improvement, and rapid and flexible response to change. These concepts can also be applied to change management in general. With the rapid pace of technological advances, the decreasing ability of IT shops to control their users' technology ecosystems, and leadership demands for increased accountability, IT strategies that take an agile approach to change management are critical. The software design strategies of flexibility and continuous improvement are finding their way into efforts related to strategic planning, desktop management, IT governance, and infrastructure planning. In addition, institutions that are working to develop a culture of innovation may find that agile approaches increase cost-effectiveness.

Bimodal IT (managing two separate IT delivery modes, one focused on stability and the other on agility). This trend attempts to resolve two separate and sometimes competing IT service delivery modes. The first mode can be

thought of as traditional IT service delivery with a focus on stable operation. The second mode is considered agile or emergent, with a focus on providing IT services in a way that emphasizes speed and innovation. The basic premise of bimodal IT is that both types of service delivery are needed for IT operations to create value for the underlying institution.⁶

Blending of roles and blurring of boundaries between IT and academic/administrative areas. This trend is in evidence across all dimensions that involve the application of IT. Discussions around the issue of next-generation enterprise IT have suggested new, more integrative roles and skills for the CIO and the IT organization, such as the ability to network “throughout the institution and the higher education ecosystem” and to “integrate a myriad of ‘micro best-of-breed’ solutions ... in very tailored ways.” In parallel with this, on the teaching and learning side, almost all strategic discussions around academic transformation take as a starting point the need to integrate a variety of campus organizations to further the teaching and learning mission. Entailed in this blending and blurring of roles are new job titles, new governance models, new skill sets, and new demands for professional development.

Business process redesign. Examining and redesigning work processes through business process management methods can uncover opportunities for greater efficiency, possibly allowing for cost savings or reallocation of resources. For example, business process improvement can decrease the need for customization of enterprise systems and increase alignment between business processes and institutional mission. A move to the cloud can be a catalyst for examining business processes in this way. Because processes tend to span functional unit boundaries, strategies in this area are most successful when they include multiple units at an institution. Business process is more than simply workflow; it encompasses workflow design, systems capabilities, motivation, human resources, policies, rules, funding, and other resources. All should be considered in a business process redesign strategy.

Campus safety. The safety and security of campus students, faculty, staff, and visitors are priorities for higher education institutions. Institutions regularly evaluate their campus operations to strengthen and improve them in order to provide a safe, secure, and welcoming environment. Similarly, the security of campus resources, including IT resources and data, is a concern. Institutions must regularly review and improve their IT operations to ensure the security of their most important IT system and data resources.

Changing enterprise system architectures, integrations, and workflows. The many facets of higher education require colleges and universities to run a large set of enterprise-wide computing systems. Options for these computing systems are expanding and becoming more specialized. In addition, the sourcing of those systems is evolving. Whereas IT once ran all enterprise systems on premises,

many IT units now choose cloud options, with the result being a mix of different systems from different vendors, some on premises and some in the cloud. These changes require IT to focus on system architecture, integrations, and workflows to ensure adequate interconnection between systems and data, enabling many different computer systems to effectively share information, automate data-sharing workflows, and efficiently support task workflows for students, faculty, and staff.

Changing faculty roles (focus on advising and student success, growth in adjuncts, etc.). Prompted by sociological, technological, and economic forces, the role of the faculty member in higher education has significantly transformed over the past 20 years. New instructional models and the innovative use of technology have resulted in faculty serving as coaches, software developers, advisors, and instructional leads to sizable cohorts of adjunct faculty. Team-developed courses and demands for increased access to education that can be delivered in various ways have led to an increased focus on the quality of instruction and the rise of the instructional design profession. In his paper on the unbundling of the faculty role, Vernon Smith points to the disaggregation of faculty work to include teaching, course design, assessment, and advising.⁷ The shift of most faculty from tenure tracks to adjunct status makes support more complex, as part-time faculty often work at multiple institutions and lack a significant on-campus presence.⁸ The faculty transformation continues, as an evolving competitive workplace and rising higher education costs place new demands on the relevance of higher education.

Changing vendor–institution relationships (bypassing IT to work directly with business-area leaders). As cloud-based services become increasingly common, individual departments often negotiate directly with vendors and bypass IT departments to select and purchase technology-related services. This practice makes it difficult for IT staff to maintain standards for architecture and integration, and it complicates concerns about information security, compliance, privacy, data management, and data governance. IT departments are responding in part by developing expertise in relationship management skills, allowing IT staff to communicate better with both campus stakeholders and the vendor community.

Changing vendor–institution relationships (moving from a transactional to a strategic relationship). Next-generation enterprise IT is characterized by a shift in IT's role from being a technology provider to being a service broker and partner. This shift allows for a different level of conversation between institution and vendor, as IT can broker a strategic conversation between the two, bringing technology investments into closer alignment with institutional mission in the process. In the broker role, IT can ensure that cloud contracts meet institutional needs for data management, security, backup, and more.

Compliance environment. The regulatory environment impacting higher education IT systems and the data contained in those systems can seem labyrinthine. Data elements in many IT systems may be protected by a number of different federal, state, and local laws and industry regulations. The complicated regulatory environment can be difficult to understand, making it even harder to secure IT systems in a compliant manner.

Concerns about institutional sustainability or even survival. Higher education institutions are besieged by a host of external problems that include competition from alternative educational models, decreased revenue from tuition dollars, and, in the case of public institutions, decreased state budget allocations. For-profit institutions have suffered a major market-share crash but still compete energetically for students with low-cost state universities and especially community colleges.⁹ Combined with internal demands to provide the best educational experiences possible for their students, these pressures may undermine the long-term stability of colleges and universities.

Continued complexity of security threats. The security threat landscape is increasingly complex, with cloud applications, the Internet of Things, complex technology architectures, and sophisticated emerging threats requiring a flexible and layered institutional information security approach. Finding new tools and technologies to help identify and mitigate these threats is of great importance to IT professionals.

Cross-institutional and international research collaborations. Research collaborations are increasingly the norm, and institutions need to be ready to support not only normal cyberinfrastructure levels for on-campus research but also a greater quantity of complex, even interinstitutional collaborations.¹⁰ These entail working with multiple institutions as well as working across international borders. Collaborating with colleagues beyond the institution is getting technically easier through a variety of options that include enterprise-level collaboration tools as well as free web-based tools. Enterprise tools offer greater assurance of privacy and security through the institution's identity management system.

Cross-institutional partnerships and consortia. In an effort to be as efficient as possible with enterprise IT systems and services, many institutions look to cross-institutional partnerships and consortia to reduce costs or gain efficiency. Purchasing consortia are a good example. In a purchasing consortium, a group of institutions develops a contractual relationship that allows for collective cost savings and the opportunity to work more closely with system and software vendors, including cloud vendors.

Data-driven decision making. Data-driven decision making is often used as a synonym for analytics. The term emphasizes the purpose rather than the

process and technologies of analytics. Many analytics initiatives focus on data, tools, and reports. All are necessary inputs into the activity that makes analytics worthwhile—deriving meaning from the data and determining the best actions to take. Data-driven decision making can take many forms. It can be incorporated into existing planning and management activities and processes. It can also be programmed into applications to generate real-time personalized triggers, alerts, and advice for students, faculty, advisors, and other constituents.

DevOps movement to bring development and operations staff together to better manage an end-to-end view of an application or IT service. DevOps efforts usually emphasize people over tools, focusing on building a collaborative relationship between development and operations staff to improve efficiency and provide better service. Strategies may include streamlining operations by automating and standardizing repetitive tasks and creating self-service applications. An institutional strategy that considers DevOps can take advantage of past work and save time on testing, potentially freeing resources for other activities. Lack of a current standard definition can create confusion, and the DevOps implementation that works for one institution may not work for another. A strategy that adopts a simplified definition can be a good starting point for developing a common understanding for developers and operations staff.

Digitization of scholarly and research data (data management, visualization, discipline-specific tools, etc.). Data today are typically produced in a digital format and increasingly are being used, manipulated, and studied in scholarship and research in digital ways. It is essential for data management practices to be updated so that they can work with “born digital” data throughout their life cycle. Higher education IT must also be aware of and able to provide researchers with the necessary tools and resources to work with and manage these data, including discipline-specific tools and practices, data visualization, research support for both traditional and more nascent areas of study (such as digital humanities), interdisciplinary research support, and more.

Diversity and inclusion. Diversity and inclusion are the lifeblood of higher education. Science and scholarship can only proceed by encouraging a diversity of opinions and insights proffered by myriad sources. Technology is a key enabler of this dimension, making it possible to draw on diverse information resources and allowing all voices to be heard. In the domain of teaching and learning, the issue of accessibility—one dimension of diversity/inclusion—jumped from seventh to fourth in the ELI key issues survey. Both the Department of Justice and the Department of Education have become increasingly active in this area as well. For the IT organization, diversity/inclusion issues are highly relevant to concerns about sustainable staffing as well as the composition of the IT workforce.

Evaluation of technology-based instructional innovations. Evaluating the impact of technology-based innovations in teaching and learning has long been a key issue. In light of increasing demands for technology and support, often dogged by dwindling resources, the need to know which innovations have the greatest positive impact is more acute than ever. ECAR research on faculty and IT shows that the greatest motivator for faculty to incorporate technology into their teaching is evidence of its benefit to students.¹¹ Due to the complexity of measuring pedagogical impact, a variety of evaluation methods must be utilized to produce the evidence persuasive to key stakeholders.

Green technology/sustainability. Green, sustainable technology strategies may call for standards for computer power usage, changes to power and HVAC systems in data centers, or even the development of a cloud-first strategy to decrease data center use. These strategies may be driven both by the need to decrease costs and by the desire to be good environmental stewards, sometimes connected to an institution's drive to make its physical plant more sustainable by meeting LEED (Leadership in Energy and Environmental Design) standards.

Incorporating open standards into enterprise IT architecture. Getting the typical institution's wide variety of complex enterprise systems to interconnect is difficult to begin with and arguably more complicated when some of those systems are in the cloud. Most enterprises adopt an existing framework or standard for how complex data architectures and communications between systems will work to produce a truly integrated computing environment. For example, The Open Group Architecture Forum framework for enterprise architecture is a widely adopted set of standards, methods, terminology, business workflow descriptions, and tools for standardizing systems-planning language and methods and for avoiding dependence on proprietary vendor solutions.

Incorporating risk management approaches into IT strategy and service delivery. The term "risk management" refers to a detailed, thoughtful process whereby an institution identifies and assesses the risks that could keep it from meeting its goals and then creates a plan for prioritizing and addressing those risks. It is a mechanism for managing uncertainty. As IT strategy and service delivery models evolve beyond traditional offerings, addressing IT risk more strategically involves focusing on IT's impact on the achievement of institutional goals rather than on the simple identification of risks related to physical inventories of assets in isolation. Risk management can draw productively on institutional and professional implementations of project management, including formally identified project managers and project management offices (PMOs).

Increasing complexity of technology, architecture, data. The pace of change in technology continues to increase. As institutions try to keep up, they are finding that the environments they manage are becoming more and more complex. New technologies need to be incorporated into the environment, older technologies

need to be maintained and updated, and end users expect it all to work seamlessly. As the IT environment grows, and as cloud services are added to the environment, IT complexity increases.

Institution-wide data management and integrations. Next-generation enterprise IT provides agility, scalability, and cost-effectiveness through a growing combination of applications, architectures, and sourcing strategies. However, it also complicates the challenge of making all those disparate systems communicate with each other. To provide useful information from so many different systems and applications, IT needs an institution-wide strategy for data management that takes multiple stakeholder needs into account, as well as an intentional focus on data integration across many different types of systems.

Institutional international strategies (international campuses and partnerships, internationalization of student body, etc.). Higher education today needs to be viewed through a global lens. When developing institutional strategy, an international perspective will be needed to recruit and support a diverse student body, faculty, and research; to develop and maintain complex international partnerships; and to support teaching and learning on international campuses. IT is a key consideration in all these endeavors—from networks that support data sharing to identity management and security—and must be able to support unique international needs, infrastructure systems to help manage this work, and more.

Internet of Things (IoT). The number of computers and servers connected to the Internet is being dwarfed by the number of other physical objects with embedded Internet-capable technology. Gartner estimates that the IoT will encompass more than 20 billion devices by 2020, a fourfold increase from 2015.¹² Two-thirds of those devices will be consumer-level devices. This enormous change will increase bandwidth needs, contribute to privacy and security challenges, introduce new computation needs, and potentially provide enormous opportunities for institutions as they begin to support smart campuses of the future. Perhaps the most obvious opportunities initially will be in automating and enhancing infrastructure management. But wearables and other person-based devices offer the potential for learning more about people's behavior, particularly if they begin to automatically interact with institutional applications.

IT as an agent of institutional transformation and innovation. Almost all projects involving innovation and transformation strategic in scope involve IT. IT has always had a dual role with respect to transformation and innovation: IT can be the vehicle by which an innovation is realized, and new breakthroughs in IT can open the door for a new set of innovations and opportunities that were scarcely imaginable before. There is no indication that IT will relinquish this dual role; indeed, if anything, the pace of such change seems only to be accelerating. Finally, the power of IT can greatly increase the scope and scale of current

initiatives (e.g., the collection and analysis of greater amounts of data provide the basis for new directions for business modeling and technology-enabled student advising).

Managing mobility (people, data, institutional resources). As mobile devices become ubiquitous, as the Internet of Things expands, and as stakeholders expect seamless connectivity through mobile devices to institutional resources and data, institutions need to consider a number of IT and business processes that cover management, administration, and support for mobile services. Finding a balance between access and control is important, from addressing bring-your-own-device (BYOD) policies to expanding bandwidth infrastructure.

Platform-agnostic vulnerabilities. Closely related to the trend *continued complexity of security threats*, the platform-agnostic vulnerabilities trend recognizes the explosion of information security vulnerabilities in devices and IT systems, and notes that vulnerabilities tend to be platform agnostic. This means that any single vulnerability has the potential to impact multiple technologies and devices.

Reduced reliance on service desk as the primary model for support (includes shift to self-help, automated provisioning, BYO-support, etc.). Knowledge management and automation are enabling IT organizations to provide alternatives to supplement the traditional call-in or walk-in center model of service desk support. This helps offload growing demand for IT support, as faculty, staff, and students increasingly want to access institutional resources from their personal devices and environments. Support staff are challenged to keep up with all the complexities of supporting so much variety. Web- or app-based self-help is one efficient way to supplement the hours of the help desk by providing institutional communities with support 24/7, as are outsourced IT service desks to either supplement or, in some cases, replace institution-staffed service desks.

Service management (ITSM, ITIL). As colleges and universities increasingly expect their IT departments to deliver services and, more importantly, value, ITSM and ITIL are receiving considerable attention. ITSM (IT service management) is the practice of running the IT organization with a focus on delivery of services to constituents in a repeatable, measurable, and proactive way that is aligned with organizational needs. ITIL (IT Infrastructure Library) is a framework of service management processes—such as change, incident, and configuration management—designed to optimize the internal operations of the IT organization. ITIL is a way to operationalize ITSM concepts. Other, complementary processes and frameworks that support ITSM include COBIT (for governance, audit, and compliance), Lean (for continuous improvement), agile (for development), and DevOps (to integrate development and service delivery).

Shared services. Shared services is the provision of a service by one part of an organization or group that had previously been provided by more than one part of the organization. It offers an economy of scale that may lead to decreased costs and greater value for the institution. However, attaining that economy of scale can require a large and challenging scope expansion. A shared-services solution differs from centralization in that the former focuses on collaboratively developing business processes and service level agreements that deliver value to the business. Centralization typically emphasizes compliance and control more than service value. Strategies that include leadership engagement, good change-management practices, shared governance, and a long-term financial model will lead to greater success in shared-services efforts.

Student success focus/imperatives. With an increased national focus on student completion, higher education faces a new urgency not only to innovate but also to collaborate across departmental silos to bring about institutional transformation. In an environment of “big data,” institutions are being called on to change the way they address student success, resulting in more students finishing what they start and developing the skills to contribute to society in and beyond the workplace.

Ubiquitous digital sources and streams (social media, IoT, systems and applications, OERs, etc.). Institutional data stores, systems, and applications provide a wealth of information that can be used in analytics initiatives. Increasingly, data from other sources such as social media, open educational resources, and the Internet of Things should also be considered as potential sources of important information, presenting institutions with the challenges of how to collect and harness so much data as well as how to deal with policy, privacy, and cultural issues related to externally sourced data.

Findings

Technologies are what IT organizations do. Trends, on the other hand, are widespread external factors that influence institutional and IT strategy and often spur the adoption of technologies. We assessed the IT trends¹³ presented in this report via an EDUCAUSE survey in the summer of 2016. We characterized a trend as “influential” if it was already incorporated into IT strategy or exerting a major influence over emerging IT strategy. We used that characterization to classify the trends into four levels of influence, based on the prevalence of influence across institutions surveyed:

- **Most influential:** Trends that were already incorporated or exerting a major influence on emerging IT strategy in 61% or more of institutions
- **Taking hold:** Already incorporated or exerting a major influence on emerging IT strategy in 41–60% of institutions
- **Worth understanding:** Already incorporated or exerting a major influence on emerging IT strategy in 21–40% of institutions
- **Limited impact:** Already incorporated or exerting a major influence on emerging IT strategy in 20% or fewer of institutions

The influence of the trends that we studied this year ranged widely (see figure 1).

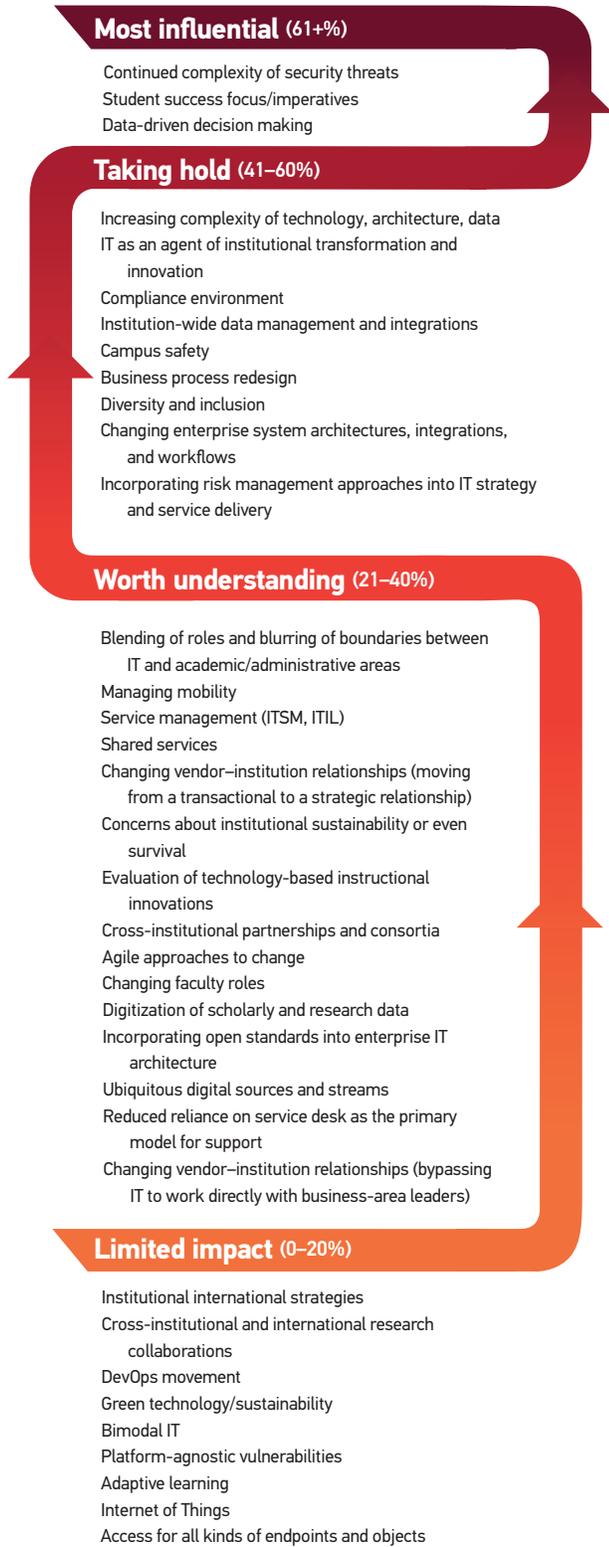


Figure 1. Trends and their influence on IT strategy

Understand how the most influential trends are affecting your institution.

Three trends are influential at 61% or more of colleges and universities (listed below from highest to lowest level of influence):

- Continued complexity of security threats
- Student success focus/imperatives
- Data-driven decision making

We can understand these three trends as responses to major changes in higher education beyond technology, as well as from the broader worlds of technology and demographics. Total enrollment in American higher education has declined for the past five years, increasing pressure on institutions to recruit and retain students, hence the renewed focus on student success. Cybersecurity threats have escalated in severity and sophistication worldwide, as seen in numerous examples from the Sony hack to the October 2016 DDoS that worked in part through an IoT vector. The ongoing development of data-gathering and -analysis tools both empowers and challenges campus IT in trying to provide better business intelligence, with interoperability and privacy issues looming large. Colleges and universities have also been responding to the demographic transformation of a reduced K–12 population, which places even more emphasis on competing for students, especially among institutions serving traditional-age undergraduates.¹⁴ We also note how intertwined these three trends are, as the security of student data connects with hacking threats, student data fits into data-driven decision making, and so on.

Review the trends that are taking hold and address them at your institution.

Nine trends (listed below from highest to lowest level of influence) are influential at 41–60% of institutions:

- Increasing complexity of technology, architecture, data
- IT as an agent of institutional transformation and innovation
- Compliance environment
- Institution-wide data management and integrations
- Campus safety
- Business process redesign
- Diversity and inclusion
- Changing enterprise system architectures, integrations, and workflows
- Incorporating risk management approaches into IT strategy and service delivery

These trends demonstrate the classic IT problem of maintaining a mix of services and hardware while new requirements appear, including regulatory demands, cultural shifts, and technological development—all while the imperative to keep cost growth in check remains. They also reveal the increasing role of IT in campus life, reaching further into strategic purposes (redesigning higher education) and operations (business processes, campus safety).

Understand these trends and consider their possible role at your institution.

The influence of 15 trends (listed below from highest to lowest level of influence) is limited to no more than 40% of institutions:

- Blending of roles and blurring of boundaries between IT and academic/administrative areas
- Managing mobility (people, data, institutional resources)
- Service management (ITSM, ITIL)
- Shared services
- Changing vendor–institution relationships (moving from a transactional to a strategic relationship)
- Concerns about institutional sustainability or even survival
- Evaluation of technology-based instructional innovations
- Cross-institutional partnerships and consortia
- Agile approaches to change
- Changing faculty roles (focus on advising and student success, growth in adjuncts, etc.)
- Digitization of scholarly and research data (data management, visualization, discipline-specific tools, etc.)
- Incorporating open standards into enterprise IT architecture
- Ubiquitous digital sources and streams (social media, IoT, systems and applications, OERs, etc.)
- Reduced reliance on service desk as the primary model for support (includes shift to self-help, automated provisioning, BYO-support, etc.)
- Changing vendor–institution relationships (bypassing IT to work directly with business-area leaders)

The relative popularity of several of these trends connects with certain sectors in higher education. For example, changes to scholarly research and publishing most closely apply to research-intensive institutions; OERs tend to appeal

mostly to community colleges and some state systems.¹⁵ Yet most of these trends can conceivably apply to the majority of higher education, given their focus on technological and institutional transformation. Perhaps most striking is the extent of human change, as roles shift for faculty members, vendors, and technologists.¹⁶

The remaining nine trends were of limited impact in our research:

- Institutional international strategies (international campuses and partnerships, internationalization of student body, etc.)
- Cross-institutional and international research collaborations
- DevOps movement to bring development and operations staff together to better manage an end-to-end view of an application or IT service
- Green technology/sustainability
- Bimodal IT (managing two separate IT delivery modes, one focused on stability and the other on agility)
- Platform-agnostic vulnerabilities
- Adaptive learning
- Internet of Things
- Access for all kinds of endpoints and objects, including RFID- and GPS-based devices

Here we see a smattering of trends whose relative scarcity explains their heterogeneity. Each trend, however, points to wider applicability in the near future, as they articulate institutional and technological change. Most are technological, but several are institutional: international strategies and cross-campus collaboration, for two important examples.

Conclusions and Advice

Taken together, these trends reveal campus technology departments to be in the continued throes of transformation. New technologies, upgraded roles on campus, additional demands for services, developing structural forms, novel security threats, and changing personnel roles are arriving from all directions and spreading across institutions. One of the few signs of stability is the persistence of current and legacy technologies, which must be maintained even as new hardware and software appear and campus structures change.

Perhaps the most dynamic trends are those surrounding data. As academia comes to embrace the world of data analytics—already used so powerfully in sports, business, and government—we find ourselves shifting resources and roles to best grapple with it. Data-driven decision making appeared as one of the three most widely seen trends in this report, advancing from its secondary position in our 2016 publication. Other trends directly key into this, starting with the other leading development: student success focus/imperatives. This emphasis on IT's contributing in new ways to students requires additional work on data gathering, analysis, and storage (for example, by which metrics shall we measure IT's contribution to student retention?). That in turn connects with the single most vital trend in the report, security threats, as IT must now not only determine how to collect and make best use of data but also protect those data from rising attacks. Operationalizing data analytics in the real world then activates other trends: the increasing complexity of technology, architecture, and data; changes to the compliance environment, as new data must cope with new regulations; the digitization of scholarly data, as we help faculty conduct studies and measure their research for impact; interinstitutional (including international) collaborations, as data cross even more siloes; and adaptive learning, as we consider data from publishers, student activities, the LMS, and more. Perhaps one way of understanding all of these developments is as the restructuring of IT departments as central campus data services.

The overall trends mapped in this report also indicate a sea change in people and their roles at nearly every position within an institution. Many IT departments now have a role in improving their institution's diversity and inclusiveness, which increases their activity within the domains of student life and recruitment. Users demand services from the hallowed service desk less often, as other resources fill the gap. The continued growth of technologies means IT staff also have to train and retrain on more skills, while their mission turns increasingly toward data-mediated student success. Simultaneously, students become both data consumers and producers; the latter is not a role most have been accustomed to playing at an institutional level. Meanwhile, faculty members continue their historical transition from stage sages to coaches, learning how to gather and use more

data while increasingly playing a role in IT decision making at an individual or departmental level. Faculty are also more likely to have international relationships and to work part time. Off campus, vendors are generally less involved with strategic IT and more closely connected to individual researchers and instructors. In short, the sociology of higher education and technology is churning, developing into a new culture.

We can see that churn driving new forms for campus IT culture. Some campuses report trying to work through bimodal structures, committed to maintenance and pivoting at the same time. Others are applying business process, risk management, ITSM, agile, DevOps, or ITIL approaches to their work, aiming to improve efficiency and responsiveness. Interinstitutional work calls for new political skills, whether through shared purchasing, combined data backup, or support for multisite faculty research. The structures and methods by which campus IT does its work are mutating.

In a sense this new campus IT structure is a response to the maturation of parts of the digital world. Mobile has gone mainstream, transforming every other domain it touches, from politics to shopping, romance to youth culture.¹⁷ Riding on many devices, although mostly mobile ones, comes a world of nearly ubiquitous content sources and streams. Members of a campus community now have something close to always-on connections and access to an unprecedented amount of information. Such was the promise of the web in the 1990s, followed by the mobile and social-media revolutions a decade later; now that this promise has just about been achieved, IT departments continue to adjust. They grapple with mobile support, enabling access for all kinds of endpoints and objects; copyright enforcement; threats to the campus community conveyed through social media; licensing issues; and an ever-growing number of platforms through which faculty, staff, and students engage an increasingly connected world. The centrality of data becomes even more important here, offering users a more effective and intelligent path through the deluge.

Looking ahead, we can introduce an emerging technology to see how these changing IT organizations might best react to it. Virtual, augmented, and mixed reality (VR/AR/MR) are already present in the consumer market, and educational content and practices are cropping up. They present challenges to media services, as well as to bandwidth: Some of those files are immense, either downloaded or streamed. Users will also generate data as they engage with learning materials, and those data can be captured, stored, and analyzed. Faculty may well take the lead in individual or departmental adoption, posing a tactical challenge to IT. Perhaps IT departments will have to create positions tasked with supporting VR/AR/MR as they develop. Will bimodal organizations first respond through their agile wing, then eventually shift the tech to their maintenance

section? How can IT help a campus address accessibility and inclusion issues that such immersive media may present? Will departments focus on a VR/AR/MR provider or address the technology through emerging open standards? Individually, most of these are not new questions to be asked when a campus engages with a new technology, but collectively they point to IT departments' continued transformation.

Asking such questions now is one way for a campus to prepare for what might come next. Perhaps IT departments can enhance those explorations through their expanded data-collection and -analysis role, examining technology usage in its earliest stages to discern how larger populations might employ it. Some organizational methods, such as agile, can structurally position staff members to think ahead with open yet practical minds. The best way to apprehend the future might be to consider another set of trends, those concerning rising interinstitutional connections. Comparing notes across different campus types and geographical locations could well improve our collective understanding, opening us up to a variety of voices and imaginations. Sharing our experiences and seeking those of others through interinstitutional venues and organizations is simply a practical way to learn. In an age of social media, thinking and strategizing through digital connections could well be the wisest move.

Authors

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Notes

1. [“Current Term Enrollment Estimates—Spring 2017,”](#) National Student Clearinghouse Research Center, May 23, 2017.
2. [“Sharp Partisan Divisions in Views of National Institutions,”](#) Pew Research Center, July 10, 2017.
3. Susan Grajek, [Higher Education’s Top 10 Strategic Technologies for 2017](#), research report (Louisville, CO: ECAR, March 2017).
4. Susan Grajek and the 2015–2016 EDUCAUSE IT Issues Panel, [“Top 10 IT Issues, 2017: Foundations for Student Success,”](#) *EDUCAUSE Review* 52, no. 1 (January/February 2017).
5. This year, in addition to reviewing the overall list of trends, EDUCAUSE published nine separate reports examining in detail the technology domains we asked about and reviewing each domain’s component technologies and the trends associated with those technologies. The domain reports are available from the [2017 strategic technologies research hub](#).
6. Gartner is credited with creating the term “bimodal IT” in 2014. See Leong, Lydia, [“Bimodal IT, VMworld, and the Future of VMware,”](#) Gartner Blog Network, August 25, 2014.

7. See Vernon Smith, “The Unbundling and Rebundling of the Faculty Role in E-Learning Community College Courses,” dissertation, The University of Arizona, 2008.
8. “Background Facts on Contingent Faculty,” American Association of University Professors.
9. Tressie McMillan Cottom, *Lower Ed: The Troubling Rise of For-Profit Colleges in the New Economy* (New York: The New Press, 2017).
10. See the very influential National Science Foundation call for cyberinfrastructure in the sciences (aka, “The Atkins report”), *Revolutionizing Science and Engineering Through Cyberinfrastructure: Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure* (January 2003). It was followed up by a similar call aimed at other disciplines, published by the American Council of Learned Societies, *Our Cultural Commonwealth* (2006).
11. D. Christopher Brooks, with a foreword by John O’Brien, *ECAR Study of Faculty and Information Technology, 2015*, research report (Louisville, CO: ECAR, October 2015).
12. “Gartner Says 6.4 Billion Connected ‘Things’ Will Be in Use in 2016, Up 30 Percent from 2015,” press release, November 10, 2015.
13. Primary sources were *The Horizon Report*, Gartner’s Top 10 Strategic Technology Trends, and multiple Gartner Hype Cycles (education, big data, cloud computing, cloud security, enterprise architecture, enterprise information management, GRC, identity and access management, IT operations management, privacy, business intelligence and analytics, and emerging technologies). We augmented those with several additional trends that we had noted in higher education literature.
14. U.S. Census Bureau, “The Nation’s Older Population Is Still Growing, Census Bureau Reports,” Release Number: CB17-100, June 22, 2017.
15. See, for example, Marguerite McNeal, “38 Community Colleges Launch Entire Degree Programs with Open Educational Resources,” EdSurge, June 14, 2016.
16. For example, one possible change for educational technologists: Carl Straumsheim, “Contours of a New Discipline,” *Inside Higher Ed*, May 16, 2016.
17. Mary Meeker, “Internet Trends 2017,” May 31, 2017.