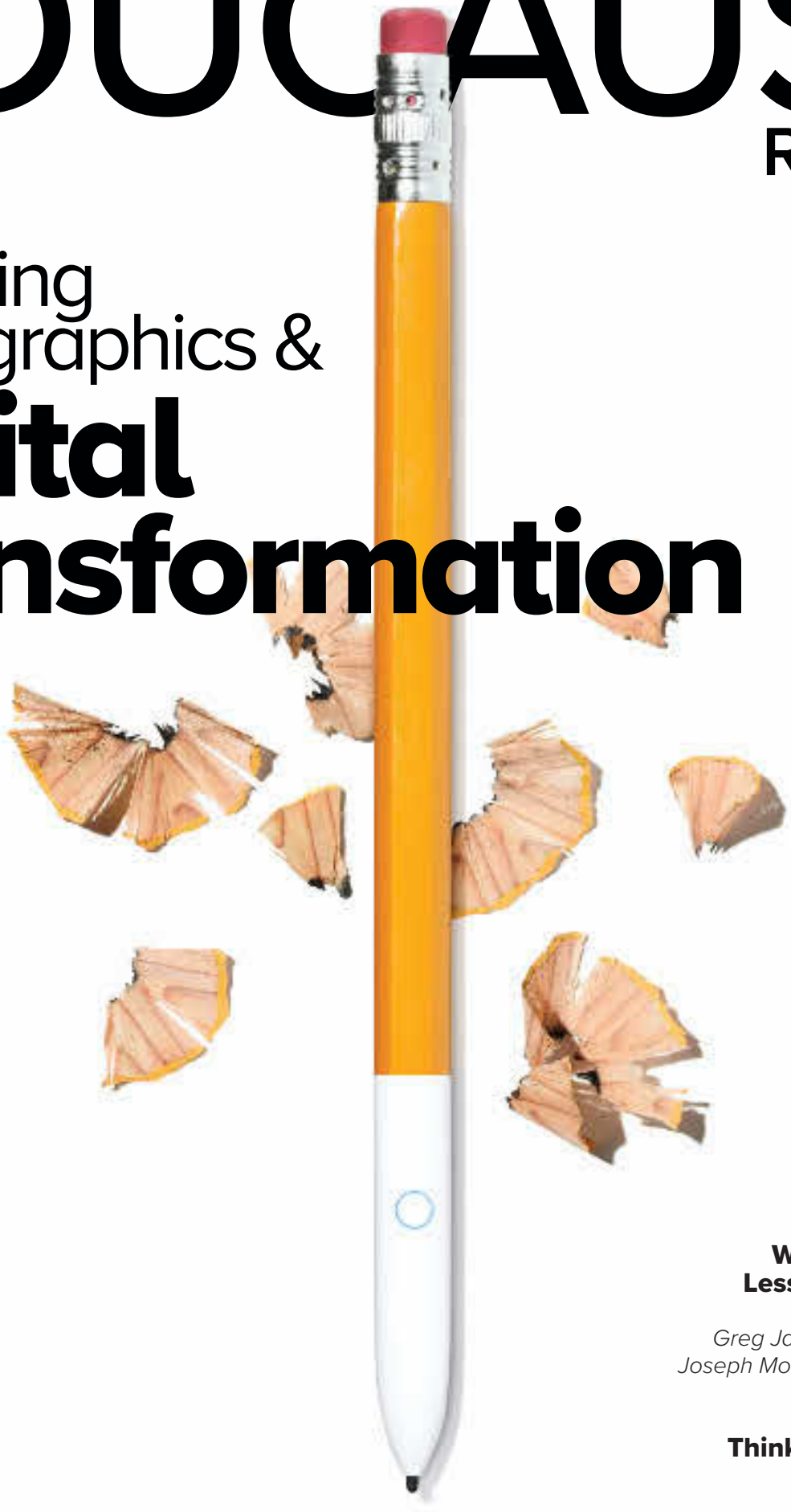
Why IT Matters to Higher Education

Winter 2019 er.educause.edu

# EDUCAUSE REVIEW

## Changing Demographics & Digital Transformation

*Ted Mitchell*



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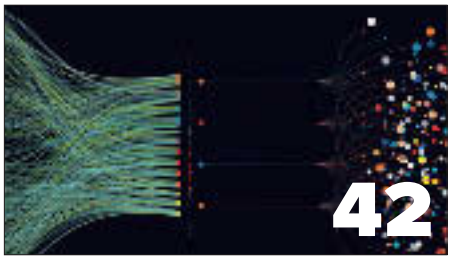



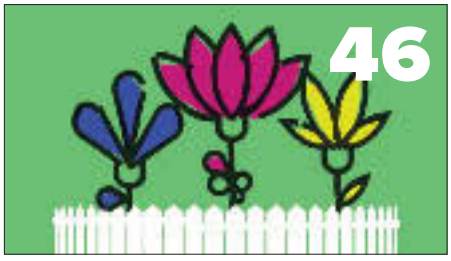


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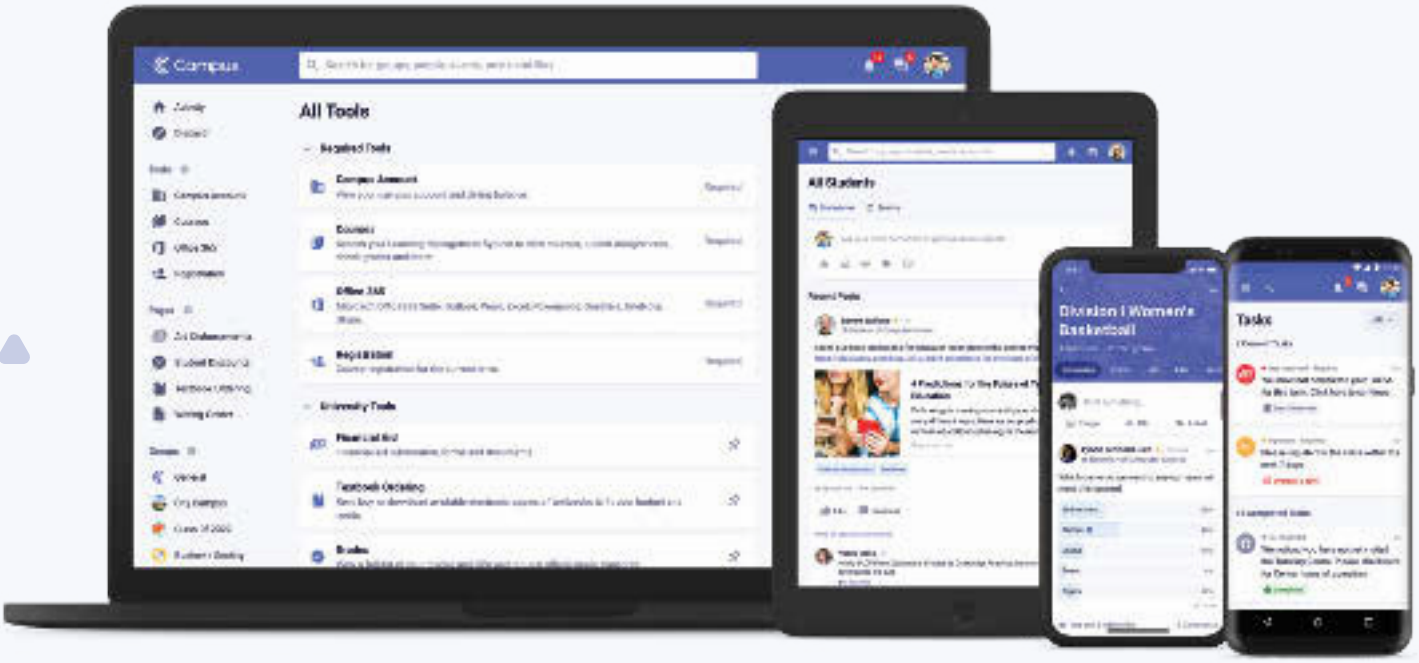


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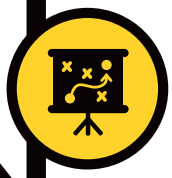

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# Digital Transformation: A Caterpillar or a Butterfly?

**By John O'Brien**

**In 2019, EDUCAUSE is launching** a critical conversation in our community around *digital transformation* (Dx). Two years ago, this phrase popped up on our annual Top 10 IT Issues list at #10: Digital Transformation of Learning. We broached the topic on a broader level in our March/April 2018 issue of *EDUCAUSE Review*.[1] In May of that year, the magazine published "Digital Transformation: What Is It?" by Ed Clark, University of St. Thomas chief digital officer.[2] The article was among the top 10 most read *EDUCAUSE Review* articles for 2018.

The article subtitle—"What Is It?"—captures the fact that we are in the early stages of figuring out what Dx means in our unique higher education ecosystem. To help clarify the discussion, last year EDUCAUSE brought together influential leaders from member colleges and universities to create a Dx definition suitable for higher education and to help us, as an association, determine the best way to support this kind of transformational effort. As a result of the work by this task force, EDUCAUSE defines Dx as "a cultural, workforce, and technological shift . . . being driven by technology trends and changes that include advances in analytics, artificial intelligence, the cloud, mobile, consumerization, social networks, and storage capacities."[3]

As for supporting this effort, I believe that in 2019 two approaches to digital transformation lie before us and that the path chosen by any given college or university will be consequential. First, we can dismiss digital transformation as nothing more than an underexplained, overhyped phrase that signifies nothing—it's just another name for the technology innovation we've been working on long before the phrase emerged. We can shrug and point to the fact that technology is clearly continually transforming everything. Second, rather than dismiss Dx, we can intentionally embrace digital transformation as a powerful, deliberate choice and can work to energize our institutions around the ideas it encompasses.

Rather than dismiss Dx, we can intentionally embrace digital transformation as a powerful, deliberate choice and can work to **energize our institutions around the ideas it encompasses.**

George Westerman, research scientist at the MIT Center for Digital Business, encourages us not to confuse *change* and *transformation*. When we feel that Dx is nothing new and is simply the same kind of work we have been doing since the digital revolution began, we are likely missing the point. Successful digital transformation requires a broad team

*Continued on page 7*

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*Continued from page 5*

effort that includes senior leadership and alignment of effort across all of the well-established silos in higher education. Westerman suggests that when digital transformation is done correctly, "it's like a caterpillar turning into a butterfly," but when done wrong, "all you have is a really fast caterpillar."[4]

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I recently overheard one higher education IT colleague ask another if they were engaged in digital transformation at their institution. After sharing their ambivalence about the term, the two agreed that if you have to ask, you're probably not experiencing a digital transformation in progress. Which is to say that even if an institution is experiencing impressive ad hoc technology innovation, true digital transformation includes that innovation as part of a larger strategy that transcends the IT organization or any other single organization and that has the active endorsement of the campus chief executive and cabinet. Building out impressive digital capabilities is a feature of Dx only when the effort begins with—and is an intentional expression of—a larger institutional strategic priority. The technologies that enable Dx (e.g., analytics, artificial intelligence, the cloud, mobile, consumerization, social networks, and storage capacities) constitute only one of the levers involved. True Dx goes far beyond tools to include cultural and workforce changes in how we teach, learn, enroll, and engage in scholarship and research.[5]

At EDUCAUSE, we think that what makes digital transformation, well, *transformational* is a commitment—made by campus leadership far beyond the IT organization—to the belief that the future of the campus will be an unapologetically *digital* future. The soon-to-be-released EDUCAUSE 2019 Strategic Technologies and Trends data shows clear signs that Dx is in place at only a few institutions (4%) but that it is exerting a "major influence" at two-fifths (40%)."[6] We are, therefore, convinced that the time is right to double-down on our understanding and promotion of digital transformation. The changes ahead in technology, culture, and the workforce are inexorable. Institutions that choose to be along for the ride will certainly not be alone. With the conversations we plan for 2019, EDUCAUSE will be making the case that we can accomplish so much more when we approach, together, these powerful forces—with deliberate intentionality embraced across our institutions. ■

For more on this topic, see the EDUCAUSE web page "Dx: Digital Transformation of Higher Education" **(educause.edu/dx).**

**Notes**

1. For more on this topic, see the EDUCAUSE web page "Dx: Digital Transformation of Higher Education" (educause.edu/dx).
2. Edmund Clark, "Digital Transformation: What Is It?" *EDUCAUSE Review,* May 21, 2018.
3. EDUCAUSE, "Report from the 2018 EDUCAUSE Task Force on Digital Transformation" (November 2018), p. 6. See also the resources on the EDUCAUSE web page "Dx: Digital Transformation of Higher Education" (https://www.educause.edu/dx).
4. Westerman quoted in MIT Sloan Executive Education, "The Digital Business Transformation Imperative," *innovation@work* (blog), June 12, 2014.
5. See also Jim Phelps, "Scenarios, Pathways, and the Future-Ready Workforce," *EDUCAUSE Review* 53, no. 4 (September/October 2018).
6. D. Christopher Brooks and Mark McCormack, *Higher Education's 2019 Trend Watch and Top 10 Strategic Technologies,* research report (Louisville, CO: ECAR, forthcoming).

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# Supporting Access to Education in the Arab World: An Interview with Maysa Jalbout

**Maysa Jalbout is CEO** of the Abdulla Al Ghurair Foundation for Education. Established in July 2015, the Foundation is one of the largest privately funded philanthropic education initiatives in the Arab world. Jalbout was previously CEO of the Queen Rania Foundation for Education and before that the head of Education Policy at the Canadian International Development Agency. As a nonresident fellow with the Center for Universal Education at the Brookings Institution, she focuses on four education research areas: refugee education, skills development, financing, and technology in education. She recently talked with EDUCAUSE President and CEO John O'Brien about her work and her hopes for the future.

**John O'Brien:** *Who does the foundation serve, and how?*
**Maysa Jalbout:** The Abdulla Al Ghurair Foundation for Education serves all young people in the United Arab Emirates (the Foundation's home country) and the Arab world (twenty-two states), especially those who are underserved and need additional support to complete their education. The Foundation is focused exclusively on increasing access to quality education in the region. Its programs include university scholarships at 16 universities in 10 countries, college and career-readiness guidance, and education innovation through open and online learning.

**O'Brien:** *You work with those in desperate need. For those who have so little, how can technology innovation be a solution?*
**Jalbout:** The Foundation prides itself on supporting those who are most in need—generally young people whose families have the lowest income levels in their respective countries. Today, 40 percent of our STEM scholarship recipients are the first in their family to enter university, 20 percent are refugees, and 40 percent are female (higher than the global average).

While I am very optimistic about the potential of technology in advancing our goals in education for the region, I think we are still at the beginning of this journey. Technology is not a panacea. The solutions targeting the young people we aim to reach have not been as effective as the promise.

We have, however, been able to use technology as an important tool to make the education opportunities we offer more accessible. For example, our applications are online and open to any young Arab. This direct online access has leveled the playing field for applicants, allowing them to compete on need and merit without third-party or bureaucratic processes. It has also helped us at the Foundation to learn much more about their challenges and to adapt our programs and processes to meet their needs more efficiently.

**O'Brien:** *How are you using technology innovation to empower youth?*
**Jalbout:** Our programs are built on the needs of, and feedback from, young people across the Arab region. We learned early not to chase the technology solutions that promise to solve everything. Thoughtful technology solutions and partners are key to designing tech-based education programs.

For example, we are working with Arizona State University (ASU) on delivering two of our programs using technology: Al Ghurair Young Thinkers Program; and Al Ghurair Open Learning Scholars Program. ASU has been working closely with us to address the specific needs of Arab youth and to meet our organizational goals, especially scaling.

The Young Thinkers Program uses gamification to introduce students to different careers in the job market based on their interests. Students can receive college and career coaching by chatting with expert success coaches

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while completing short courses that improve their soft skills such as time management and résumé writing. We have also developed a mobile application, available on the Apple Store and Google Play, that allows users to engage in the program on their portable devices. It offers something all Arab youth need, yet it is the first such program in the region, and the technology enables us to expand quickly.

The Open Learning Scholars Program gives Arab youth the opportunity to upgrade their academic qualifications and job skills through online degrees and credentials. With ASU, we are offering 550 fully online, accredited master's degrees in 28 specializations. Our plan is to expand our partners and offerings significantly in 2019.

**O'Brien:** *Affluent countries are watching age-old models for higher education being called into question and are seeing colleges and universities close or restructure in painful ways. Is this disruption creating room for innovation and opportunities for organizations like yours to do some good?*
**Jalbout:** Although these trends have not yet taken hold in the Arab world in the same way, we are proactively working to invest in innovations that will help students and higher education institutions better prepare for the future of education and jobs. The programs I mentioned above are part of the Foundation's early contribution to innovation in education in the region.

We are particularly proud of our support to the American University of Beirut and the American University of Cairo in their adoption of online learning. Through our collaboration with MIT, we invested in the capacity of these two universities to develop their first online degree courses. We have high hopes for both universities to be innovators in this space.

Still, we have a long way to go in the region. I am personally concerned about the low level of engagement among our regional universities on the big questions of our time—in particular, the massive disruptions and threats that technology can have on our lives.

**O'Brien:** *What new models are you considering?*
**Jalbout:** We are always thinking about how to better respond to the needs of our target youth. Most recently, we launched a special fund—the Abdulaziz Refugee Education Fund—to support refugee youth in Jordan, Lebanon, and the UAE. This fund is focused on finding the most innovative solutions (both low- and high-tech) to support funding of secondary education and vocational or higher education for the refugee population that is 14 years and older. The second round of funding applications is opening in February 2019 for implementation in September 2019. More information will be shared through our social media channels.

**O'Brien:** *If you could wave a magic wand and create the comprehensive dream partner, what would it look like?*
**Jalbout:** The Foundation is committed to working with organizations that share our vision for education as the best way to improve the lives and prospects of young people everywhere. Our partners demonstrate a strong commitment to young people in the Arab region, have experience successfully serving the underserved, and deliver high-quality education. The ideal partner also pushes our thinking as an organization and brings new ideas to solve the challenges we aim to address.

**O'Brien:** *Who inspires you?*
**Jalbout:** I am very fortunate to find my inspiration in my job. I am most inspired by young people in this region, especially our scholars who have experienced hardships that would discourage most people. Their resilience, drive to succeed, and commitment to give back to their families and communities motivates me to strive to do more every day, for them and for many more we have not yet reached.

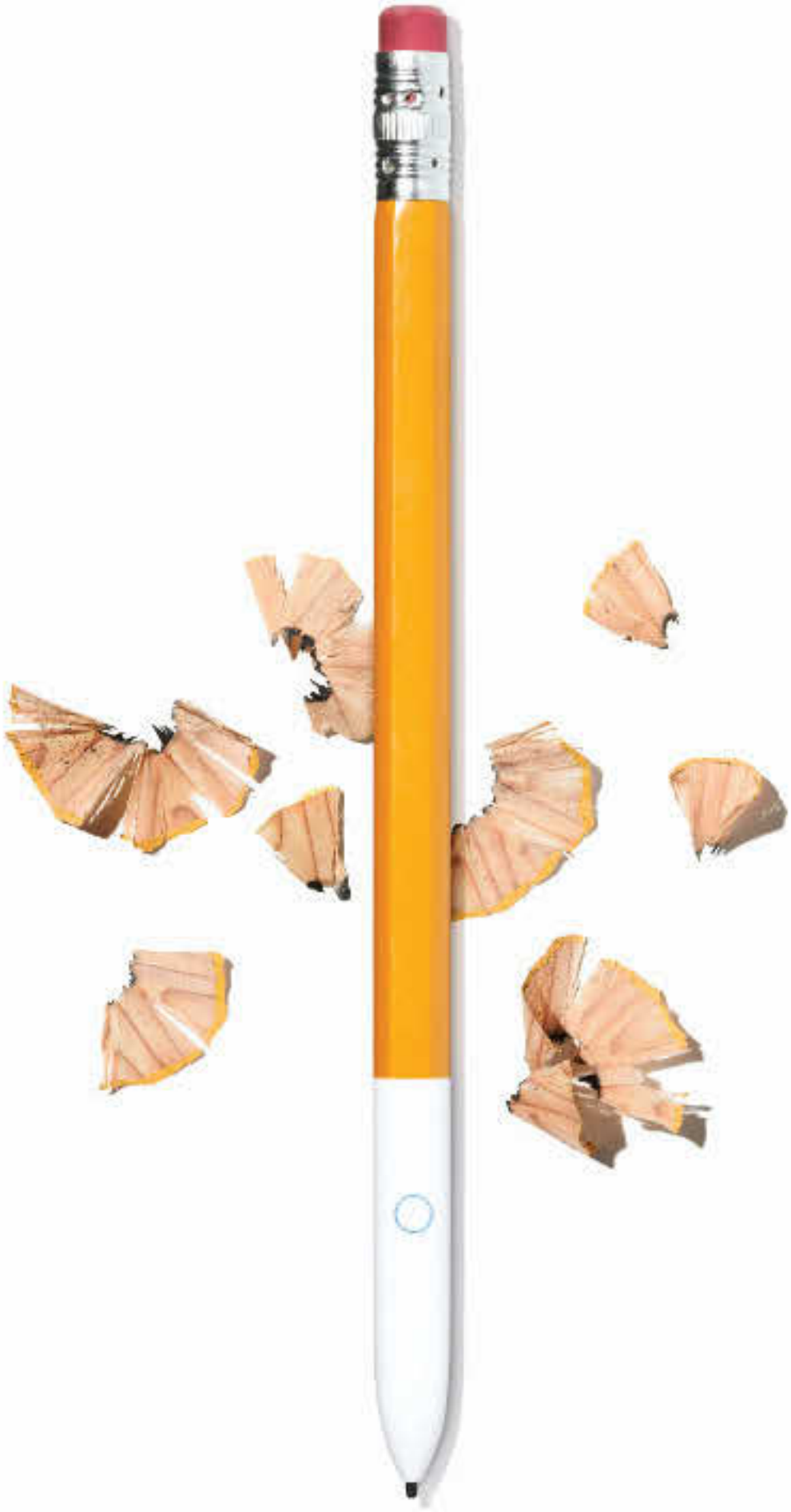
**O'Brien:** *Raised voices and angry divisiveness seem to be an international phenomenon these days. What gives you hope?*
**Jalbout:** I try to remain focused on results regardless of the sentiments of current international affairs. Results are what have kept me hopeful and persistent in my twenty-five-year career in this field—in Canada, in the Arab world, and even in conflict-affected countries. I have often met people who have gone to extreme lengths and sacrifices to survive, to help others, and to showcase the best of humanity.

Badriyeh Diab, a Palestinian refugee living in the Nahr El Bared refugee camp in Lebanon, is an example. Badriyeh is one of five children. Her parents are unemployed because they are not allowed to seek employment. Her life has been disrupted by conflict many times over. When I went to visit Badriyeh in her very modest family home inside the refugee camp in 2016, she told me that she had always clung to the dream of going to university. She did so through the toughest moments of her life, studying for exams even when she was living in a car garage after her family's house was destroyed. Several weeks ago, I visited Badriyeh (she is one of 87 Al Ghurair STEM Scholars studying at the American University of Beirut). Her confidence and outstanding grades, as well as the fact that she is less than two years away from becoming an environmental engineer, give me immense hope. ■

"This direct online access has leveled the playing field for applicants, allowing them to **compete on need and merit without third-party or bureaucratic processes.**"

This interview is the first in a series of 2019 articles featuring international educational organizations working to make a difference through scalable worldwide technology innovation. This series, edited by Hilary Baker and John O'Brien, coincides with the goals of the newly created EDUCAUSE International Task Force, which is seeking to better understand and increase engagement among the EDUCAUSE international community.

**Maysa Jalbout** (ceo@alghurairfoundation.org) is CEO of the Abdulla Al Ghurair Foundation for Education. **John O'Brien** (jobrien@educause.edu) is President and CEO of EDUCAUSE.



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# TRANSFORM

## Changing Demographics and Digital Transformation

By Ted Mitchell

# TODAY IT IS FASHIONABLE ONCE AGAIN (THIS OCCURS APPROXIMATELY EVERY THIRTY YEARS) TO PREDICT THE DEMISE OF COLLEGES AND UNIVERSITIES.

I want to state right off that I am not even tempted to leap on that bandwagon. My prediction is that the next generation of higher education will be vibrant, thriving, and more important than ever to US social and economic progress—not because the sector will have remained the same but precisely because the opposite will have happened. Through changing demographics and digital transformation, the sector will have evolved in important ways.

And it has ever been thus. Ours is a sector that has responded to, and often driven, change. I began my career at a campus that started accepting women students only in 1976. The Civil Rights movement in the United States, with important roots in colleges and universities, was both cause and consequence of opening campuses to people of color. One hundred years earlier, in the midst of the Civil War, Justin Morrill and Abraham Lincoln created a whole new kind of institution: the land-grant college. And at the founding of the republic, George Washington, John Adams, and others insisted that higher education should break from its European moorings to serve not only the nation's purpose but also individual or sectarian interests.

We've done it before, and we are doing it again. The imperative for change is all around us. It's not coming just from the headlines or the pundits, although those pundits would like us to believe that they are the ones who are pushing us to change. Now the imperative for evolution in US higher education is driven from that most authentic of sources, our students. As in so much else, our students will lead us—if we have the will and the tools to listen. All around us, we are seeing shifts in the nature and character of our students. Four of these interrelated, changing demographics stand out.

First, today's students are not the students of myth and legend. The new "normal" student is not an eighteen-year-old who is dropped off at the entrance to "Leafy U" in the family minivan to be retrieved four years later with a diploma marking a body of learning that will somehow last a lifetime. Instead, the new normal student is just as likely to be a twenty-five-year-old returning veteran, a thirty-year-old single parent, or a fifty-three-year-old displaced worker who is looking to reskill and retrain. According to data from the National Clearinghouse and the Department of Education:

- The average age of a college/university student hovers around twenty-seven (though that is decreasing as the economy heats up).[1]
- 38 percent of students who enrolled in 2011 transferred credits between different institutions at least once within six years.[2]
- 38 percent of students are enrolled part-time.[3]
- 64 percent of students are working either full-time or part-time.[4]
- 28 percent of students have children of their own or care for dependent family members.[5]
- 32 percent of students are from low-income families.[6]
- The secondary education experience has an increasingly high variation, resulting in students whose preparation for college-level work varies greatly.

In some areas of higher education, these statistics are described as "risk factors" that impede students in their journey through the traditional system. For others, they are simply "design features" that guide us in redesigning institutional experiences and public policy to be more responsive, more customized, and more personalized to the needs of these learners who, right now, are our students.

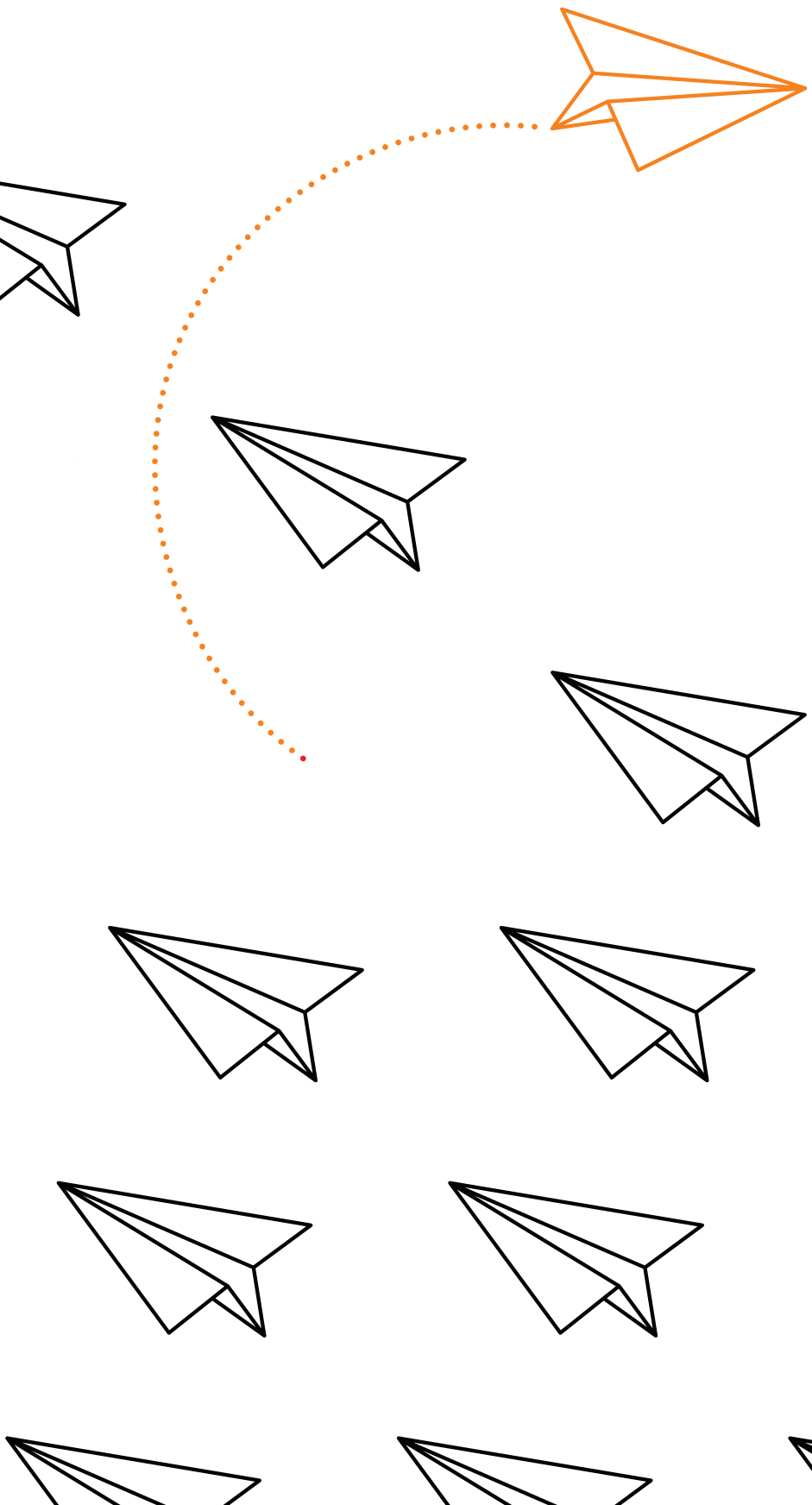
Second, if we look ahead, and not even that far ahead, we see the most profound demographic shifts to impact the United States over the last century as we become a majority-minority nation:

- The K-12 system is already majority-minority.[7]
- California, Texas, New Mexico, Nevada, and Hawaii are majority-minority states.[8]
- By 2050, the workforce will be about 55% people of color.[9]

Let's think of this first as a math problem. To educate the citizenry and the workforce of tomorrow, we simply must create policies, practices, and institutional cultures that embrace equity and that, in particular, make the persistent achievement gaps between white students and their peers of color a thing of the past. Let's broaden our lens a bit. We must erase access and success gaps for low-income students, first-generation students, and rural students if we are to thrive as a nation.

Let's also think of this as a moral problem. To have the diverse, prosperous democracy that is at the root of our sense of nationhood, we must understand equity and diversity to be a must-have, not a nice-to-have. Equity and diversity are not gifts that higher education institutions

Delivered as a featured session at the EDUCAUSE Annual Conference, November 1, 2018, Denver, Colorado.



**As in so much else, our students will lead us—if we have the will and the tools to listen. All around us, we are seeing shifts in the nature and character of our students.**

impart to somebody else. They are the *ways* in which we become better, stronger, and fuller advocates for our highest aspirations. They are the ways in which we create better thinkers, individuals with stronger communication skills, and more-creative problem solvers. Equity-minded leadership, at all levels of the institution, will be critical in leading us forward.

Third, the majority of our students are fully digital natives. They have grown up not only with digital entertainment, communication, and communities but also with digital learning and services. Children's Television Workshop began in 1968, and the television series *Sesame Street* premiered in 1969. By 1981, faculty and students at institutions across the country were connecting to each other and with their students by e-mail. The Free Application for Federal Student Aid (FAFSA) went online in 1997. LeapFrog began shipping learn-to-read tablets (the LeapPad) in 1999. By 2009, 80 percent of college applications were made online.[10] Our students, whether they are eighteen or thirty-five, have lived through these milestones. Even if they don't remember them, they have been impacted. As a result, they expect and accept that technology will be an important and helpful part of their college/university experience.

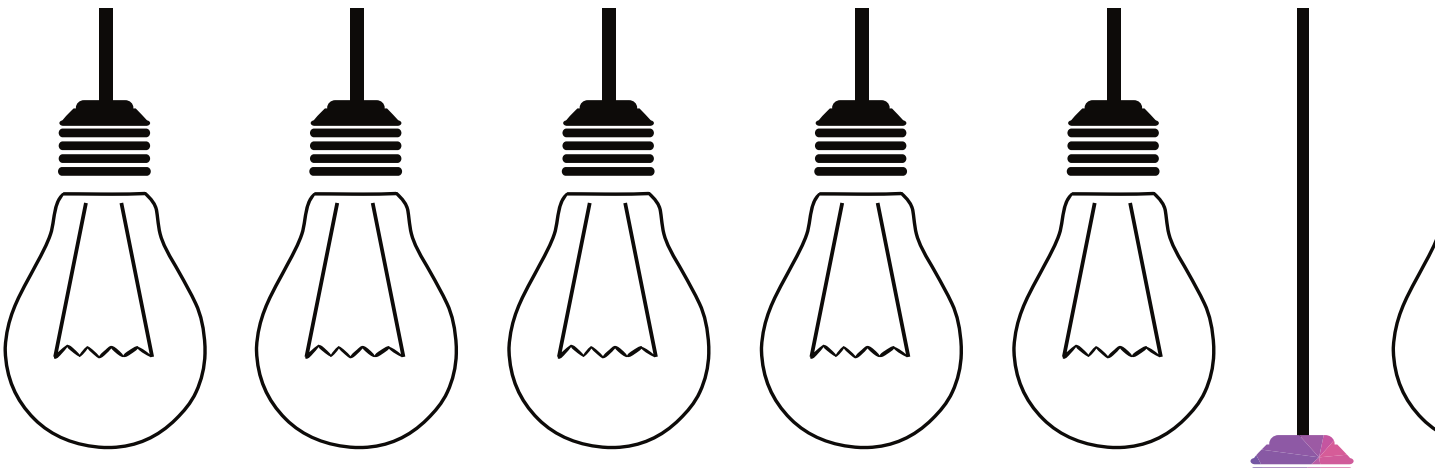
Fourth, we need to understand our institutions and digital transformation through the eyes and the realities of our students—not just through their demographics but through the context in which they live now and will live in the future. Insecurity weighs on them, and it's not a short-term phenomenon. Students worry, for good reasons:

- Income inequality is separating haves and have-nots in ways not seen since the Gilded Age.
- Job displacement or the threat of job displacement hangs over every college/university student.
- Most students will work in jobs, if not industries, that haven't been invented yet. How can we help them prepare for that future? While our students look to us to provide closer links to the world of work, they also look to us to provide opportunities for lifelong learning.

Each of these four vectors—student characteristics, emerging demographic changes, technological ubiquity, and the context in which our students live—creates challenges. To meet the needs of our students at this time of change and challenge, we cannot simply do things the old way. We cannot tinker around the edges. We cannot just work a little harder or a little better. We cannot rely on instituting a new program here or there. We need to embrace a level of change that is transformative and that capitalizes on the digital tools at hand and coming down the line. Only in that way can we meet the needs of the new normal student in a dynamic economy and a diverse democracy.

At the American Council on Education (ACE), when we think of digital transformation, we think of seeking answers to five related questions:

1. Against this backdrop of changing demographics, how can

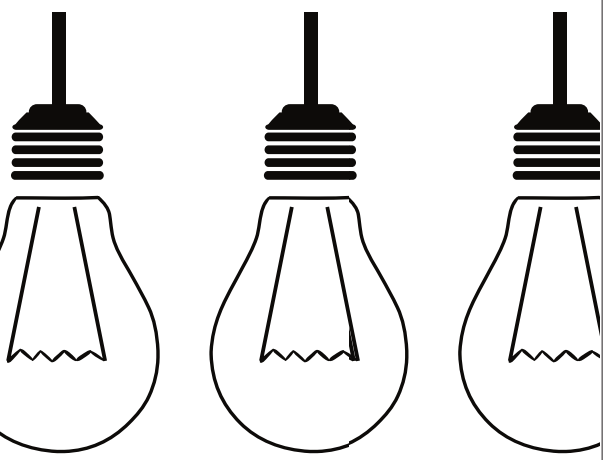


**To have the diverse, prosperous democracy that is at the root of our sense of nationhood, we must understand equity and diversity to be a must-have, not a nice-to-have.**

we enhance engagement among students and faculty in order to increase student success?
2. How can we innovate and then measure the results of those innovations to increase our impact at scale?
3. How can we stabilize or lower both cost and price?
4. How can we leverage existing physical and human capital to increase institutional capacity and responsiveness?
5. How can we use digital tools to close equity gaps?

We believe that the combination of advances in teaching and learning technology, in information technology and communication, in the capacity to store and use data, and in the skill of our workforce in the immersive digital environment will create both digital transformation and an enormous opportunity.

And it's already happening.[11] Together we are identifying policy, practice, and culture innovations that are meeting students where they are and creating new pathways for them as they seek to improve their lives. Whether it's the EDUCAUSE work on Integrated Planning and Advising for Student Success (iPASS), the University Innovation



PHOTOTECHNO / ISTOCK / GETTY IMAGES, © 2019

Alliance, the Association of Public and Land-grant Universities (APLU)'s Transformation Clusters, or the ACE research on the important impact that MSIs are having on social mobility, we know that it is possible to deploy digital resources to serve social mobility, student success, and institutional progress.

These digital resources take many forms, such as learning modalities that offer instruction in more flexible and personalized ways, assessment tools that deliver meaningful information on student learning, and information systems that allow us not only to describe but to predict student progress and match students with resources when needed—or even before. What cuts to the heart of all of those innovations is one central innovation: the focus on and commitment to analytics and data-driven decision-making. CUNY's Accelerated Study in Associate Programs (ASAP) and Georgia State University's GPS advising and intervention system, for example, are as much analytics and data science projects as they are education innovations.

These are just the beginning. There is more work to be done to move from innovation to transformation. To make this digital turn, we need to work on a rational deployment of tools and technology. But to harness the power of technology in truly transformative ways, we must also focus on the insights of the analytics revolution and on the governance structures, the culture, and the people who carry that work forward daily in our institutions. The is not just a case of more or better data. The key is how the data is used.

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**Digital transformation will not be self-executing. To move ahead, we should work collectively to promote the activities, the personnel, the structures, and the culture in integrated ways that support this transformation.**

Having data and using data are often two distinct worlds. Data-sets do not speak to each other. Data is too often walled off, leaving key stakeholders without access. Analytic tool development is under-resourced and siloed, and we pay too little attention to the training of our workforce, from the IT department to the president's office. I worry most about the latter. In the 2017 ACE survey of US college and university presidents, only 12 percent regarded institutional research and information technology as important areas of strategic development going forward.[12]

Finally, when we think about data, we too often think only about numbers, when in fact qualitative data is an equally important place for us to look to understand the student experience and to reach some conclusions about how to innovate and the next steps to take. Countless examples provide evidence that digital transformation will not be self-executing. To move ahead, we should work collectively to promote the activities, the personnel, the structures, and the culture in integrated ways that support this transformation.

In conclusion, I'd like to suggest a rubric for us to consider as EDUCAUSE takes on the question of how to further digital transformation. The rubric has six parts:

1. Digital transformation must be question-driven. Why do our first-generation students persist in their education at lower rates? When do students make decisions about majors and how? The answers to these questions need to inform the analytics that inform the innovations that inform the tests and measurements that inform the rollout of the implementation of digital transformation strategies.
2. Digital transformation requires both strategy and tactics. Without a full focus on strategy, all the tactical improvements in the world will not get us to the point of improving student outcomes.
3. Digital transformation must be experimental and iterative. Approaches to innovations need to concentrate not on engineering the perfect but, rather, on engineering the good and on moving to "the perfect" based on analytic exercises.
4. Digital transformation should be part of decision-making at every level of the institution. IT and IR professionals must play meaningful roles in strategic thinking at the departmental, school, and institutional level and should, in my opinion, sit on the president's cabinet. This returns to my worry, noted earlier, that only 12 percent of US college and university presidents identified "using institutional research to inform decision making" as a future area of importance.
5. Both digital transformation and analytics are everybody's business—from facilities and faculty to human resources and trustees. We must invest in training to build skills and cultural support for digital transformation. In the recent AACRAO/ACE survey, we found that leaders across schools and departments, even within a single institution, have very different ideas about the utility of data and analytics and about who should be in charge of that work.[13] Again, this must be everybody's work.
6. Finally, digital transformation is not morally neutral. We have learned quite a lot lately about the implicit biases that are built into the various algorithms in the private marketplace (e.g., resume-sorting tools). We need to keep these problems in the front of our minds as we think about the

systems and the tools that we build and deploy. Bias is built into the questions we ask. Bias is built into the problems on which we focus. Bias is built into the outcomes we test.

I believe we have a moral responsibility to focus our analytics and digital transformation strategies on improving outcomes and clearer pathways for low-income, first-generation students of color. Not because we should leave others behind, but because these students have been left behind for far too long. This must stop in the United States, lest we endanger our higher education institutions, our economy, and our democracy. ■

**Notes**

1. Calculated from US Department of Education, Institute of Education Sciences, National Center for Education Statistics, 1999–2000 National Postsecondary Student Aid Study, 2003–2004 National Postsecondary Student Aid Study, 2007–2008 National Postsecondary Student Aid Study, 2011–2012 National Postsecondary Student Aid Study, and 2015–2016 National Postsecondary Student Aid Study.
2. Doug Shapiro et al., "Transfer and Mobility: A National View of Student Movement in Postsecondary Institutions, Fall 2011 Cohort," Signature Report No. 15 (Herndon, VA: National Student Clearinghouse Research Center, July 2018).
3. Calculated from Joel McFarland et al., "The Condition of Education 2018," NCES 2018-144 (Washington, DC: US Department of Education, Institute of Education Sciences, National Center for Education Statistics, May 2018), p. 160.
4. Calculated from US Department of Education, Institute of Education Sciences, National Center for Education Statistics, 2011–2012 National Postsecondary Student Aid Study, p. 126.
5. Calculated from ibid., p. 64.
6. Calculated from ibid., p. 68.
7. US Department of Education, Institute of Education Sciences, National Center for Education Statistics, "Digest of Education Statistics 2017," Table 216.30.
8. Dudley L. Poston Jr. and Rogelio Sáenz, "U.S. Whites Will Soon Be the Minority in Number, but Not Power," *Baltimore Sun,* August 8, 2017.
9. Michelle Asha Cooper, "The Economic Imperative of Achieving Diversity," *Forbes,* April 27, 2010.
10. National Association for College Admission Counseling, 2010 State of College Admission, cited in "News from NACAC 2010," *CollegeBoundNews.com* 25, no. 3 (November 3, 2010).
11. See John O'Brien, "Strategic IT: What Got Us Here Won't Get Us There," *EDUCAUSE Review* 53, no. 6 (November/December 2018).
12. Jonathan S. Gagliardi, Lorelle L. Espinosa, Jonathan M. Turk, and Morgan Taylor, *American College President Study 2017* (Washington, DC: American Council on Education and TIAA Institute, 2017), p. x.
13. AACRAO and ACE, "Use of and Access to Data: Opinions on Institutional Data Practices" (November 2017).



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# We Shoulda Known

## Lessons for the Future from the Past

By Greg Jackson, Klara Jelinkova, Joseph Moreau, and Jenn Stringer

"Failure at the detailed, individual level, whether plant or animal, company or government policy, is absolutely necessary for the health and vitality of the system as a whole. We need change and evolution to make progress. But evolution implies extinction, the discarding of ways of working that have outlived their usefulness."

—Paul Ormerod, *Why Most Things Fail* (2005)

In the two decades since CAUSE and Educom merged to become EDUCAUSE, information technology has transformed higher education myriad ways. Members have worked with others in the technology field to achieve, share, and disseminate successes. They have published articles and presented sessions at meetings and conferences to offer advice on how colleges and universities can successfully enhance teaching/learning, research, and community service through the intelligent use of information technology. That's great.

But the economist Paul Ormerod and other scholars of success remind us that important lessons come as much from what goes badly as from what goes well. So, in addition to pursuing the secrets to success, we should be looking for the causes of failure. That is, what hasn't worked? Why has it failed, and therefore what should we avoid? Such advice and case studies are harder to find. That's not great.

IT failure in higher education is worth exploring, lest (in the philosopher George Santayana's timeworn phrase) we be condemned to repeat this part of our forgotten past. Following this thought, the four of us asked colleagues for examples of things campus IT professionals should have known over the years. We reflected on our own diverse experiences, and we engaged scores of participants at a 2018 EDUCAUSE Annual Conference session. What we learned crystallized around eight general "lessons":

- Mission must drive IT choices (not vice versa).
- Campuses resist change by design (not by accident).
- Security depends on people (not on technology).
- Technology evolves regardless (not according to plan).
- Accessibility is a goal (not a problem).
- Technology costs more (not less).
- Personal trumps central (not vice versa).
- Collaborations are iffy (not straightforward).

### Mission Must Drive IT Choices

Surrounded by new technologies, IT professionals are conditioned to enjoy them. But we often advocate technologies regardless of our institutional missions—that is, we don't ask whether new technologies appropriately enhance teaching/learning, research, and/or community service. As a result, we sometimes expend or divert resources inappropriately. Think, for example, about Second Life, the online virtual world that was all the rage in higher education and IT organizations back in the late aughts and then, quite suddenly, was not.

IT professionals also deliver and support information technology in ways that faculty, students, and non-IT colleagues can find confusing and frustrating. Even when we recognize that we do this, we find it difficult to persuade and enable our staff to focus on what customers need and want. Compounding the problem, we struggle to identify the customer. Often, especially around administrative systems, we act as though the customer is, say, the CFO or the registrar rather than the faculty, staff, and students who actually use services.

Moreover, we view our role as maintaining and protecting information technology. We manage technology efficiently, but too often only from our own perspective. Efficiency is value divided by cost, and when our measure of "value" is too narrow—that is, for example, whether the technology "works" rather than "serves"—what we deem to be efficient may instead be counterproductive.

### *We Shoulda Known!*

We should remain interested in, and even enthusiastic about, new technologies. But we must be careful to advocate and implement them only when we have good reason to believe they align with our institutions' missions. This means that we should organize and manage IT planning, operations, and support based solidly on institutional mission and customers' needs. When we believe that customers' needs or wants are misguided, we should work to learn from and educate our customers, not simply dismiss their perspective. This, in turn, has implications for how we motivate our staff.

According to an often-quoted story, when U.S. President John F. Kennedy was visiting the NASA space center in 1962, he saw a janitor carrying a broom. JFK asked the man what he was doing. The janitor replied: "Mr. President, I'm helping put a man on the moon." The story is likely apocryphal.[1] But like most apocryphal stories, it illustrates an important point. In campus IT organizations, the "we" who must be aligned with the college/university mission includes everyone, not just the leadership. That's an organizational development challenge.

We can't give in to the entropy of individual preferences. No one benefits from students navigating through scores of inconsistent administrative applications, each of which does one thing for one office. The IT organization has a point of view and a voice. IT professionals are not order takers. We should recognize that we live in a complex, stakeholder environment and that we have a unique sense of how everything fits together. We must behave less like wizards and defenders and more like mediators, advisors, and analysts.

### Campuses Resist Change by Design

James G. March, a sociologist and organizational behavior scholar, pointed out that except for some minor details, the essence of higher education today is just what it was before universities were invented centuries ago: people sitting around on rocks talking about what they've learned. Campuses change slowly. And this, March argued, is by design, not by accident.[2]

March's point was that higher education is supposed to create, conserve, and protect knowledge. Colleges and universities therefore are organized and governed to stay the course, crosswinds notwithstanding. The obstacles to change that we IT professionals often bemoan—for example, tenure, closed stacks, departmental autonomy, peer review, search committees, layered approval mechanisms, Byzantine governance, incremental budgeting, and stone buildings with thick conduit-resistant walls—continue to exist for good reason.

Don Michael Randel, president of the University of Chicago from 2000 through 2006, observed on many occasions: "The problem with being a university president is that you're running a billion-dollar-a-year business, and yet there is no one to whom you can give a direct personal order…" He also observed, without surprise or complaint: "In faculty decision making, 200 to 2 is a tie."[3] Unlike Randel, IT professionals always seem to be surprised (and often complain) when our campus communities don't respond enthusiastically to new technologies or to new uses of existing technologies.

#### *We Shoulda Known!*

To advocate change, we should work within rather than bypass institutional governance. Otherwise, we can be viewed as institutional threats rather than assets, as kvetches rather than contributors. IT leaders must use their seats at "high tables" to work collaboratively with others, especially those charged with conserving the institution.

### Security Depends on People

It's hard to escape the ever-present shadow of security. As IT professionals, we often fall into the trap of thinking that technology can cure its ills by itself. We rely heavily on technology to secure networks, devices, and information. We use algorithms aided by artificial intelligence to detect anomalies. We work diligently to improve our institutional security posture. We struggle to balance mandated controls, well-known best practices, and basic usability.

There are clear risks to be managed. Effective technology-centered approaches can help manage them. But users often find those security approaches burdensome and inconvenient. They act accordingly (see "Personal Trumps Central," below). And so despite our investments in security technologies, the principal security risks to campuses still stem from individuals neglecting, ignoring, or bypassing security mechanisms.

#### *We Shoulda Known!*

We should take difficult questions about security very seriously. Is it better, for example, to have a simple rule that eases compliance or a more complex rule that maximizes security? Who gets to decide the answer to that question?

IT professionals should focus on educating technology users and helping them to understand that individual choices to bypass security can have major institutional impacts. We should continue to implement technology-based security mechanisms but also try to help users comply with them. Rather than hide behind authoritarian compliance directives, we should appeal to shared goals and promote a culture of care.

In addition, we should be willing to take risks in favor of usability and increased compliance. This requires an engaged conversation among end users, service providers, and security experts. It requires that security be embedded in the human fabric of the institution.

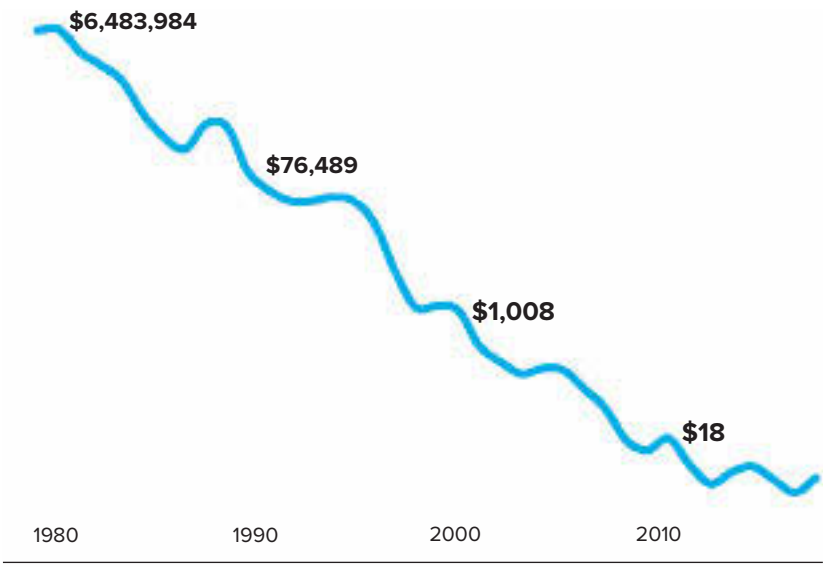
### Technology Evolves Regardless

To manage resources and respond to "Mission Must Drive IT Choices" (above), we have developed complex, lengthy prioritization processes for IT resources and practice. These are helpful, but they encourage incrementalism. We extrapolate from current practice, and we commit resources accordingly. As a result, we often spend resources in ways that become obsolete, and we are slow to recognize emerging trends.

For example, many of us made long-term, costly decisions about network architecture based on wired-network designs supported by vendors. These decisions, however sound at the time, may constrain our future as

We should recognize that we live in a complex, stakeholder environment and that we have a unique sense of how everything fits together.

**Figure 1. Average Computer Memory Cost ($/gigabyte) (current dollars, logarithmic scale)**




*Data source:* "Historical Cost of Computer Memory and Storage," *Hblok.net* (blog), December 17, 2017

wireless networks, 5G, and software-defined networking (SDN) become important.

Similarly, most of us have used smartphones for a decade or more. We know the value of these devices for things like email and calendars. However, we and the software vendors we rely on underestimated how rapidly smartphones would become the overwhelming device of choice for students, faculty, and researchers to do their work. Millennial and Generation Z students do things with their smartphones that many of us in earlier generations would never have considered desirable (or even possible) in the past. "You'll need to use a real computer for that" doesn't fly today.

***We Shoulda Known!***

Our constituents have a certain level of expectation about our institutions' ability to provide them with the information, resources, and transactions they need in a mobile-friendly or, more important, a mobile-optimal manner. Those institutions that get their mobile act together faster than others may have a competitive advantage. Those that don't, won't.

The evolutionary leadership challenge is to stay relevant and excited by the future that technology can bring, without diverting energy and resources from the institutional mission. We need to make sure that faculty, students and administrators think of IT staff as thought partners. When this happens, we can explore—together—various possibilities for a future that will be enhanced and even transformed by technology.

We should remain both conversant in new technologies and relevant to our institutions. We need the foresight and the room to experiment. And we must have the courage to walk away from past decisions and best practices that are no longer sound: sunk costs are a bad rationale for technology investment.

**Accessibility Is a Goal**

Making digital resources fully accessible for all our users is a long and expensive road, but one we must travel. Sometimes we get off the road too soon.

About five years ago, EDUCAUSE joined forces with Indiana University (IU) in an e-text initiative. The idea was that IU's partner would contract with major textbook publishers to make e-texts available to campuses through flat-rate, annual site licenses based solely on institutional size. Students would no longer buy or resell print textbooks at the campus bookstore. Three key challenges, it appeared, were to convince publishers that campus site licenses made more sense than selling each textbook separately, to persuade campuses to pay for e-texts centrally (perhaps absorbing the cost into tuition or fees) rather than have students pay for the texts individually, and to deal with the impact of all of this on campus bookstores.

Soon a fourth major challenge arose: the National Association for the Blind (NAB) wanted to make sure that e-texts would not discriminate against visually-impaired students. Unlike publishers or browser providers, colleges and universities are subject to Section 504 of the Americans with Disability Act (ADA) and therefore may not discriminate against students with disabilities—for example (in this case), by providing e-texts not equivalently accessible to visually-impaired students. Campuses providing textbooks, rather than bookstores selling them, would bring Section 504 into play.

IU and a few other institutions in the e-text initiative kept at it and successfully implemented e-text site licenses. However, many other participants attempted end runs around the fourth challenge, either asserting that responsibility for accessibility lay elsewhere or arguing that the e-text initiative was merely an experimental pilot program and therefore need not serve the disabled. That didn't work. What had begun as a laudable effort to simplify delivery of academic materials and save students money turned into an embarrassing adversarial interaction, one that served neither NAB nor campuses—nor, for that matter, students—well.

***We Shoulda Known!***

Whether information technology and IT-based services and materials are accessible should be among the key criteria for assessing and implementing new educational policies and programs. As is now common for physical facilities, accessibility of IT services and materials needs to be a goal accepted and addressed from the outset. If a given technology disserves certain populations, that

should be recognized and dealt with fairly, openly, and soon.

ADA and related statutes and regulations became law not arbitrarily but, rather, to symbolize and formalize social commitments to meeting the needs of the disabled. Colleges and universities are vital to those commitments. For IT professionals, accessibility should be an especially important goal, rather than a problem to be solved.

### Technology Costs More

One gigabyte of computer memory cost approximately $6.5 million in 1980, $76,000 in 1990, $1,000 in 2000, and $20 in 2010. Even logarithmically, the cost decline has been steep (see figure 1).

The same is true for other technologies that depend on chip density, as Moore's Law of 1965 predicted. It has thus been tempting for IT professionals to assert—or to imply, or to allow non-IT colleagues to assume—that the cost of providing campus IT services and materials has dropped accordingly. But that assertion/implication/assumption entails two fallacies: (1) that the cost of campus IT services and materials depends mostly on technology costs, and (2) that there are no investments in new technologies.

In fact, the dominant components of campus IT costs are staff salaries and outside services—not technology prices. And those costs go up rather than down. Moreover, savings from any decline in technology costs usually get reinvested in expanded or new technologies, rather than harvested for nontechnology purposes. For example, "savings" from lower telephony costs paid for data networks on many campuses, much as "profits" from computer stores paid for help desks. Even when IT advancements enable process improvements in business offices, the resulting "savings" usually get consumed by new activities.

To illustrate this further, figure 2 (see page 25) shows computer-memory costs and average campus IT spending per person at nonspecialized US campuses since 2010. That our colleagues and constituency don't understand the divergence between the two trends—with specific technology costs going down and campus IT costs going up—causes endless problems.

### *We Shoulda Known!*

We should stop asserting that IT costs will go down or that IT investments will save money. Instead, we need to explain IT costs, argue for realistic IT budgets, and focus on how IT enables institutions to tackle new

We need to explain IT costs, argue for realistic IT budgets, and focus on how information technology enables institutions to tackle new challenges and expand services.

The key lesson is that as control over key technologies moves to individuals or outside entities, IT management challenges evolve. The skills and experience required of campus IT leaders need to evolve as well.

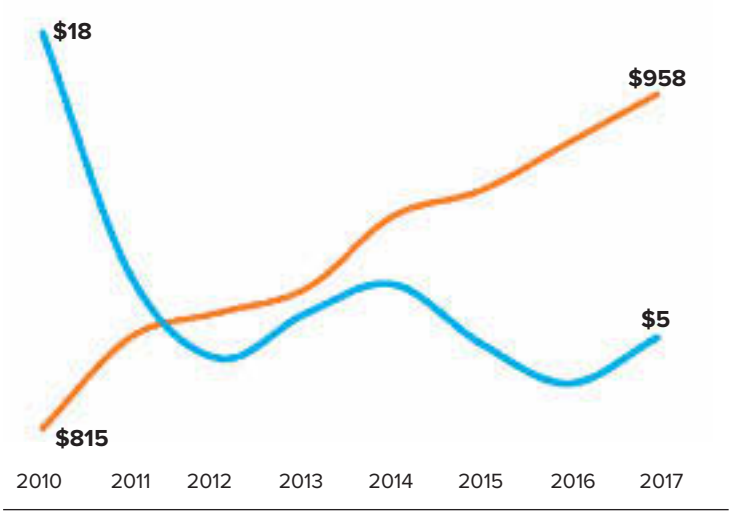
challenges and expand services (see "Mission Must Drive IT Choices," above).

### Personal Trumps Central

IT professionals have long behaved as though campus IT organizations should and can control all campus IT services and needs. Historically, that was reasonable. We have run machine rooms, filled them with mainframes and servers, installed business applications, and managed all of this ourselves. We have wired buildings, installed access points, connected the access points with switches and routers, and operated the resulting network. After negotiating volume deals with vendors, we have bought, configured, and distributed computers to faculty, staff, and sometimes students. All of this has almost always been to the benefit of our institutions.

But the era of control is over. This is true for machine-room infrastructure, for networks, and for end-user devices. Our machine rooms and local business applications are giving way to cloud-based servers and hosted applications. Our locally managed wired and wireless networks are giving way to commercial cellular services. And our standardized, bulk-purchased personal computers are giving way to diverse devices purchased, owned, configured, and managed by individuals. So even though important central roles remain—including integration, support, security, and negotiation—the three principal segments of the IT organization are now out of our control.

**Figure 2. IT Spending ($/fte) and Computer Memory Cost ($/gigabyte) (current dollars)**




*Data source:* "Historical Cost of Computer Memory and Storage," *Hblok.net* (blog), December 17, 2017; EDUCAUSE Core Data Service

***We Shoulda Known!***

One clear lesson for an out-of-control future is that how campuses manage IT must change. In particular, much that was once handled directly by the IT organization will instead be managed through contracts negotiated with outside entities. This has implications for IT leadership.

Eight years ago, Greg Jackson asked:

> Can there be effective campus *leadership* for information technology without central *control* of information technology? . . . As the strategic importance of information technology increases, entrusting it to a single individual can be dangerous for an institution, especially if that individual speaks the language of technology rather than the language of higher education or if that individual is organizationally and geographically isolated. At the same time, a large fraction of information technology is indeed a critical utility, one whose failure can jeopardize the institution. Much information technology thus must be managed as a critical utility.[4]

So perhaps the word *trumps* is overstated. The key lesson is that as control over key technologies moves to individuals or outside entities, IT management challenges evolve. The skills and experience required of campus IT leaders need to evolve as well. IT leaders' behavior must depend less on control and more on collaboration and negotiation.

Collaboration is hard, especially if it requires institutional commitments. Success requires adequte resources, clear goals, evolving finances, organizational flexibility, or, most commonly, all the above.

**Collaborations Are Iffy**

Collaboration among institutions is a long-standing and distinctive attribute of higher education. Faculty, for example, commonly undertake research with colleagues at other colleges and universities. They use textbooks and other curricular materials developed elsewhere. On the administrative side, staff from the finance, facilities, human resources, general counsel, library, and other departments freely borrow ideas and practices from colleagues on other campuses.

IT professionals do the same—informally, online, and at physical gatherings under the auspices of international IT associations such as EDUCAUSE, sector-based entities such as the League for Innovation in the Community College and the Consortium of Liberal Arts Colleges (CLAC), regional entities such as the NorthEast Regional Computing Program (NERCOMP) and the Big Ten Academic Alliance (BTAA, earlier known as the CIC), and *ad hoc* entities such as the Common Solutions Group (CSG) and Merlot.

Some IT collaborations have gone beyond sharing and borrowing. These include "buying club" consortia such as the Midwestern Higher Education Compact (MHEC), shared-development entities such as the New Media Consortium (NMC) and various Mellon-initiated projects including Sakai, attainment-oriented efforts such as the California Community Colleges' California Virtual Campus–Online Education Initiative (CVC-OEI), and research and education networks (RENs) such as the regional NEARnet, CICnet, and CENIC and their national analogues Internet2 (I2), National LambaRail (NLR), and The Quilt.

These deeper collaborations entail common efforts, standardized practices, and in many cases substantial commitments of institutional money and staff. Some of these collaborations have worked exactly as intended. Some have shut down or been absorbed. Most of those that have survived evolved to accommodate changing circumstances.

Consider, for example, the evolution of Internet2. The stated mission of Internet2 was to enable high-performance networking within and among research universities. The strategy was to consolidate these institutions' buying power by standardizing their specialized research and related requirements and then collectively approaching major vendors with specific plans for a national high-performance network mesh.

This required major commitments and investments from member campuses. Thirty institutions signed up right away, and this had the desired effect: major backbone network providers rearchitected some of their infrastructure to serve higher education and sold national network capacity at a fixed rate rather than based on network routing and consumption. Colleges and universities were able to operate with abundant flexible bandwidth, which had—and continues to have—profound, positive effects on how faculty, students, and administrators exploit networks.

All went well until Internet2, which had grown well beyond its initial committed members, faced some structural, competitive, and financial challenges. These issues induced some of the original members to create a rival entity, National LambdaRail (NLR), in 2003. Years of competition between the two ensued, ultimately ending in the dissolution of NLR in 2014 and the subsequent expansion of Internet2's mission to include NLR's goals and infrastructure. Successfully accommodating first the challenges and then the expansion required significant changes in how Internet2 organized itself and funded its operations.

Similarly, the California Community Colleges' CVC-OEI recast its mechanisms for campus relationships when it became clear that the original model—depending on a single point of contact who also was an advocate—sometimes inadvertently left senior campus executives in the dark as to the CVC-OEI's specific requirements. CVC-OEI now engages its member campuses through an expanded array of relationships with key stakeholders at senior and operational levels. That has enabled smoother progress toward the CVC-OEI's goal of using online

instruction and tools to maximize educational attainment and degree completion for community college students.

But CICnet shut down when its financial plan proved to be overly optimistic with regard to equipment replacement (see "Technology Costs More," above) and when adding customers couldn't make up for that miscalculation. The NMC was absorbed by EDUCAUSE after some organizational surprises proved intractable. Chandler, a CSG-sponsored collaborative effort to develop open-source personal management applications, failed when its participants underestimated a third-party partner's requirements, overestimated its capabilities, accepted overly optimistic reports of progress, and failed to recognize that the market moment had, in any case, passed.

### *We Shoulda Known!*

Collaborations work only if participants are fully committed to them, recognizing and accepting obligations and accounting for expectations. Participants must openly share information about how the collaboration is working, the challenges it faces, and choices regarding how to address those challenges.

Moreover, collaborations must be fiscally sound over their anticipated term. This typically requires not only realistic long-range planning (e.g., properly depreciating equipment and budgeting for management) but also substantial capitalization in the form of member contributions, outside corporate or government support, stable revenue streams, and/or some combination of all of those. Finally, collaborations need to remain flexible, since circumstances, challenges, and opportunities can change with little warning.

Internet2, CVC-OEI, and many other collaborations have adapted to changed circumstances, and their success provides useful lessons for how future collaborations should proceed. Collaborations that have failed also offer helpful lessons—but for how *not* to proceed. The point is that collaboration is hard, especially if it requires institutional commitments. Success requires adequate resources, clear goals, evolving finances, organizational flexibility, or, most commonly, all the above.

## Lessons for the Future from the Past

Hindsight is easy. Even so, as we suggest above, hindsight too often emphasizes what success tells us to emulate rather than what failure tells us to avoid. If the intelligent use of information technology is going to advance higher education, that use must be guided as much by lessons from failure as by lessons from success.

EDUCAUSE and the other entities and mechanisms through which IT professionals in higher education communicate enable us to work toward this goal. They do so by organizing gatherings, publishing perspectives, hosting discussions, and/or enabling conversations.

Yet talking about failure isn't fun, and it isn't energizing, so we naturally tend to avoid doing so. Only when we stop avoiding these discussions and fully follow Ormerod's and Santayana's advice to learn from our mistakes and from our past will our efforts be properly productive. *We shoulda known!* ■

**Notes**

1. There's no authoritative evidence for the story, and variants have been told before—for example, about Christopher Wren, the English architect who designed St. Paul's Cathedral, and a construction worker at the building. For a recent retelling of the JFK story, see Mark Zuckerberg's commencement address at Harvard University: *The Harvard Gazette*, May 25, 2017.
2. Jackson remembers March using the "sitting around on rocks" image in meetings and conversations when March and he both taught at Stanford in the late 1970s. The more general point about higher education is from Michael D. Cohen and James G. March, *Leadership and Ambiguity: The American College President* (New York, NY: McGraw-Hill, 1974).
3. Randel made both observations frequently in faculty, trustee, andother meetings where Jackson, who then worked for him, first heard them. Ron Grossman also quoted Randel in "U. of C. Picks Music Man to Lead Way," *Chicago Tribune*, December 10, 1999.
4. Gregory A. Jackson, "The Shrinking CIO?" *EDUCAUSE Review* 46, no. 1 (January/February 2011).



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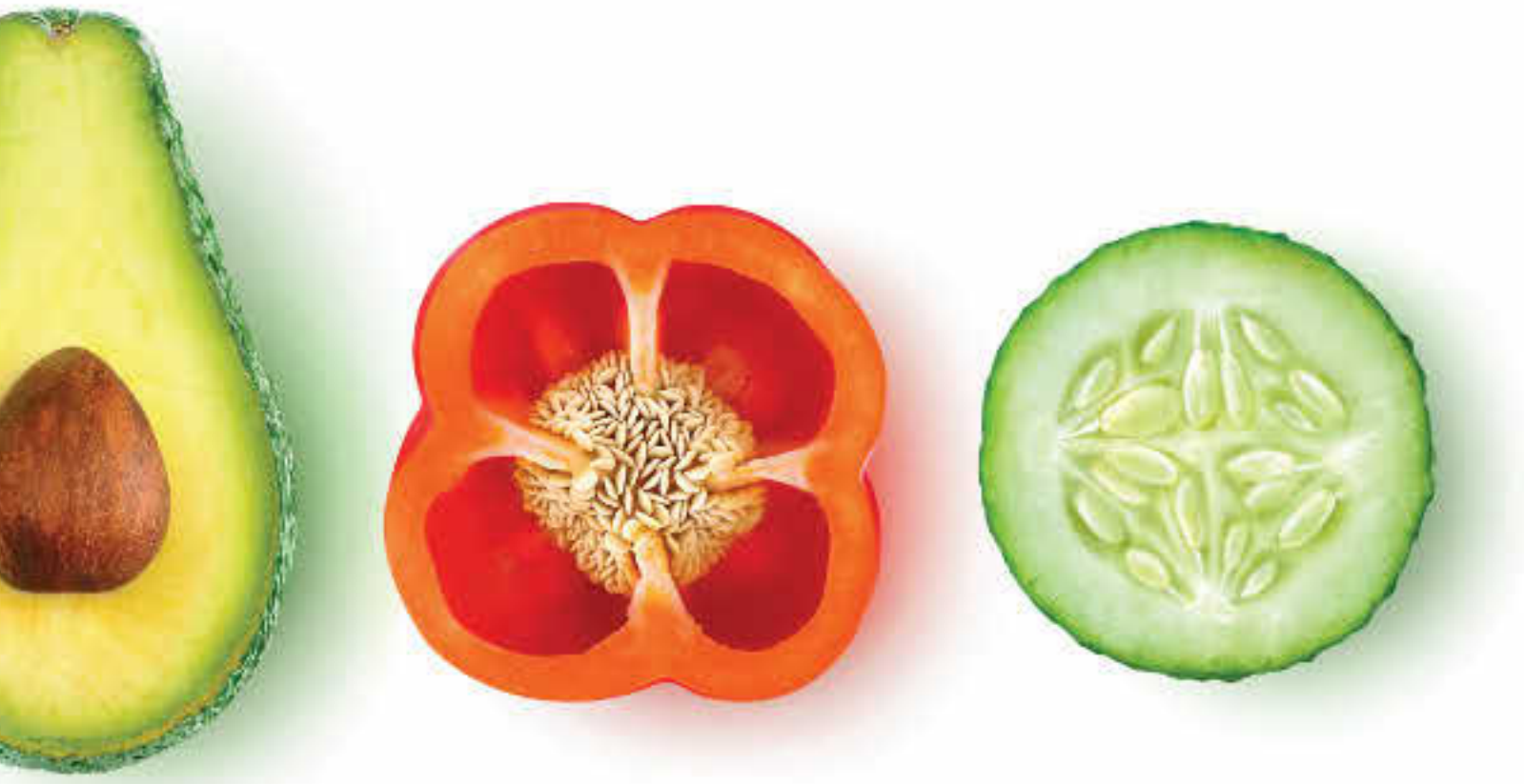
# 5 Principles for Thin



# king Like a Futurist

By Marina Gorbis

In 2018 we celebrated the fifty-year anniversary of the founding of the Institute for the Future (IFTF). No other futures organization has survived for this long; we've actually survived our own forecasts! In these five decades we learned a lot, and we still believe—even more strongly than before—that systematic thinking about the future is absolutely essential for helping people make better choices today, whether you are an individual or a member of an educational institution or government organization. We view short-termism as the greatest threat not only to organizations but to society as a whole.

In my twenty years at the Institute, I've developed five core principles for futures thinking:

1. **Forget about predictions.**
2. **Focus on signals.**
3. **Look back to see forward.**
4. **Uncover patterns.**
5. **Create a community.**

## Forget about Predictions.

If somebody tells you they can predict the future, don't believe them. Nobody can predict large sociotechnical transformations and what exactly these are going to look like. We are getting better at making point predictions. There are prediction markets and all kinds of data-rich tools with which we're trying to predict elections, market share prices, and the success of product introductions. All of these focus on one particular event, a particular point. But a lot of our work at the Institute for the Future is focused on comprehending big, complex transformations—rather than just one thing, one event. We're looking at the interconnection between technologies and society and economics and organizations.

One way to think about this is to look at the difference between waves and tides. Waves are what we see on the surface. They are fleeting events, they come and go, appear and disappear. But there is something bigger underneath that is causing these waves. Underneath the waves is the tide, causing all kinds of disturbances of which waves are just one sign. Our work involves trying to understand those tides, the deeper forces underneath the waves.

***Futures Thinking Is about Readiness***

So, if no one can predict the future, why think about it? Because doing so helps you to inoculate yourself. In the medical field, inoculating yourself prevents you from falling ill. In futures thinking, if you've considered a whole range of possibilities, you're kind of inoculating yourself. If one of these possibilities comes about, you're better prepared.

***Futures Thinking Is about Seeing New Possibilities***

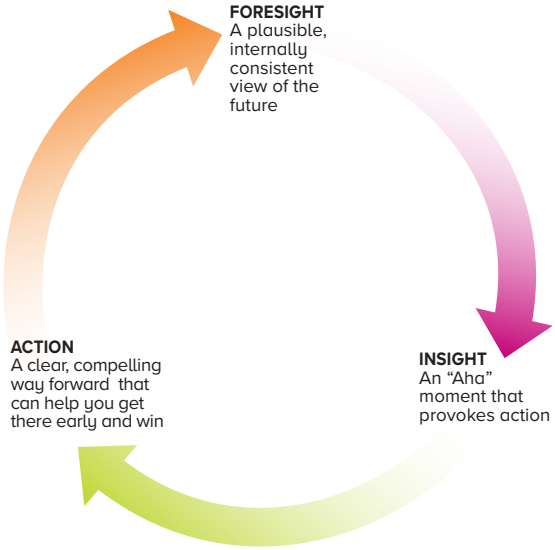
Thinking about the future is also about imagining. It's about transforming how we think. It's about creating a map to the future and looking for the big areas of opportunity. We like to think about transformations, for example, in learning and work, and how they get connected and intertwined in various ways. And then we start thinking about zones of opportunity. How can we shape the future to make it more equitable? How can we amplify learning outcomes? What do we need to do to achieve these outcomes?

The future doesn't just happen to us. We have agency in imagining and creating the kind of future we want to live in, and we can take actions to get us there.

When we think about the future at the Institute, a ten-year horizon is our "sweet spot." This is for multiple reasons. Ten years is a safe place. People don't bring a lot of turf issues when thinking that far out, and they can agree on a desirable future to consider and to prepare for.

We use a cycle that we call the F-I-A process: foresight to insight to action (see figure 1). We believe that any successful strategy is based on a good insight about the future. So, as you think about the future and consider the tides—that is, as you develop *foresight*—ask yourself a question: What does it mean for us? What's the *insight*? The same foresight, the same possibility, or the same tide may offer very different insights depending on your type of industry or organization. For example, if we're moving to a new way of accreditation or credentialing, one very different from traditional degrees, the insights will likely vary depending on your institution. Ultimately the goal is to use this foresight and the resulting insight as a way to determine the *action* to take. Although the foresight is usually five to ten years out, the action may be needed today or six months from now. What do we need to do today or tomorrow to either prepare for that future or to shape it in a more desirable direction?

**Figure 1. Foresight to Insight to Action Framework**




*Source:* Institute for the Future, 2007

## Focus on Signals.

What tools do we have to help us systematically think about the future and develop foresight? There is no data about the future; all the data we have is about the past. Historical data is useful when things continue as they are. You can just continue planning for the same trajectory. That's fairly easy.

The situation is different when things are changing and there are inflection points. I think we are in this space right now: notions of what learning is, how and where people learn, and the value of degrees and who grants degrees are all changing. What tools do we have to help us think about the future in this landscape? At the Institute for the Future, we use what we call *signals of the future* to help us develop foresight.

The science fiction writer William Gibson famously said, "The future is already here, it's just not very evenly distributed." Indeed, signals of the future are all around us today. Often these are things or developments that are on the margins. They may look weird or strange. They are the kind of things that grab your attention and make you ask: "Why is this happening? What is going on here?" A signal can be anything. It could be a technology, an application, a product/service/experience, an anecdote or personal observation, a research project or prototype, a news story, or even simply a piece of data that shows something different. Recently I read that 62 percent of jobs today do not afford people with middle-class livelihoods. For me, that was a signal. Unemployment is low, and the economy is booming. What is going on here? A signal is anything that makes you want to dig in and say: "Why? What is causing this situation?"

Let's take as examples an old signal and a new signal. In 1995, eBay first appeared on the horizon and created a lot of excitement. Strangers began to trade with each other. You trusted somebody you'd never met to sell you something, and you agreed to pay them! The significant signal here, the critical innovation of eBay, was the creation of a reputation system, for both the seller and the buyer. The creation of this online reputation system enabled strangers to conduct economic transactions easily. This idea could be carried into many different arenas, and it was. Today, all online transactions rely on some sort of a reputation system. Online reputation has become a new kind of currency. When I was a child, we were told: "Don't get into cars with strangers." Now most of us don't think twice about getting into Uber or Lyft cars with complete strangers. So, this signal, this notion of online reputation markets, changed the whole industry, allowing new kinds of transactions in which strangers come together. Just a few examples are Uber/Lyft, Upwork, LinkedIn, and the whole ecology of badges certifying that someone has certain skills or abilities.

That's the old signal. An example of a new signal is a video billboard in Sweden. It's placed at a bus stop. If somebody at the bus stop starts smoking, the billboard plays a video of a person choking. What this signal shows is that what used to be on our laptops and desktops—all of this information, all of this content—is moving into the real world. It will become available not just on billboards but all around us. We've talked about how the whole world can become infused with media, and that has happened. We can access content almost anywhere and interact with it.

If you are a futurist, you will get into the practice of looking for signals all the time. When you wake up in the morning and read the news, you will look at everything through the lens of these signals. You will naturally ask about events: "Is this a signal of something? Why?" This kind of curiosity and the ability to continually sense while also sharing with others is very important.

Ideally, people in organizations will think about signals and get together to share their observations. I call this *sensing*. To be a sensing organization, staff need to create some means, formal or informal, of aggregating these signals and working to interpret them. This will allow feedback and direction on what to do next.

## 3 Look Back to See Forward.

I said earlier that there is no data about the future; the only data we have is about the past. While we cannot fully rely on past data to help us see the future, there are larger patterns in history that we tend to repeat over and over again. Thus, we need to look back to see forward. I've started to think of myself as a historian as much as a futurist. I'm trying to understand the larger story and to place what is happening today and what we see on the horizon into a larger context. We don't repeat our history completely, but we do repeat patterns. If we look at the invention of the printing press and the debates and worries that people had at that time, we see that those concerns are very similar to our current debates and worries about fake news, computational propaganda, bots and

how they skew our public opinion.[1] It's almost eerie. People were talking about fake information and propaganda and lies all those years ago!

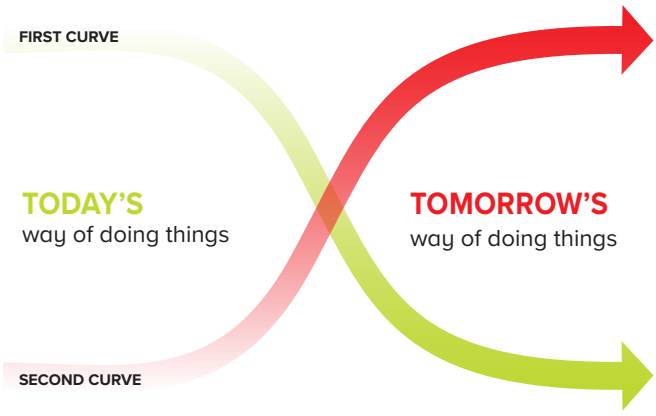
What is the larger pattern? Changing our fundamental information, communications, and infrastructure changes our society in very dramatic ways. Why? Because of power dynamics. New media tools alter who has the voice, who has the platform, and who has the ability to shape opinion. In Gutenberg's days, the authority was with the church, which held the ultimate truth. But with the printing press, people could distribute leaflets. Luther nailed his thesis on the church doors. At that time, the transformation in the media led to social transformations, to scientific revolution, and even to wars. Eventually people created new rules, new regulations, new principles around how to value and assess this information and how to decide who has the authority to say what is true or not true. We are in the process of trying to figure this out again. This is our Gutenberg moment.

## Uncover Patterns.

Ultimately, the goal of aggregating signals and connecting these to the larger historical context helps us understand patterns of change—the deeper tides I mentioned earlier. It helps us understand how we got to key developments shaping our future. What is the larger story? What are the tides of change? At the Institute for the Future, we've been working with a pattern that we call the Two-Curve Framework. It comes from Ian Morrison, former president of the Institute for the Future, who wrote the book *The Second Curve*. In the book Morrison argues that in any period of large transformation—which I think we're going through now—we are simultaneously living along two curves (see figure 2).

The first curve is the descending curve. This is the curve we've lived on for a long time. We have rules, we have regulations, we have usage patterns, we know how to live this way. But that way of doing things is slowly declining, and we don't know the exact angle of the decline. At the same time, a new way of

**Figure 2. The Two-Curve Framework**




*Source:* Ian Morrison, Institute for the Future, 1996

**Institute for the Future (IFTF)** is the world's leading futures organization working with businesses, governments, educational institutions, and social impact organizations to leverage its global forecasts and custom research to navigate complex change and develop world-ready strategies.

**IFTF's Foresight Training** program leverages over 50 years of futures content, tools, and methodologies to help individuals and organizations build foresight capacity. Our three-day introductory training in futures thinking creates new views of transformative possibilities in support of a more sustainable future.

doing things is emerging: a nascent curve. We're in the early stages—we're just now seeing signals of it—but this curve tells us something about a new way of doing things.

What we see, and what I write about in my book *The Nature of the Future,* is that the declining curve, the curve on which we've existed for a long time, is the curve of *institutional production*. It is a system in which most resources—money and people—are concentrated in large formal organizations, whether corporations, news organizations, or colleges/universities. But this way of doing things is on the decline. We're moving from institutional production to what I call *socialstructed creation*. In this way of doing things, a platform engages large numbers of people to create something that no formal organization could, with no or very little formal structure. The best example is Wikipedia. Today, the Wikipedia Foundation has about 300 staff and contractors, but the online encyclopedia has millions of contributors and billions of users from all around the world. Together they created what no one organization could create. We're seeing this new way of doing things in open-source software, in the news media, and in other parts of our lives.

Moving from the old to the new curve requires one to behave like an immigrant. I am an immigrant to this country, and I strongly believe that we are all immigrants to the future. We are all moving somewhere new, so it is good to have the mindset of an immigrant. When you're an immigrant, you must learn a new language, a new culture, a new way of doing things. These are exactly the attitudes and skills we need to bring to thinking about and shaping our future. We must be open to learning a new language, a new culture, a new way of doing things.


## Create a Community.

Being a futurist or thinking about the future is not a solitary affair. I have a lot of distrust for people who say: "I'm a futurist. I went to a mountaintop, and I saw this vision, and this is your future." That's not real futurism. Thinking about the future is a collaborative and highly communal affair. It requires a diversity of views. We need to involve experts from many different domains. When we think about anything, from higher education to work, we need to include people who bring different perspectives on the topic—demographics, economics, technology, artificial intelligence, organizations. We need young people in the room. A robust forecast is a collective endeavor; it's very much a product of collective intelligence. So, if you're going to create a sensing and signaling mechanism in your organization, make sure you're not bringing in people who all think the same way. Be sure to create a diverse group of people who can contribute their varied experiences and their differing knowledge to give you much more robust views of the future.

A few years ago, the Institute for the Future brought together a group of experts and contributors to develop a forecast that ties together innovations in blockchain technologies, new patterns of working and learning, and new forms of assessment. The product of this research was a provocative video scenario titled "Learning Is Earning 2026."[2] What if we could bring blockchain and new reputation systems together in education? What would that scenario look like? What would it mean for students? For educators? What

challenges would be created? We produced the video to raise these questions and to provoke conversations.

## Conclusion

Fifty years ago, Alvin Toffler warned us of the impending "future shock," a condition not unlike the culture shock experienced by travelers to foreign countries, involving disorientation, irrationality, and malaise. "Imagine not merely an individual but an entire society, an entire generation—including its weakest, least intelligent, and most irrational members—suddenly transported into this new world. The result is mass disorientation, future shock on a grand scale."[3]

We seem to be living Toffler's future today. Between climate change, media disruption, and the rise of automation and machine intelligence, many people are feeling like they are victims rather than makers of the future: they are victims of the future shock. To overcome this malaise, we must answer Toffler's call to make futures thinking a way of life not just for a few innovators in Silicon Valley but for everyone—including students, educators, and average citizens.

At its best, futures thinking is not about predicting the future; rather, it is about engaging people in thinking deeply about complex issues, imagining new possibilities, connecting signals into larger patterns, connecting the past with the present and the future, and making better choices today. Futures thinking skills are essential for everyone to learn in order to better navigate their own lives and to make better decisions in the face of so many transformations in our basic technologies and organizational structures. The more you practice futures thinking, the better you get. The five principles outlined above—not focusing on predictions, uncovering signals, understanding historical trajectories, weaving together larger patterns, and bringing diverse voices into the conversation—should help you on your journey of making futures thinking a way of life for you and your community. ■

**Notes**

1. Gorbis, "Our Gutenberg Moment," *Stanford Social Innovation Review*, March 15, 2017.
2. "Learning Is Earning 2026," March 6, 2016, is available on the Institute for the Future YouTube channel: https://www.youtube.com/user/IFTFvideo/.
3. Alvin Toffler, *Future Shock* (New York: Random House, 1970), 12. The book grew out of an earlier article: Alvin Toffler, "The Future as a Way of Life," *Horizon* (Summer 1965) 7, no. 3.



**Marina Gorbis** is Executive Director of the Institute for the Future. She is the author of *The Nature of the Future: Dispatches from the Socialstructed World*.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# Collaborating to Offer Access for California Students Online

**California is known** for innovation in many sectors: technology born in Silicon Valley, fine wine crafted in Sonoma County, television shows and movies produced in Hollywood, and many other regional contributions. In recent years, California has also focused on innovation within and across its three systems of higher education.

In 2013, Governor Jerry Brown and the state legislature funded online learning initiatives for the California Community Colleges (CCC), the California State University (CSU), and the University of California (UC) systems, each of which is governed independently. The goal of these programs was to leverage the size and innovation of the three segments to better meet the needs of populations that—based on economic, lifestyle, or other barriers—lacked access to a traditional brick-and-mortar education.

Five years later, these initiatives are bearing fruit and are shifting the paradigm of student access to online courses in the Golden State.

With similar mandates to multiply access to online courses across colleges and universities within the California systems, the group was able to identify common challenges that **a little bit of joint effort might go a long way to solving.**

## The Genesis of Collaboration

In November 2017, the Brown administration organized a meeting with online learning leadership from each system, along with leaders from selected private and nonprofit colleges and universities, to discuss opportunities to build intersegmental and public-private cooperation designed to increase access to online learning for Californians. This meeting, and the conversations that followed, set the stage for unprecedented collaboration among online programs.

With similar mandates to multiply access to online courses across colleges and universities within the systems, the group was able to identify common challenges that a little bit of joint effort might go a long way to solving. Some academically oriented topics of discussion included evaluating approaches toward online course quality standards and rubrics, developing infrastructure and strategy to facilitate the sharing of open content, identifying complementary resources or strategies to support accessibility of online platforms and content, and sharing professional development resources for faculty and staff. Perhaps surprisingly to some, a major area of opportunity emerged around the coordination of purchasing and contracts. Because each segment is governed by the same or similar public contracting regulatory framework in California, opportunities to leverage each other's contracts could avoid duplication, result in cost savings, and provide more equitable access to educational technology across institutions in each higher education segment.

One day in the spring of 2018, the topic of course search and enrollment across campuses came up in a conversation between CSU and CCC staff. At that point, both had been focused on their own system-wide, cross-enrollment initiatives surrounding general education and transfer course completion. The CSU was actively promoting cross-enrollment across its 23 campuses through Cal State Online, and the CCC was evolving the Online Education Initiative (OEI) by integrating and innovating its legacy California Virtual Campus (CVC) to create the CVC-OEI.

## Goodwill and Common Needs

With goodwill having been built among the players, leaders from Cal State Online and the CVC-OEI came together to focus on the shared interests of students from both segments by accelerating completion through summer courses. What leaders from the CSU and the CCC recognized was that there was an opportunity to use the summer term as a test-bed. Because of the tuition, funding, and enrollment complexities in each system, summer presented somewhat "neutral" territory to share students between the segments. In other words, many of the normal barriers were lessened during the summer term. After all, 93 percent of new undergraduate transfers to the CSU come from the CCC, and roughly half of the overall CSU student population consists of transfer students from the CCC.

This meant that a significant number of CSU students already had a prior "home" community college and that some would be physically returning to their local community during summer break. Being able to pick up an extra class or two online could help these students graduate faster, in line with the CSU Graduation Initiative 2025. Similarly, students currently enrolled at a CCC campus could gain access to online versions of courses not offered at their local institution, in line with the Chancellor's Vision for Success, or they could test out a general education course through the CSU.

With 115 colleges in the CCC and 23 in the CSU, a plan to provide students with massively amplified online course access was born. Collectively, through Cal State Online and the CVC-OEI, the project would give over 2 million college students access to more than 10,000 online, transfer-level courses offered by the CCC and CSU systems.

### Implementing across Two Large Systems

Both of these systems have learned that helping students to cross-enroll between institutions is not a simple matter. In the CCC, each of the 73 districts manages its own student information system; these systems are not standardized across districts or colleges, creating significant data-automation challenges. The 23 CSU campuses are on the same enterprise student information system platform, but implementation variances between colleges provide another set of challenges. As it turned out, the significantly lower enrollment activity in summer was also a good opportunity to test some new tools and service providers.

Additionally, leaders from both systems saw opportunities to improve the student experience. Gathering online class inventory, helping students navigate it, comparing the inventory against an aging course articulation database, and giving students a clear pathway to apply and enroll all posed significant challenges—ones that both the CSU and the CCC had already been working on in parallel but slightly different ways. With the two segments working together, both could leverage shared marketing, reduce the total spend, and achieve more than they would individually.

A preexisting Cal State Online summer campaign named Finish Faster was revamped and jointly adopted by the CCC. Cobranded marketing collateral and student-outreach strategies were engaged to raise awareness about the universe of online classes available through the program.

Both systems partnered with the commercial course search provider Quottly, which had already indexed the state's ASSIST online transfer information system, to create a customized, searchable interface. Students could search by transfer area requirement or subject and could choose from classes badged and sorted for quality review, online tutoring integration, and online readiness activities. Further integrating modern functionality, students could search via a mobile device and could refine their search by attributes such as start date, term length, and end date. Similarly branded but distinct CVC-OEI and Cal State Online entry points were created, with both containing courses from the CCC and the CSU, so no matter which entry point CCC or CSU students used, they would all have access to the same inventory.

### Results and Lessons Learned

The results of the Finish Faster project—which was put together in a relatively short timeframe—were better than expected. The project resulted in just over 141,000 clicks on the digital ads delivered via Facebook, Google, Instagram, and Pandora. Surveys and application data were gathered separately from the CCC and CSU systems. Cal State Online reported that the vast majority (94%) of its students using the system did so to complete GE requirements, while about a third were taking courses to help them graduate on time. Interestingly, 28 percent reported that they were using the system to complete their final course for graduation. Both systems saw heavy usage from students working full- or part-time (over 80%), and 67 percent of Cal State Online students were from minority groups (this data was not readily available for CCC students). CCC students reported that their top three reasons for enrollment through the CVC-OEI were (1) to finish transfer requirements to the CSU or UC; (2) to find online classes not available at their home institution; and (3) to finish local degree or certificate requirements. The most-searched courses across both segments were math/quantitative reasoning, English composition, and oral communication/speech.

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Since the conclusion of the project, collaboration continues between the segments. The CCC has taken the platform that was used over the summer and is evolving it to expand streamlined automation of cross-enrollment between the 56 colleges in the CVC-OEI Consortium, including functions such as live data, real-time seat counts, and automated financial aid processes. Cal State Online also continues to further its work across the CSU system and has proposed a repeat campaign in summer 2019 in partnership with the CCC.

This project demonstrates that California is creating a network approach to providing students with access to its higher education system. An additional ingredient will be its newly funded fully online community college, (http://www.ccconlinecollege.org) another catalyst for change targeted at working adults as online learning matures and transforms our institutions. In order to continue providing a high-quality, accessible online learning pathway for our shared and unique students, all segments and institutions must continue to collaborate. Doing so has opened a world of possibilities for the students we serve. ■

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# Using Linked Data for Discovery and Preservation

*"If linked data is so important, why isn't everyone using it?"*

*"Libraries need to express their collections as linked data. . . . It's one of the most important web technologies."*

**I have heard both** of these statements during meetings this year, but for me, they seem to be at odds with one another. Linked data has been discussed since the beginning of the World Wide Web 30 years ago (i.e., the so-called semantic web). For something potentially so important, this begs the question: Why hasn't linked data more directly affected galleries, libraries, archives, and museums (aka GLAM)?

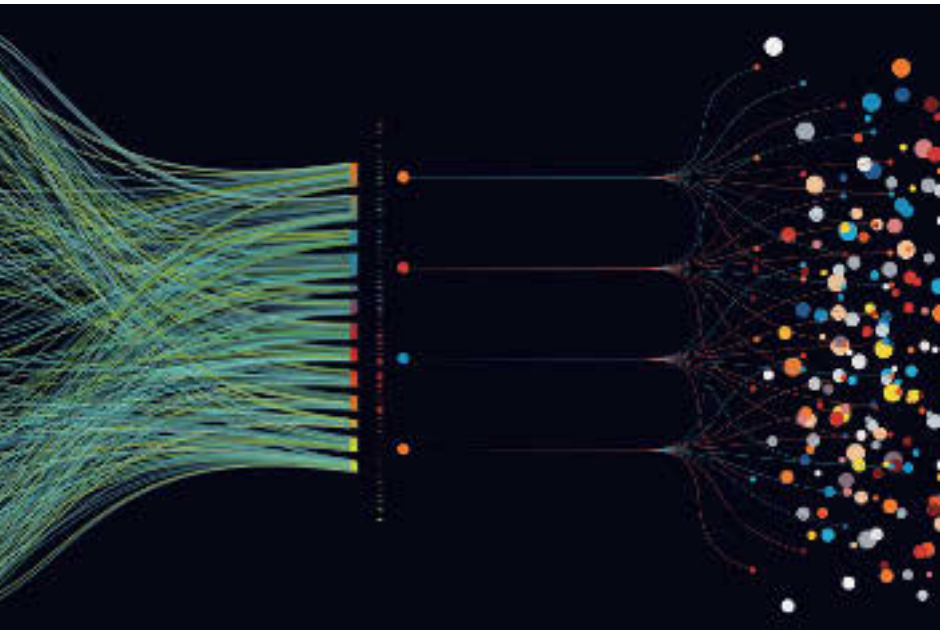
The following definition of *linked data* comes from Wikipedia: "A method of publishing structured data so that it can be interlinked and become more useful through semantic queries." Essentially, linked data has been proposed as the means by which the web can move from being a collection of documents to a global data space where people and machines can not only discover data but understand and infer the associated relationships.

Tim Berners-Lee, known as the inventor of the web, listed four principles for linked data:

1. Use URIs to name (identify) things.
2. Use HTTP URIs so that these things can be looked up (interpreted, "dereferenced").
3. Utilizing open standards such as RDF and SPARQL, provide useful information about what a name identifies when it's looked up.
4. When publishing data on the web, refer to other things using their HTTP URI-based names.[1]

Furthermore, in 2009 Berners-Lee offered three "extremely simple" rules for linked data:

1. All kinds of conceptual things, they have names now that start with HTTP.
2. If I take one of these HTTP names and I look it up . . . I will get back some data in a standard format, which is kind of useful data that somebody might like to know about that thing, about that event.
3. When I get back that information, it's not just got somebody's height and weight and when they were born, it's got relationships. . . . And when it has relationships, whenever it expresses a relationship, then the other thing that it's related to is given one of those names that starts with HTTP.[2]



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While these principles and rules may seem simple, they belie a complex set of data models, schemas, and ontologies, particularly related to RDF. RDF is a highly canonical, schema-less model that can support powerful search, interpretation, and relationships. However, both the learning curve and the implementation path for RDF are steep.[3]

In recent years, several developments have lowered the barrier to entry (with perhaps a corresponding trade-off in capability) to linked data. Though the metaphor may be crude, this is similar to the early debates regarding SGML and HTML. SGML provided greater capability for processing and interpreting web-based content, but the advent and the proliferation of HTML provide evidence that ease of use fosters adoption more effectively.

Rob Sanderson, semantic architect for the J. Paul Getty Trust, affirmed this point in 2016 when he noted that if developers cannot adopt or leverage an approach for linked data, that approach is unlikely to gain much traction. He elaborated that if one has to choose among the triad of complete, usable, and accurate, choosing *usable* will result in the most traction and highest adoption.

Sanderson noted that the International Image Interoperability Framework (IIIF) Presentation API, Schema.org, and the Europeana Data Model are good examples of the balance between complete, usable, and accurate.[4]

OCLC's International Linked Data Survey of the library community provides evidence of the growing use of linked data, though it notes use within sectors such as e-commerce, medicine, scientific research, and government services in addition to growth within research institutions and cultural heritage organizations. It is worth adding that OCLC also identified responses from service providers and the presence of linked data projects in production for at least four years, both signs of a maturing landscape.[5]

At the 2018 ASIST conference, Matt Mayernik from the National Center for Atmospheric Research described a useful framework for classifying linked data tools and services. Looking both retrospectively and prospectively, Mayernik identified four categories: Relationship Identification; Relationship Validation; Relationship Characterization; and Relationship Preservation. One of the linked data services Mayernik identified in the Relationship Preservation category is RMap, developed by my institution—the Sheridan Libraries at Johns Hopkins University—in partnership with IEEE and Portico through a grant from the Alfred P. Sloan Foundation. RMap, which is based on a flattened or simplified version of the OAI-ORE protocol, expresses and preserves the map of items related to a scholarly work. The current RMap service contains information graphs related to IEEE's article database.

The Sheridan Libraries is applying RMap in additional ways through the Black Press in America (a collaboration with the Johns Hopkins University Press Project MUSE) and the Archaeology of Reading (a project funded by the Andrew W. Mellon Foundation). For the Black Press in America, RMap will be used to identify the connections between print books, open ebooks, and content presented through a customized Mirador application, which is an IIIF-compliant viewer. For the Archaeology of Reading, RMap is being used to display "research findings" or pathways of exploration through the digital content. A research finding is defined as "an ordered list of actions taken by the user in a certain state." By mapping research findings, scholars will be able to keep track of their own exploration through digital resources, share those explorations with others (especially for teaching and learning), and maintain a record of those explorations. In this case, the nodes within the graph represent different states of the viewer or application, and the links between them represent the pathways.

RMap represents one possible approach for linked data applications in the GLAM sector. The Association of Research Libraries recently issued a draft white paper focused on possible collaboration with WikiData. The Arches project at the Getty Conservation Institute represents another application with a museum collection focus. But rather than identifying a comprehensive list, I would like to point out the growing use and possibilities of linked data within the GLAM sector.

While the lower barrier to entry approach (including RMap) has fostered greater adoption of linked data, I believe that if any community should embrace the higher degree of challenge associated with a full implementation of RDF-based approaches, it should be the GLAM sector. The disadvantage of lightweight linked data approaches is that they are often context-specific or raise challenges with migration or do not account for provenance or persistence. The GLAM sector in particular should care about a global, comprehensive approach with a foundational underpinning of preservation when considering linked data.

Returning to the two statements at the beginning of this column, I'd like to note that while not everybody is using linked data, there are clearly more organizations and applications, particularly from the private sector, that are doing so. Every time our community uses a Google service, we contribute to its information graph—and Google is not sharing those graphs back with us. Perhaps the more relevant question is: "If linked data is so important, why isn't it being more broadly utilized in the GLAM sector?"

As for the second statement, when I first joined the research library at Johns Hopkins, I noted a handout for our students that stated: "Why you should use the library instead of Google." At this point, everyone in the GLAM community would agree that if collections do not appear in a Google search, they are largely invisible. Very soon—if not even now—if collections do not appear on an information graph, they will be largely invisible. If the GLAM sector does not express its collections in linked data, it will not have a voice in the evolving forms of discovery and preservation being made possible by this global, interrelated collection of data. ■

If the GLAM sector does not express its collections in linked data, it will not have a voice in the evolving forms of **discovery and preservation being made possible by this global, interrelated collection of data.**

**Notes**

1. Tim Berners-Lee, *"Linked Data"* (website), July 27, 2006 (updated on June 18, 2009).
2. Tim Berners-Lee, *"The Next Web,"* TED2009 (February 2009).
3. Tom Heath and Christian Bizer offer a useful description for implementing linked data based on RDF in chapters 4 and 5 of their book *Linked Data: Evolving the Web into a Global Data Space*, Synthesis Lectures on the Semantic Web: Theory and Technology (Williston, VT: Morgan & Claypool Publishers, 2011). While useful, the description also provides evidence regarding the complexity of such an implementation.
4. Rob Sanderson, *"Community Challenges for Practical Linked Open Data,"* December 15, 2016.
5. For a summary of this OCLC survey, see Karen Smith-Yoshimura, *"Wrapping Up the 2018 International Linked Data Survey for Implementers,"* Hanging Together (blog), December 5, 2018.

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# Research Computing in the Cloud: Leveling the Playing Field

**Imagine you're a researcher** at a regional university or a small college, and you want to analyze a big data set or perform an experiment that requires massive amounts of computing power and storage. Until recently, you had the difficult task of trying to get access to equipment worth thousands or millions of dollars, equipment that your institution couldn't procure or support. But today, advances in cloud computing mean that you can "rent" such equipment, often for hundreds or thousands of dollars. Such is the dramatic revolution in access to high-end computing resources enabled by Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform, as well as others.

Traditional high-performance computing (HPC) presents major challenges for research faculty at most campuses. First is the high cost of acquisition. A small computing cluster can cost a hundred thousand dollars or more, and the sky's the limit. Second, most academic and IT departments lack the specialized expertise to support such equipment—in some cases, they may not even have an appropriate place to house it. The lack of in-house support means that campus researchers spend valuable time specifying, configuring, and operating HPC, and unless HPC is your research area, that time detracts from valuable research time. Large research universities may use graduate students to do some of this work, but even so, this is often not the most productive use of their time either.

Furthermore, HPC is often funded by one-time research grants and quickly becomes obsolete. Frustrated researchers find their once state-of-the-art computing clusters aging and look to institutional support to keep them updated—support that's often not available. Without technical and administrative support, in-house technology can be underutilized. HPC in one department might be used by researchers in another department, if they know it exists, if they have documentation and assistance, and if a scheduling process is available to support equipment sharing. In the absence of this infrastructure, valuable equipment in one department or college often sits idle while another department struggles to obtain funding for its own HPC.

The universal availability of commodity cloud services and high-speed networks can eliminate the requirement that departments must have local HPC resources. The infrastructure available from large cloud providers such as AWS dwarfs and outperforms all but the largest and most-specialized supercomputing facilities. Researchers can design and deploy experiments requiring hundreds or thousands of high-end processors in short timeframes, creating access for research faculty, graduate students, and even undergraduate students to HPC environments that were unimaginable just a few years ago.

Modern programming tools such as Docker and Kubernetes enable researchers to build, scale, and share massively parallel computation analysis and experiments. As one researcher told me: "I can re-create the exact same environment my colleagues at NASA are using, without having to configure a single piece of hardware. Most people just don't get how big a deal this is." Jupyter Notebooks have become a de facto standard for organizing, documenting, and sharing computational experiments.

Significant challenges to widespread adoption exist, of course. Cloud computing for research requires a different model for research support, just as it does for business information technology. Instead of one-time capital investments—which can often be made opportunistically from one-time funds, grants, and donations—cloud-based HPC requires ongoing financial support. With the cloud, you never stop getting a bill. However, you also eliminate the problems associated with supporting aging, obsolete equipment.

A lack of experience among researchers and IT support staff creates a fear of runaway costs. This is a little like the problem that was common among new cell phone users who would arrive home to the shock of their phone bill after an overseas trip. However, just as with cell phone providers, cloud providers offer sophisticated tools for

estimating, controlling, and reducing the costs of cloud usage. While this concern is legitimate, it's often blown out of proportion.

Cloud computing doesn't eliminate the support and expertise issue. While cloud providers have invested a lot of time and effort into providing training and simplified interfaces, most researchers are not going to create a cloud account on Monday and be running an experiment on Tuesday. But the volume of users and the amount of standardization that cloud providers have developed—along with tools such as Jupyter Notebook, Docker, and Kubernetes—have created a more common HPC infrastructure that enables a quicker ramp-up than in the past. It's entirely possible for researchers with a rudimentary understanding of these tools to use a computing environment created at another research lab, substitute their own data, and be up and running with an experiment in a few hours. In this way, research productivity is greatly accelerated.

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Network bandwidth can be another issue. Moving large data sets on commodity networks, or even on regional research and education networks, simply doesn't work well for hundreds of terabytes or petabytes of data, which is the scale required by modern researchers in many fields. Often researchers resort to shipping hard drives; cloud services such as AWS Snowball and AWS Snowmobile have been developed to support the process. Three steps in the network path—from the lab to the campus border, from the campus to the ISP or regional research and education network, and from the network provider to the cloud provider—can each pose a challenge.

To begin to address these issues, the Pacific Research Platform (PRP), a collaboration among research universities and CENIC (operator of the CalREN network serving California), has been funded by the National Science Foundation to support the streaming of "elephant flows." The PRP uses dedicated, specialized network endpoints (FIONAs) to optimize the continuous, high-speed streaming of large data sets, connected to a dedicated network reserved for research. It also depends on end-to-end performance measurement to (1) ensure that theoretical throughput can be achieved in practice and (2) diagnose network bottlenecks that can occur, whether in the PRP network or—more often—in the "last mile" connection on campus between the campus border and the research network.

As is the case with any use of cloud services, information security considerations play a role. Intellectual property protection, personally identifiable information, and export controls can all present issues, requiring the appropriate review and analysis. Since many researchers lack a detailed understanding of these issues, the responsible use of cloud resources will often require collaboration with campus information security personnel. Just as with traditional enterprise computing, most research can be moved to a cloud provider if the appropriate protocols are in place, but some may benefit from being kept in the local environment.

Even though the cloud provides real advantages for many workloads, there may be good practical and financial reasons to stick with on-premise resources. A lab or a campus may want to fully amortize an investment in a local computing cluster rather than "paying twice" by adding cloud services fees into the mix. Furthermore, while a local cluster might be suboptimal for the largest computations, it can be a great "sandbox" environment for teaching students and developing computational techniques without having to "pay by the second." And of course, if the intent of the research or education is to better understand the implementation of high-performance computing, there can be great value in having a hands-on lab environment available for researchers and students.

A promising strategy today is a hybrid environment that takes advantage of both local resources and cloud resources as appropriate. The tools mentioned above—such as Jupyter Notebook, Docker, and Kubernetes—make executing the same code in the local environment and in the cloud relatively easy. Thus, researchers can develop and test their code using owned equipment, and then if they need to access more processor cores and memory, they can run their final experiments in the cloud once they're confident that they understand how it will work—thereby reducing the chance of incurring cloud fees for an unsuccessful run.

While there are still challenges and objections to using the cloud as a research instrument, the advantages in many cases are so compelling that we will continue to see research migrate in that direction. From large research universities to small liberal arts colleges, the research cloud will become a growing part of the research instrumentation portfolio, and campus IT departments will likely have to add cloud facilitation for research to the ever-growing list of capabilities expected of a modern IT department. The good news is that the cloud has the potential to allow almost unlimited access to high-end computing resources for researchers at every type of institution, creating a more level playing field for experimentation than has ever existed before. ■

The cloud has the potential to allow almost unlimited access to high-end computing resources for researchers at every type of institution, **creating a more level playing field for experimentation than has ever existed before.**

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# Male, Female, Nonbinary: The Ethical Responsibility of the IT Community

We should be thinking about our role not just in designing data systems **but also in supporting social justice.**

**Several US states are** advancing the recognition, equality, and dignity of nonbinary and genderqueer people in our society through the addition of a new nonbinary gender identification checkbox on legal documents, such as birth certificates and driver's licenses. We're hopeful that these changes will serve as a catalyst for conversations about the collective ethical responsibility of the IT community to safeguard this data and support its appropriate use once collected. This feels especially important considering that classifications of gender—as well as race and ethnicity—and their codification in systems of record have been used to reinforce discriminatory practices in society for generations.

In the summer of 2017, the state of Oregon was the first to announce that it would recognize a new gender choice, nonbinary, on its driver's licenses. Washington DC quickly followed suit. Currently, Arkansas, California, Colorado, Maine, and Minnesota offer nonbinary driver's licenses, while other states have bills in the legislature.[1]

In our state, Governor Jerry Brown signed California State Senate Bill 179 (SB-179) into law on October 15, 2017, enabling "intersex people, like transgender and nonbinary people, to be able to use state-issued identification documents that accurately recognize their gender identification as female, male, or nonbinary." SB-179 requires that a third, nonbinary gender marker be made available not only on driver's licenses but also on birth certificates, identity cards, and gender-change court orders. It also improves the process a person must follow to change their gender marker and/or name on these identifying documents.[2]

And so, a little over a year after the passage of this bill, the two of us were sitting with IT leaders from across campus listening to a presentation from the working group that had been created to support implementation of SB-179. At UC Berkeley, this has meant answering the following questions: Which IT systems and/or administrative processes collect and store gender identification information? What changes are required to support an individual's nonbinary choice? What downstream systems do they feed? What are the costs and technical implications of the changes? How do we translate a nonbinary gender selection in our systems to best comply with federal reporting requirements where only binary options are allowed? Are their special considerations for international students hailing from countries that are hostile to LGBTQ individuals?

As we reviewed the technical issues, the conversation quickly evolved to the myriad ways that online systems currently reinforce gender norms. How many of us have filled out an online form that requires us to add a title or honorific that denotes gender? While the honorific Mx. has been established, it is rarely used in online forms or systems. And what about marital status? Some women probably still feel like a bit of a rebel when they select "Ms." instead of "Mrs."

The implementation of IT systems updates will need to address these issues as well as the implied promise for how gender identification information is used by the institution after collection. For example, will it be used to generate salutations in donor letters or admittance correspondence? Will it be used for creating student housing assignments or "balanced freshman cohorts" for orientation? Will it be presented to faculty via class rosters?

As we have reflected on these questions, a number of additional questions have surfaced: How do we ensure that we are representing the designation in the most inclusive manner, without "otherizing" it? Does the order or presentation for gender identity options say something about the value that we place on the person inhabiting that gender? Even our existing binary choice has a standard pattern: "male" and then "female" (M/F). That certainly isn't a decision based on alphabetical order. What does that reinforce about gender and position in our society? Will we offer nonbinary as the first choice, the last, or one in between?

At UC Berkeley, those of us in the IT organization will often be the ones answering these questions and making these design decisions. To be truly inclusive, and to honor both the letter and the spirit of SB-179, we will need to get input from the genderqueer community on how best to represent the nonbinary identity.

In their 2000 book *Sorting Things Out: Classification and Its Consequences* Geoffrey C. Bowker and Susan Leigh Star note: "Classification systems are often sites of political and social struggles."[3] Many of their examples focus on race and ethnicity classification systems developed by people in power to suppress and demoralize entire populations. The same holds true for gender.

While the classification of "nonbinary" is embraced and supported by most of the genderqueer community as

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empowering, with a potentially positive impact on social justice, IT service providers must consider and guard against misuse—or abuse—of this information. We must be mindful of how the data is stored, how it is used, and with whom it is shared. One can't help but think about current events and the unintended consequences of data being used in harmful ways. Analysis of FBI hate crime statistics for 2016 by the Human Rights Campaign shows that of the 6,121 crimes classified as hate crimes in the United States that year, 1,076 were predicated on sexual orientation bias, and 124 were based on gender identity bias.[4]

Student records follow students as they attend multiple institutions throughout their lives. Thus, even if a higher education institution is not located in a state that is considering or has passed legislation around this issue, its IT leaders need to think about several considerations:

1. *Data Governance:* Who stewards this data at the institution? What, if any, additional considerations, protections, and/or controls should be put in place for access and usage? Who participates in those conversations? Does the institution have student representatives serving in its data-governance model?
2. *Ethics:* Does the institution have a statement on ethical behavior, an honor code, and/or an IT code of ethics? Can these be used as a framework for conversations?[5] Will they need to be updated to include this new use case?
3. *Implied Promise or Experience:* What promises are implied through the collection of this data? For example, when users are allowed to specify their preferred pronouns in the institutional systems, can they expect that formal communications from the institution will address them using their preferred pronouns?

The world of data, classification, and systems will grow only more complex. With the utilization of machine learning and artificial intelligence, the kinds of seemingly simple decisions we make about the design of our systems will have an impact for years to come. We should be thinking about these issues and our role not just in designing data systems but also in supporting social justice. Ensuring that we are treating the data with the same dignity and respect with which we treat the person would be a good start toward meeting our ethical responsibility. ■

**Notes**

1. Casey Parks, "Oregon Becomes First State to Allow Nonbinary on Drivers License," *The Oregonian/OregonLive,* June 15, 2017 (updated August 3, 2017); "State Laws," Resources: Non-Binary Gender, Intersex, *Intersex & Genderqueer Recognition Project* (website), page updated on January 15, 2019.
2. "SB-179, Gender Identity: Female, Male, or Nonbinary (2017–2018)," *California Legislative Information* (website), accessed January 7, 2019; "SB 179: Gender Recognition Act of 2017," fact sheet from *Equity California* (website), accessed December 15, 2018.
3. Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and Its Consequences* (Cambridge: MIT Press, 2000), 196.
4. Jordan Dashow, "New FBI Data Shows Increased Reported Incidents of Anti-LGBTQ Hate Crimes in 2016," *Human Rights Campaign* (website), November 13, 2017.
5. An example is the "University of California Regents Policy on Statement of Ethical Values and Standards of Ethical Conduct," approved May 2005 and amended March 16, 2017. See also Melissa Woo, "Ethics and the IT Professional," *EDUCAUSE Review,* March 27, 2017.

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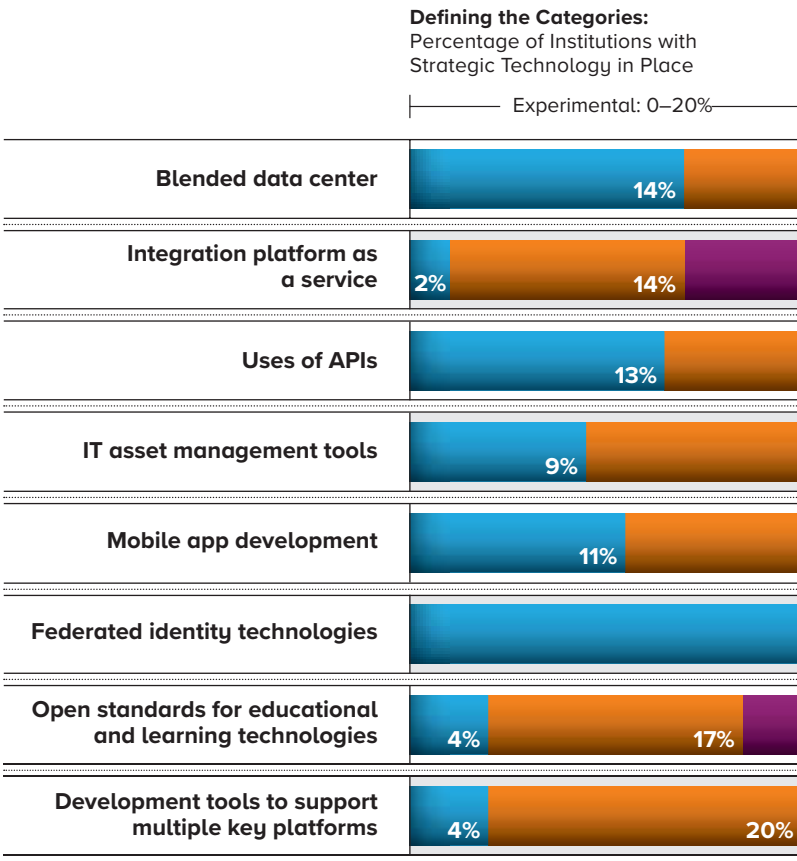
# Strategic Technologies for Trusted Data

## Issue: **Digital Integrations**

*What It Means:* Ensuring system interoperability, scalability, and extensibility, as well as data integrity, security, standards, and governance, across multiple applications and platforms

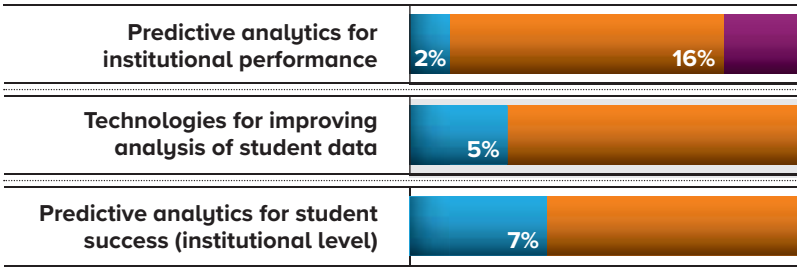
Top 10 IT Issue **#5**




## Issue: **Data-Enabled Institution**

*What It Means:* Taking a service-based approach to data and analytics to reskill, retool, and reshape a culture to be adept at data-enabled decision-making

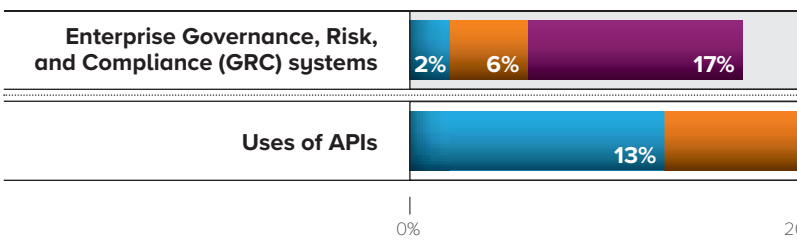
Top 10 IT Issue **#6**




## Issue: **Data Management and Governance**

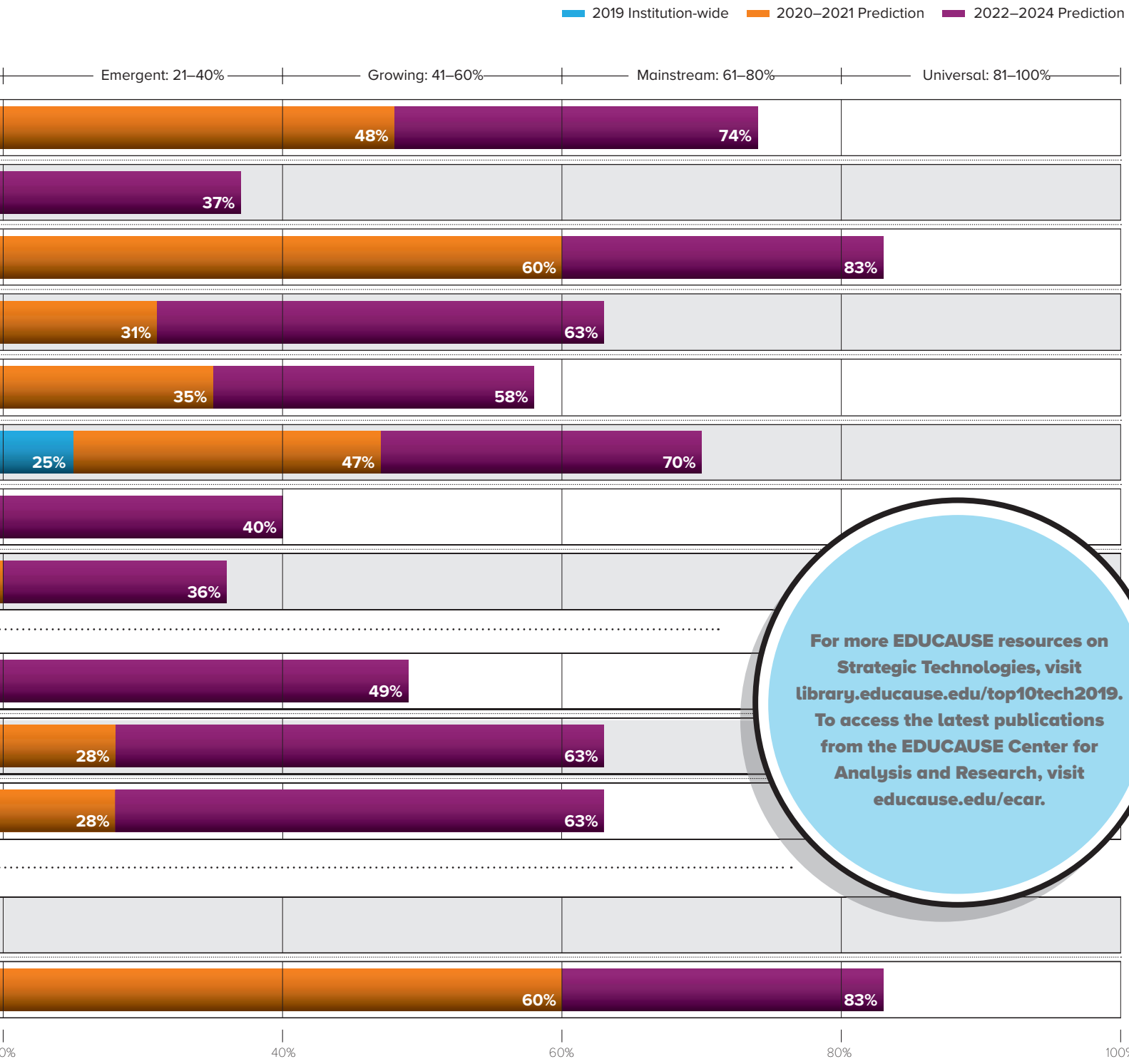
*What It What It Means:* Implementing effective institutional data-governance practices and organizational structures

Top 10 IT Issue **#8**



## Find out where institutions stand on a range of data issues.

In the EDUCAUSE 2019 Top 10 IT Issues, the call for trusted data rang out loud and clear. Below, take a look at how institutions are addressing three data-related issues now and in the future: *Digital Integrations* (#5), *Data-Enabled Institution* (#6), *Data Management and Governance* (#8).

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