Why IT Matters to Higher Education

EDUCAUSE review

MARCH/APRIL 2018

The Digital Transformation Ahead

Bernard Bull:
Four Tools

Simon J. Buckingham Shum and Timothy A. McKay:
Architecting

Grace Belfiore and Dave Lash:
Creative Know How

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MARCH/APRIL 2018 VOLUME 53, NUMBER 2

FEATURES

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EDUCAUSE Review is the general-interest, bimonthly magazine published by EDUCAUSE. With a print publication base of 22,000, *EDUCAUSE Review* is sent to EDUCAUSE member representatives as well as to presidents/chancellors, senior academic and administrative leaders, non-IT staff, faculty in all disciplines, librarians, and corporations. It takes a broad look at current developments and trends in information technology, what these mean for higher education, and how they may affect the college/university as a whole.

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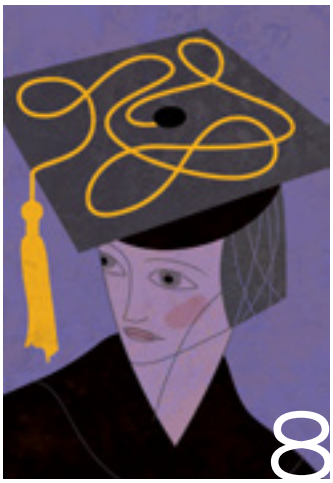

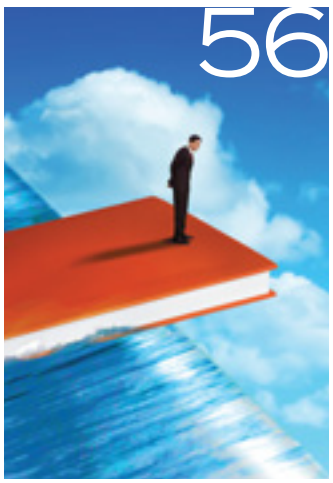

Volume 53, Number 2. *EDUCAUSE Review* (ISSN: 1527-6619) is published bimonthly (6 issues per year) by EDUCAUSE, 282 Century Place, Suite 5000, Louisville, CO 80027. Subscriptions are available at $54 per year ($84 per year outside North America) and to all academic libraries (North America and international) at $54 per year. Single copies are available for $11 each. Periodicals postage paid at Boulder, CO, and additional mailing offices. POSTMASTER: send address changes to EDUCAUSE, 282 Century Place, Suite 5000, Louisville, CO 80027.

Publications Mail Agreement #40033384
Return Undeliverable Canadian Addresses to:
Station A, PO Box 54
Windsor, ON N9A 6J5
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The Digital Transformation Ahead: Teaching & Learning

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"Alchemy, Innovation, and Learning, in 2025"

by John Cavanaugh

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By JOHN O'BRIEN

Digital Transformation and Technology Narratives

We all have a technology narrative that shapes our understanding of the change going on around us. For younger professionals and retired CIOs alike, these narratives are often transformation stories. When it comes to teaching and learning, whether our early stories of educational technologies feature punch cards, AV carts, first-generation LMS software, or tablets, the drumbeat of digital change has been continuous and quickening for decades. Most recently, these advances are less and less *ad hoc* developments or one-off innovations; instead, digital transformations are ever more interdependent, more interrelated, and—thanks to standards-promoting organizations like IMS Global—more interoperable than ever before.

I'll be the first to acknowledge that phrases like *digital transformation* are used so much in the hype-filled edtech universe that the meaning has somewhat eroded, but we've all experienced this kind of comprehensive change numerous times. Isolated breakthroughs and sporadic innovations are giving way to this more expansive kind of systemic change. It doesn't seem that long ago (it was 2016) when educational publishers Cengage and Pearson saw more than 50 percent of their business in digital form.[1] Then, in the last month of 2017, Cengage announced its new "unlimited" pricing model for digital content. No doubt, reports of the demise of traditional textbook pricing are premature, but anyone paying attention can see that textbooks are no longer expected to be either exclusively text-based or completely book-like. Something more transformational is clearly under way.

In spite of the hype, the nature of digitization—its depth, breadth, reach, and likely scale—is transforming our world in appreciable and important ways.

One colleague tells me that her "tipping point moment" was the Jill Watson artificial intelligence (AI) teaching assistant story from 2016. We don't hear a lot about Jill Watson in 2018, but we do hear about how, for the first time, an AI neural network model scored higher on Stanford's reading and comprehension test than humans. Dramatic versions of these not-so-dramatic events usually involve one or two more exclamation points than they deserve, such as *Newsweek*'s headline, "Robots Can Now Read Better Than Humans, Putting Millions of Jobs at Risk."[2] These kinds of stories hit our newsfeeds long before the technologies involved have matured or, in some cases, even taken shape. Nevertheless, in spite of the hype, the nature of digitization—its depth, breadth, reach, and likely scale—is transforming our world in appreciable and important ways.

With the print issue of the magazine and additional online articles in the March/April 2018 timeframe, *EDUCAUSE Review* will focus on this digital transformation in the context of teaching and learning. For example, in "Four Tools for Leaning into the Future in Times of Rapid Change and Innovation," Bernard Bull helps us to map this world of unceasing technological change by suggesting specific tools that can help higher education IT professionals decide which technologies are worth our attention; recognize transitional technologies; predict the future of educational innovations; and understand options for thinking about and preparing for the future of learning organizations. In another feature article, "Architecting for Learning Analytics: Innovating for Sustainable Impact," Simon Buckingham Shum and Tim McKay pose the question: "How can an institution architect itself . . . to innovate pedagogically and analytically in order to tackle substantial, strategically important teaching and learning challenges?" Shum and McKay explore three organizational models for analytics infrastructure and advocate for an autonomous, hybrid innovation center approach.

(continued on page 6)

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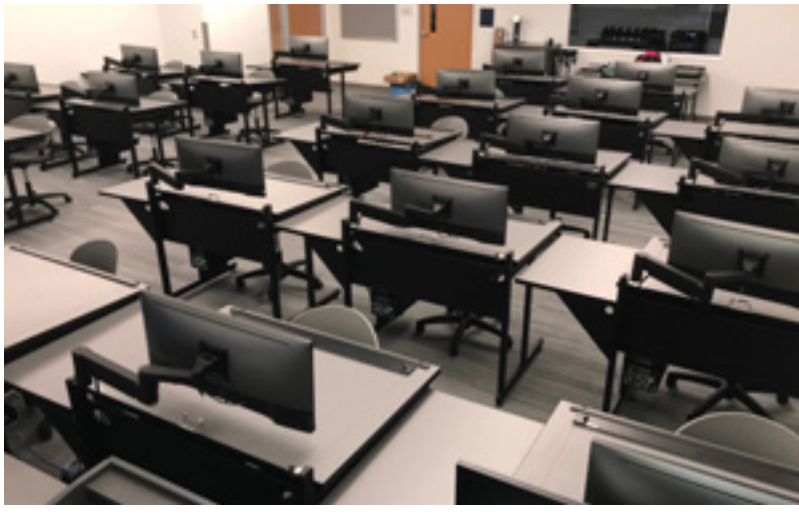

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(continued from page 4)

What does this digital transformation mean for students? The MyWays project (https://myways.nextgenlearning.org/), from the EDUCAUSE Next Generation Learning Challenges (NGLC) initiative, addresses this and related issues. As NGLC Director Andy Calkins asks: "What can schools and higher education institutions do to ensure that graduates enter their 'wayfinding decade' with the competencies, learning orientation, and agility they'll need to be successful in the 21st century?" In an excerpt from Report 8, Grace Belfiore and Dave Lash explore "creative know how." Although the need for schools to address "know how" as well as knowledge has been established, the authors add: "We are beginning to realize just how creative (or adaptive and transferable) that know how must be to prepare learners, in essence, for the unknown—for jobs not yet invented, for the impact of AI, and for engaging with others in ways that evolve every few years."

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Moving beyond teaching and learning, digital transformation is affecting the entire higher education enterprise, of course. Yet evidence from EDUCAUSE research shows that comprehensive approaches to digital transformation are not evenly distributed. Around one-third of institutions in our 2018 Strategic Technologies and Trends show clear signs of campus-wide digital strategy either already in place (3%) or exerting a "major influence" (28%) on their emerging IT strategy. On the other hand, over half of institutions report that they either have already incorporated the idea of "IT as an agent of institutional transformation and innovation" into their IT strategy (8%) or are seeing it as a "major influence" (44%). Finally, the three trends at the top of the "Most Influential Trends" list—complexity of security threats, student success focus/imperatives, and data-driven decision-making—all extend beyond information technology alone and even beyond single-campus divisional responsibility. They are both comprehensive and transformative in risk, urgency, scope, or all of the above. We will be further exploring the digital transformation of the enterprise in the May/June 2018 issue of *EDUCAUSE Review*.

The ongoing story of digital transformation, in the sense of moving analog teaching and learning materials and other higher education resources into digital form, has captivated us for many years. Today, in 2018, this story is a chapter in a larger technology narrative. At the same time that technologies are changing dramatically, the very stature of technologies at colleges and universities has also undergone a transformation. Technologies, whether they are related to research, the classroom, or student success initiatives powered by analytics, are not working silently in the background like a water tap waiting to be turned on or an electric switch waiting to be flipped. Rather, these and related technologies are mission-critical strategic assets that determine in many respects how well an institution is able to accomplish its strategic objectives.

Notes

1. "Cengage Learning Achieves Milestone of More Digital Units Sold Than Print Textbooks," press release, May 16, 2016; *Digital Learning: Pearson Annual Report and Accounts 2016* (London: Pearson, 2016).
2. Melissa Korn, "Imagine Discovering That Your Teaching Assistant Really Is a Robot," *Wall Street Journal*, May 6, 2016; Anthony Cuthbertson, "Robots Can Now Read Better Than Humans, Putting Millions of Jobs at Risk," *Newsweek*, January 15, 2018.

John O'Brien (jobrien@educause.edu) is President and CEO of EDUCAUSE.

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Leadership, Change Management, and the Nontraditional Student

Change is constant, and it is occurring at a faster rate than ever before—Moore's Law states that processing power duplicates every 24 months, thus creating a better and more powerful computer processor. Processes, the environment, technology, knowledge, and information are taking gigantic steps forward as we change the way we access, obtain, consume, use, process, and repurpose information.

Today's learner aspires to obtain a higher education under a very different set of circumstances than the ones I experienced as an undergraduate student in the early 1980s and the 1990s. While technology improvements and certain advances along the economic ladder have occurred for some students since then, many more millions of students still face challenges related to learning, disabilities, cost and affordability of an education, transportation, family responsibilities, and developmental education—thus requiring tutoring and assistance. Since economic and social pressures continue to play a major role in how citizens better themselves to be productive and successful, it is critical that higher education institutions adapt to the new circumstances of current students.

The typical student today is the nontraditional student. As defined by the National Center for Education Statistics, the nontraditional student meets one of seven characteristics: has delayed enrollment into postsecondary education; attends college part-time; works full time; is financially independent for financial aid purposes; has dependents other than a spouse; is a single parent; or does not have a high school diploma.[1]

Many nontraditional students have not been able to access opportunities primarily because of the length of time required to complete a degree or because the credits they have accumulated are not relevant to their current career, thus perpetuating the cycle of unequipped employees. Institutions of higher education need to offer students additional ways to enroll in, progress through, and complete a college education. The nontraditional student seeks flexibility and accelerated learning options. How can the higher education community adapt to these new conditions? Does doing so require a more frequent review of academic offerings? How can colleges and universities serve nontraditional learners to help them quickly integrate to the workforce?

In 2011 the state of Texas implemented a performance-based funding program, which included a criterion to allocate 10 percent of formula funding based on points earned from a three-year average of student success indicators. This was seen by many as the best approach to ensure that higher education institutions were creating ideal conditions for students to advance and to complete their higher education. The program follows a zero-sum approach because of limited dollars available every biennium to fund institutions that have earned the most points.[2] It is predicted that many more states will continue to implement their own forms of funding for higher education because doing so "focuses on spending rather than the money spent."[3] The state of Texas has also implemented 60x30, an ambitious initiative that aims at reaching four general goals by the year 2030. The overall objective is to ensure that 60 percent of the citizens of the state will have a higher education credential. Currently, only 15 percent of the population has a higher education credential.[4]

While there is a long road ahead, institutions are responding to the mandates. At Tarrant County College (TCC), we are addressing these challenges and opportunities in ways that allow us to adapt quickly to the needs of nontraditional students and to aid them in their transition to the workforce. In 2012, TCC took a bold step to establish a new campus with a single focus on developing a learning environment for nontraditional students. The district leadership wanted to instill a college-going culture within the community and moved forward to approve a fully online campus. In 2014, the TCC Connect Campus opened for business, with the goal of increasing access to learning opportunities through three programs: eLearning; Dual Credit; and an accelerated Weekend College.[5]

It is widely known that e-learning (or online education) provides flexibility and convenience for students who want to determine their own time and place of study and/or save on commuting costs to campus. In addition, this sector of the learning community has experienced continuous growth while addressing the needs of these students for the last decade.[6] In anticipation of this transformation, TCC embarked on the creation of a campus that can leverage strategies to address the growth via e-learning.[7] The TCC eLearning program extends beyond the traditional classroom by offering 18 fully online programs including 5 associate degrees, 13 certificates, and more than 350 online college credit courses. Program offerings include Accounting, Business, Small Business Management, and Office Technology. The eLearning program is a great opportunity for students to learn and apply knowledge in real time while balancing life responsibilities.

The Dual Credit learning option contributed to the creation of a college-going culture that begins at the sophomore high school level. The TCC leadership moved the program from the Connect Campus to the face-to-face campuses in 2015.

By CARLOS MORALES

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Although the Connect Campus no longer oversees Dual Credit offerings, it reengineered processes, scheduling, and priorities while increasing the number of students and its reach within the program.

Finally, the Weekend College, a brand-new design concept, is tailored to allow students to join a cohort and complete a college degree or the transferable core curriculum in less than two years by attending hybrid classes on the weekends. The classes are structured in seven-week terms, and students can select their class time on Friday or Saturday. Weekend College students attend campus only one day per week, allowing them to balance family and work responsibilities with their coursework. Students can attain a degree in less than two years when they combine eLearning and Weekend College courses. This modality facilitates a highly interactive college experience among peers with common educational goals. The Weekend College program helps build learning communities, which then develop into a strong support system for the students.

All credit online courses meet the same curriculum requirements as those held face-to-face. TCC Connect Campus student services are accessible completely online and include advising, tutoring, library services, writing center, and remote proctoring of tests.

With a forecast of an increase in the number of nontraditional learners, from 3.5 million in 2016 to 5 million by year 2020, institutions of higher education will be required to cater to these students.[8] Adapting to the needs of the population, industry, and lifelong learners must be at the forefront of institutional strategic planning. Students require not only new learning approaches that address various complexities they face in their lives but also options to retool. Higher education institutions must take action and must implement solutions through bold leadership and defined timelines that aim for long-term solutions to today's needs. ■

Notes

1. U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (NCES), "Nontraditional Undergraduates: Definitions and Data" (website), accessed February 6, 2018.
2. Texas Legislature, H.B. No. 9, September 1, 2011; Texas Association of Community Colleges, "Student Success Points" (website), accessed February 6, 2018.
3. Ying Liu, "Performance-based funding and budgeting in higher education," paper presented at the National Association of African American Studies, Baton Rouge, LA, January 2011, p. 1522.
4. Texas Higher Education Coordinating Board, "60x30TX Higher Education Plan" (website), accessed February 6, 2018.
5. *TCC Vision 2015 Strategic Plan* (Fort Worth, TX: Tarrant County College District, 2012); *TCC Connect Concept Plan* (Fort Worth, TX: Tarrant County College District, 2013).
6. I. Elaine Allen and Jeff Seaman, *Grade Level: Tracking Online Education in the United States* (Babson Park, MA: Babson Survey Research Group and Quahog Research Group, February 2015).
7. Peter J. Shapiro, Carlos Morales, and Susan C. Biro, *Distance Learning Growth and Change Management in Traditional Institutions*, paper presented at the 25th annual Conference on Distance Teaching and Learning, Madison, WI, August 3, 2009.
8. David L. Clinefelter and Carol B. Aslanian, *Online College Students 2016: Comprehensive Data on Demands and Preferences* (Louisville, KY: Learning House, 2016), 4.

Carlos Morales is founding President of TCC Connect Campus, the largest and fastest-growing of the six campuses that form Tarrant County College District.

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Bernard Bull

4 Tools for Leaning into the Future in Times of Rapid Change and Innovation

Some educational technologies and innovations emerge quickly, and they persist. Others gradually develop over time. Still others arise—only to soon fade away. The higher education leader must navigate educational technology and innovation in such a context, cultivating the discernment to make wise decisions that set the institution up for success.

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Yet there is a common fear (and sometimes reality) that I hear about when speaking with higher education leaders. We see a promising possibility. We identify a new innovation or technology. We begin the effort of moving toward it, seeking ways to apply it. When we get there, however, something has changed. Something new is now on the horizon, or what had excited us turns out to be outdated, obsolete, or far less of a panacea than we had first thought.

These leaders consistently identified what I call *missional sifters*: core ideals, practices, values, or philosophies that served as sifters for new possibilities.

In such a context, the skill of discernment has never been more important. How do we determine where the education innovation puck is going to be? The challenge is further complicated by the fact that pucks on the ice and their metaphorical equivalents in higher education do not just move once or twice. They are in constant motion.

In a world of unceasing technological change, there is a genuine risk of investing significant time, effort, and money on new technologies and innovations that are unlikely to still be around in three, five, or ten years. Sometimes we move forward with the investment anyway. Although we know that something new will come along, we consider the new technology to be worth the present-day benefits. In other instances, a strategic investment in the wrong area can cause serious problems for a learning organization. There is the money spent. There is the decrease in trust and support from people within the institution, making things that much more difficult when we need to rally around the next change. There is also the lost time and effort, which could have been spent on other, more promising changes and possibilities.

While I do not offer a certain solution to these challenges, I will suggest here four tools for functioning in such an environment while leaning into the future. The first is *missional sifting*, a concept that helps us avoid chasing after every new, shiny educational trend, technology, or innovation. The second is *transitional technologies*, an idea that (again) will not solve the problem but does offer helpful context. The third is *predicting the future:* I will provide a brief orientation to how we can become more effective at understanding the capricious nature of educational innovations—a sort of crash course in futures studies. The last tool consists of *options for approaching the future:* I will offer yet another way of thinking about and preparing for the future of our higher education institutions. These four tools will not remove the risk, the fear, or the uncertainty; but they can be helpful in better equipping us to manage and thrive in such a fluid context.

Missional Sifting

Over a decade ago, I began my study of innovative learning organizations and their leaders. By the time my initial exploration concluded, I had documented over one hundred organizations and eventually had conducted close to one thousand formal and informal interviews. From that work, I noticed ten persistent traits of the leaders in these organizations; one of those traits relates directly to the focus of this article. These leaders consistently identified what I call *missional sifters:* core ideals, practices, values, or philosophies that served as sifters for new possibilities. The leaders did not have long lists of ideals—usually only one to three that a leader held in high regard. Yet no matter how promising the practice or innovation, it had to be sifted by these core ideals.

We use sifters to make sure that we keep the "good stuff" and let the other stuff pass through. The key is to be very clear about the unavoidable, undeniable, institution-shaping ideals and values. They should be specific enough to guide each decision. They should be used as sifters of programs, projects, ideas, policies, and practices. They protect us from simply adding something because that is our image of our institution or because someone wants it. They protect us from chasing after every new and shiny educational innovation. Such institution-shaping ideals are what allow a learning organization to have a distinctive identity and to progress toward being a high-impact learning community. However, for a sifter to work, we must use it constantly and relentlessly. When it comes to this tool, the most effective leaders remain tough-minded and do not make exceptions.

Mission sifting allows us to set some priorities for our higher education institutions. It is not about closing ourselves off to new possibilities. It is about grounding ourselves in our core identity. Each college or university will have its own distinct, institution-shaping ideals and values, and that is part of what helps to create a rich, diverse higher education ecosystem. It also equips us to more effectively navigate the modern context.

I offer one word of caution with this first tool. I have seen people take this

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concept and use it to entirely dismiss and disregard new ideas, sometimes too quickly. That is unfortunate, since exploring and understanding new innovations and possibilities requires time. Until we take the time to explore, we are usually not informed enough to determine whether an idea aligns with what we most value. So even though effective leaders of innovative organizations use mission sifters, that does not keep them from learning about and widely exploring the breadth of possibilities.

Transitional Technologies

Some educational innovations and technologies find their way into learning organizations and establish themselves for decades with limited fundamental changes. Others seem to come and go in a shorter time period, sometimes as quickly as a year or two but more often in five to ten years. Then there is a third and important category that I call *transitional technologies*. These are technologies that arrive, make an impact, and then morph into something quite different over time. I further define a transitional technology as having the following traits:

- It helps expand people's thinking beyond an existing, related, but increasingly too limiting technology. As such, it helps surface the downsides and limitations of that technology, expanding the community and conversation around the alternative.
- It borrows from the existing metaphors and vocabulary enough that people can understand it, while adding new features and taking advantage of new and emerging technologies. In fact, it is always sparked by the affordances of multiple new technological developments.
- It triggers experimentation and entrepreneurial endeavors that promote further innovation and refinement.
- People understand the transitional technology in terms of what came before it. Many early experiments remain limited to the metaphors and frameworks that informed practices with the preceding technology. While there are some who will experiment in fascinating ways, demonstrating entirely new applications not possible with the previous technology, most people see the transitional technology as a supplement to or a replacement for the prior technology, missing the fact that it could actually lead to a completely different construct—one that nevertheless works largely within the established culture, beliefs, values, and norms that emerged from the preceding technology.
- Its most important role is not to be a long-term replacement for its predecessor but to aid in progress toward what is usually a completely new mental and cultural construct and associated technologies. In this sense (and drawing from a well-known Buddhist metaphor), it is the raft that gets us across the river, but that raft is left behind as we move on to the next part of the journey.

We can use the tool of transitional technologies to recognize larger changes that are soon to arrive. Consider the rather new development of digital badges. They are often described as digital credentials. What is the purpose of a credential? There are multiple purposes, but a credential generally signifies something: experience, accomplishment, traits, competence, relative growth (or the lack thereof), and much more. As such, credentials communicate something about a person. Over time, they even communicate more or less than the reason for their issuance might warrant. Some more accurately and persistently communicate something true about a person, group, or organization. Some do not. That has always been the case, just as it is with badges. Badges are sentences in the stories that we tell, and we all know that some stories are fiction while others are nonfiction. Most are a blend of the two.

Yet badges are only one of many devices useful in communicating a story to others. What is important is the story—and the connection with people as a result of the story. That is where data science and artificial intelligence (AI) come into play. As more integrated and easy-to-consume methods of connecting and communicating develop, badges and other credentials will begin to play a smaller role. That is not to say that they will disappear, but they will eventually become a support for the primary focus: connecting people with one another and with organizations through meaningful data.

Badges represent a set of fascinating technologies, and they certainly expand and deepen our thinking about recognition. They have served us well in that sense and will continue to do so for some time. Yet sooner than later, we will find that they have taken us as far as they are able in this journey, and we will set them aside for our larger and far more significant journey toward open recognition and what I expect will be a transparent but useful ecosystem of algorithmic and data-informed connections. That will bring (indeed, has already brought) ample ethical challenges that we are wise

Transitional technologies **are technologies that arrive, make an impact, and then morph into something quite different over time.**

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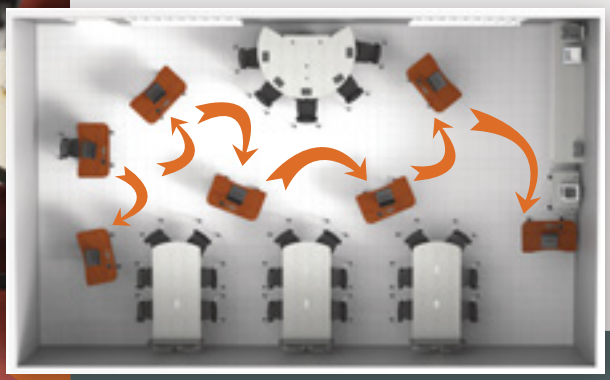

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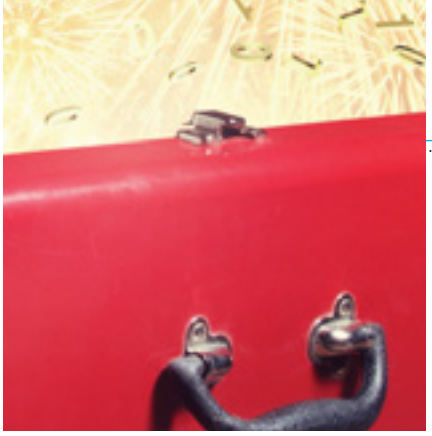

There are signs of the impending changes for a long time, and anyone with the desire and commitment can learn to read the signs and "predict the future"—an invaluable tool.

to begin exploring and addressing, especially before the next generation of AI.

Digital badging is just one of many examples of a transitional technology. It has a long enough future to warrant our time and attention, but it will eventually morph into something different. When we notice the traits of a transitional technology in our examination of new innovations and technologies, we should consider its adoption. But we should not rely on it so much that we would find ourselves unable to function without it. We adopt, innovate, learn, and grow with the technology, constantly keeping our eyes on how it will eventually expand into something new.

Each new day that we live with one foot in the digital world, we are becoming further acclimated to algorithmic living. We trust our favorite search engine to guide us toward that which we seek. We likewise trust systems when we listen to music, shop, or try to find a date (or spouse) online. We rely on these increasingly intelligent systems to match, connect, guide, and direct our choices and decisions.

Of course, not all algorithms are created equal. There is a wide spectrum when it comes to sophistication. In addition, every algorithm amplifies certain values and muzzles others, prioritizing some things over others. Though this is an increasingly recognized fact, it will not slow the global move toward an algorithmic world.

Predicting the Future

Every January we see numerous articles about the five trends to watch or the ten technologies that will dominate in the new year. Some of these are drawn from careful study and consideration. Others are simple speculation. However, they capture our interest because educational leaders see the importance of looking ahead and preparing for the future.

It often seems that the world of blended learning, online learning, augmented reality, virtual reality, learning analytics, adaptive learning, and a dozen other developments happened overnight. But educational trends develop over years, decades, or even longer. There are signs of the impending changes for a long time, and anyone with the desire and commitment can learn to read the signs and "predict the future"—an invaluable tool.

I have been reading these signs for almost two decades, long enough to learn from many errors and to refine how I approach the task. Having a feel for key factors allows seeing educational technologies and innovations develop from a distance. It is not always easy to predict when the innovation is going to reach a critical mass and spread more quickly. I admit to being off as much as a decade in some cases. Yet we can usually do better than a decade, and we can use this skill to prepare ourselves and our institutions for what is coming. The following fifteen factors are valuable for studying the trends likely to shape and change higher education over time.

Domain Jumping. Many promising ideas in higher education do not start in higher education. They begin in entertainment, in the business sector, in health care, or in dozens of other domains. When there is an impactful development in one of these domains, it will eventually influence broader cultures and find its way into education. We can't always trace the direct moment at which an idea jumps from one domain to another, but by looking at innovations more broadly, we can notice patterns that hint at a future jump.

Level Jumping. Too often, we focus on our small and local world of higher education. We don't look across early childhood, elementary, secondary, tertiary, workforce, continuing, informal, and other forms of education. As a result, we will miss a major development in one area that will likely jump to another level.

Convergence. We also should look for the mixing of ideas, within and outside of higher education. This is where two or more seemingly disconnected and distinct ideas come together, which is largely what happened with blended learning. Online learning started first. People basically imitated what they were doing in the classroom but in an online environment. Soon they discovered distinct online benefits not possible in face-to-face. Then came video-sharing technologies. These converged with face-to-face teaching to create what we today call blended learning. By exploring what it might look like if various developments were to combine, we can help predict the future.

Technology Maturity. In their infancy, most technologies are not quite as impressive as they will be in a decade or two . . . or three. As new features are added, we begin to discover new possibilities. As their ease of use or affordability increases, these technologies mature into ones that have greater applications and possibilities in higher education.

Changing Metaphors. I strongly recommend a wonderful little book called *Metaphors We Live By* (1980), by George Lakoff and Mark Johnson. In it, the authors point out the power of a metaphor to change how we think, how we make decisions, and the possibilities that we consider. By noticing the growth of a new metaphor in a culture or community, we can identify a forthcoming innovation or set of innovations.

Amplifying Technology. Some technologies amplify beliefs, values, and philosophies. When one of those amplifying technologies emerges, it will give greater power to one philosophy or set of values over another. We can use this development to predict which trends will win over others. We can also take advantage of this development by finding and

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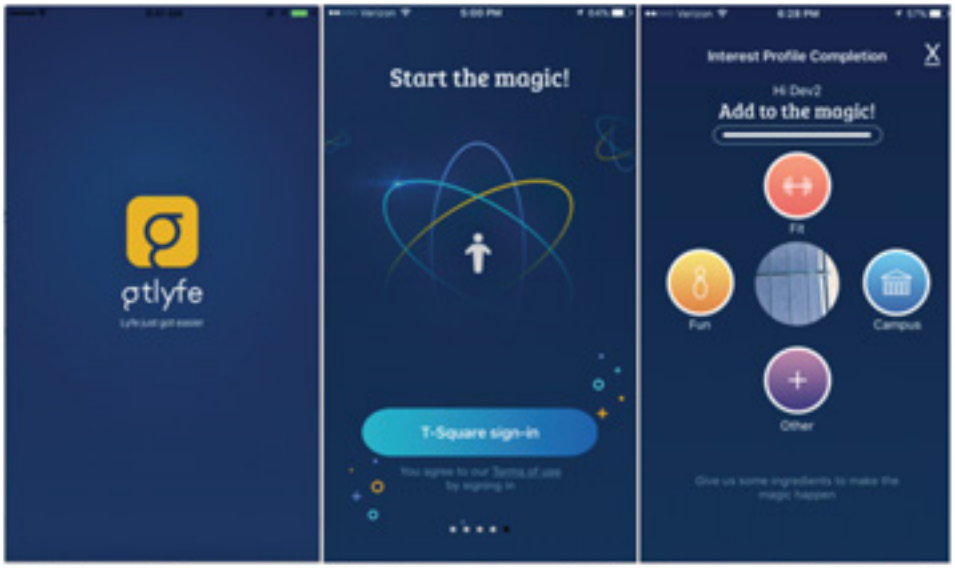

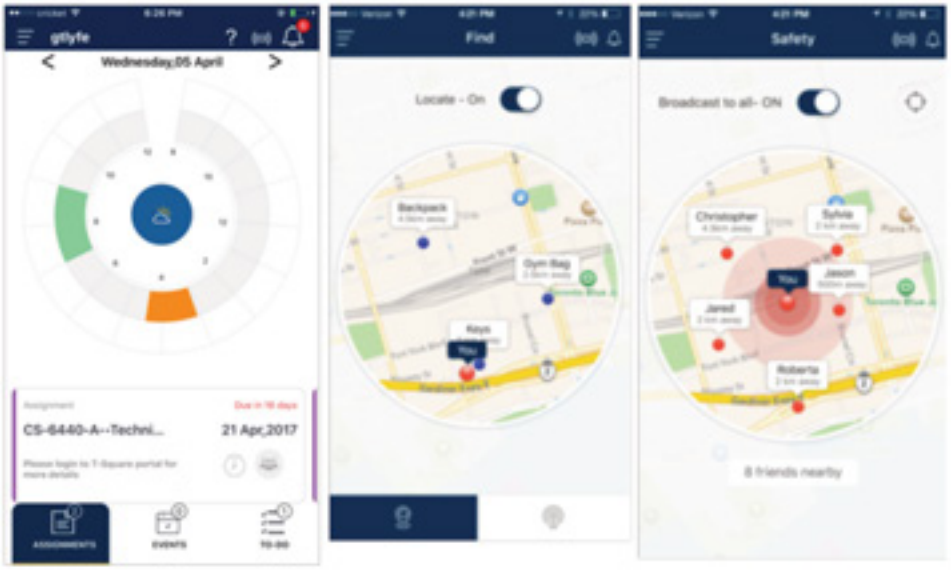

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promoting those technologies that best amplify the values and philosophies we support.

Funding Growth. Investors, foundations, and government grants can and do help create the direction of future trends. Money is not the only factor, but significant and persistent investment in an innovation is certainly an important factor to consider.

Revenue Potential. Revenue-generation potential will give an educational technology an extra boost. Textbooks didn't grow as a dominant curricular resource for a century simply because they were the best means of teaching and learning. They did so because they met a need while also creating lots of money for people and organizations.

Simplicity. Easy-to-understand, concrete, or simple innovations generally gain more traction in higher education than complex ones. This is true even when the complex solution is better for students and institutions.

Media Attention. The media doesn't typically create educational innovations, but media attention can and does influence awareness and adoption rate. We saw this with Massive Open Online Courses (MOOCs)—an innovation that continues to grow to this day even though it no longer gets the frequent media headlines. With the stories and attention around these developments and key higher education leaders and corporate players, MOOCs gained traction rather quickly. This is not a factor that lets us track trends far away, but we can use it to identify developments one to three years away and even a bit further out.

Superior but Muzzled. Occasionally great innovations, models, and ideas clash with the agenda of those in power. People ignore or muzzle the innovation to keep their influence. Sometimes this is enough to kill an idea altogether, but it usually reappears in another time and place, seeking fertile soil to grow and spread. This is why we can't always predict which organizations will take the lead on a new development. Some try it out early on but don't have the culture and support to expand. Then a new organization is created and accomplishes much of the earlier vision.

Superior but Isolated. Incredible work is happening within small pockets in higher education, and most people don't even know about it. The work is serving a small group in amazing ways, but there is currently no drive to expand it or resources to grow it, or others have not yet learned about it. We should keep an eye on this type of work, which eventually can and often does experience massive expansion.

Kairos. Kairos is the Greek word for the "due season" or the "opportunity time." This is when a series of cultural and other conditions come together to create an ideal time for a given idea, trend, or innovation. Think of *kairos* as similar to the idea of the "perfect storm." If we follow innovations in view of larger cultural developments and trends, we can sometimes see the emergence of a forthcoming *kairos*.

Policy Change. Policies can kill or can give life to higher education trends and innovations. We should watch the patterns of debate and lobbying around educational policies to get a sense of which trends are more or less likely to grow and spread.

Compounding Interest. Significant growth on a smaller scale should not be downplayed or disregarded. An innovation might increase its impact or reach by 500 percent, but it was so small to start with that the growth doesn't seem like much compared with larger efforts. Yet the law of compounding interest can apply to trend and innovation development as well as finances. Some innovations don't lend themselves to scale, and that is important to note. But with time and attention, we can uncover which innovations *can* scale and experience compounding effects.

Plenty of other factors can help in discovering growth in educational trends and innovations, but careful and collective attention to these fifteen will provide a good sense of what will and will not stick, develop, and expand over the upcoming years and decades, eventually becoming mainstream and widespread. This can allow higher education leaders to challenge trends they may consider dangerous as they approach the future.

Options for Approaching the Future

Finally we come to our last tool: various options for approaching the future of higher education. We can *ignore* the future, arguing that it is out of reach and that there is plenty to focus on in the present. We can *prepare* ourselves for the future—by being agile, alert, and responsive to subtle and significant changes and trends and by doing what it takes to

There is no rule against embracing more than one of these options, and in fact, there is much wisdom in taking lessons from all of these to fashion *a combined view* of the future.

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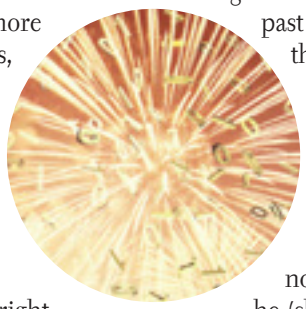
position ourselves for the unknown. We can work to *predict* the future; although this is not a certain science, as noted above there are ways to notice trends and develop a nuanced ability to track what is likely to shape the future of higher education. We can also go further and aspire to *create* the future. Lastly, there is no rule against embracing more than one of these options, and in fact, there is much wisdom in taking lessons from all of these to fashion *a combined view* of the future.



Ignore

Maybe *ignore* is not the right word, but there is something to be said for not obsessing about the future. People can become so worried about or focused on what might happen in the future that they are unable to invest in the present. In that sense, there is a time to set aside our thinking about the future and instead deal with the important tasks of today. By investing in today, we might be better situating ourselves for the future. Mother Theresa was quoted as saying: "Yesterday is gone. Tomorrow has not yet come. We have only today. Let us begin." Of course, there is a limit to this option. Completely ignoring all signs of change in the near future can be detrimental.

Prepare

Those in the "prepare" camp are sometimes skeptical about predicting the future. At the same time, those in this camp also believe that ignoring the future is unwise. Instead, their goal is to figure out how to best prepare for the future. This sort of mindset is essential in higher education. We are preparing students for a future that doesn't yet exist. We thus have to find ways to prepare for the unknown. As Malcolm X wrote: "Education is our passport to the future, for tomorrow belongs to the people who prepare for it today." Or as Franklin D. Roosevelt put it: "We cannot always build the future for our youth, but we can build our youth for the future."

Predict

As I noted in the previous section, the future might *seem* to sneak up on us unexpectedly, but it rarely happens in an instant. With attention and study, we can notice the signs of change. A good place to start is with the past. The past might or might not repeat itself, but studying the past can give us a better sense of the changes to come. As George Savile, Marquis of Halifax, wrote: "The best qualification of a prophet is to have a good memory." Or consider this quote from an unknown source, "A good forecaster is not smarter than everyone else; he (she) merely has his ignorance better organized." If we can see patterns in what seems like randomness to others, we can often make sense of the past for the future.

Create

Abraham Lincoln allegedly said: "The best way to predict your future is to create it." The future is not some distant, disconnected, and abstract thing. Each of us has a role in making it happen. Even small actions can have a ripple effect on future lives, organizations, communities, and more. I'm especially fond of how Buckminster Fuller put it: "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete." The models, metaphors, and ideas that we create or promote help shape the future. Having been involved with tracking trends in education for over twenty years, I am confident that we can do this to a degree that is helpful, but we must also do so with a healthy dose of both humility and skepticism about our own predictions.

A Combined View

Instead of selecting just one of these options for approaching the future, we can choose to be both an idealist and a realist. We can choose to learn from all of these options, seeing them more as complementary than as competitive or discrete. There are times when it is best to focus on the present and ignore distracting thoughts of the future. There is also wisdom in doing what we can to prepare ourselves for the future, even if it is unknown. At the same time, we can do the hard work of studying the past and present trends so that we are more informed and better able to predict possible futures. Yet we do not have to be fatalistic: we have a role to play to help create the future. Perhaps the best way to approach the future is to take a combined view of all four options.

Conclusion

How do we navigate higher education leadership in an era of such rapid technological change, experimentation, and innovation? How do we decide where to invest our time, effort, and money to best set up our institutions for success? We use the tools we have. We ground ourselves in the core ideals of our institution's mission, vision, and values—learning to be persistent and relentless in missional sifting. We refine our ability to identify transitional technologies and their indications of what is likely to emerge next. We demystify futures studies, recognizing that we can cultivate the skill of predicting the future: which trends are likely to fade, or persist, or expand. Lastly, we recognize that we have several options for approaching the future: we can focus on the present while also preparing for and predicting the future. And we can be active agents in creating that future not only for our own institutions but for the larger higher education ecosystem. ■

Bernard Bull (Bernard.Bull@cuw.edu) is Vice Provost for Curriculum and Academic Innovation and Associate Professor of Education at Concordia University Wisconsin.

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Architecting for Learning Analytics:

Innovating for Sustainable Impact

Simon J. Buckingham Shum and Timothy A. McKay

Learning analytics is an academic field that has been taking shape under that banner since around 2010, and it has featured regularly in reports on learning technology futures over the years. It sits at the convergence of learning (learning technology, educational research, learning/assessment sciences), analytics (statistics, visualization, computer/data sciences, artificial intelligence), and human-computer interaction (participatory design, behavioral science, sociotechnical systems design, usability evaluation). In light of the significant investments that some colleges and universities are making in their analytics infrastructures, how can an institution architect itself to innovate at this disciplinary intersection—to innovate pedagogically and analytically in order to tackle substantial, strategically important teaching and learning challenges? In short, how can an institution innovate for sustainable impact?

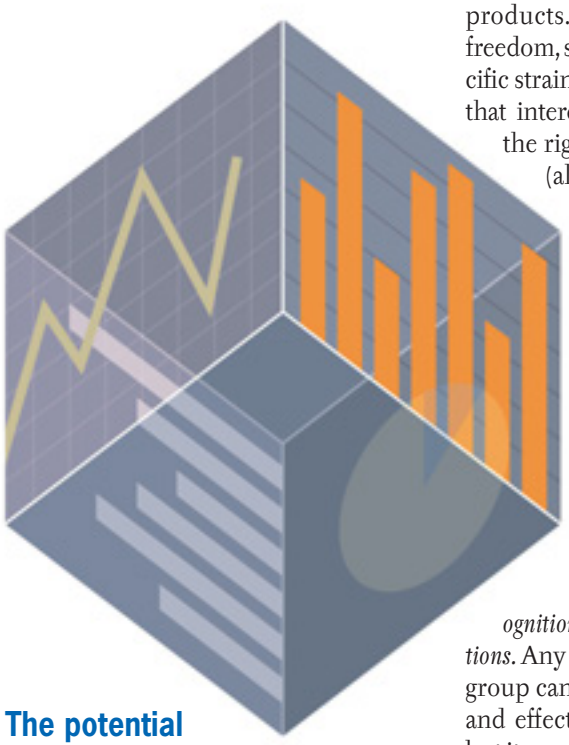
The focus of learning analytics is the application of analytics approaches to gain insight into educational data to improve teaching and learning. Learning analytics will undoubtedly be an advance if this provides new "power tools" for academic researchers—who have of course studied teaching and learning data in nondigital ways for decades. Such research is a necessary first step to validate the approaches. However, the true potential of learning analytics will be realized when we move from research to development and create human-computer systems that automate this analysis process—from data capture to visualization and recommendation—offering better (i.e., more timely, precise, and actionable) feedback to educators, students, instructional designers, and the other stakeholders who constitute the whole learning system.[1]

The word *automation* conjures up many meanings. It is important to emphasize that automation does not necessarily mean that *diagnoses, decisions,* and *actions* are fully automated, taking human educators "out of the loop." Automation may "simply" (it is still complex) make the process of data capture, cleaning, analysis, and visualization into a commodity service—a cycle that previously required skilled but scarce researchers or analysts. The responsibility for making sense of that feedback and acting on it can remain fully with the human student, educator, or analyst, or it can be shared (e.g., the analytics system may suggest areas of concern to help users prioritize their scarce attention or may recommend courses of action). It may also be that feedback and advice are fully scripted by expert instructors but are personalized at scale through tailored communication.[2]

To summarize, the potential of the "data revolution" in teaching and learning, just as in other sectors, is to create much more timely feedback loops for tracking the effectiveness of a complex system. In a field where feedback is already well established as a vital process for both students and educators, the question is how this potential can be realized through effective human-computer systems.

The Innovation/Impact Tension

Despite hosting some of the brightest academics in data science, statistics, user interface design, and organizational innovation, a college or university may be far from innovating on these fronts when it comes to tracking, analyzing, and feeding back information to improve teaching and learning. Although paradoxical to an outsider, this apparent dysfunction is all too familiar to insiders: the incentives are not there for academics to work on their own institution's strategic teaching and learning problems. As a result, research-active analytics groups are generally not responsive to their institution's analytics needs. Academics do not want to be branded with the dreaded badge of *service center*, which has connotations of not being research-worthy. Various tensions are in play here.



The potential of the "data revolution" in teaching and learning, just as in other sectors, is to create much more timely feedback loops for tracking the effectiveness of a complex system.

First, academics are under pressure to conduct novel research. They must engage in analytics innovation that is worthy of peer-reviewed publications and grants because they are making evidence-based claims, about data grounded in rigorous methodology, often using cutting-edge technology well beyond that in current products. They value their academic freedom, so they *choose* to engage in a specific strain of learning analytics research that interests them. Academics reserve the right not to try to solve "boring" (albeit serious) data challenges in the institution, generally because they feel the challenges are mundane and/or don't fit their research narrative and because they don't want to be dictated to. Funds are spent on researchers, dissemination, and equipment. Time is spent on grant writing, training PhDs, and writing and reviewing papers.

Second, academics receive little recognition for developing scalable applications. Any competent academic research group can invent novel, well-grounded, and effective analytics at a small scale, but it reserves the right to move on to the next interesting challenge. Researchers receive little reward for validating more widely or for pushing an innovation through to mainstream deployment. They certainly don't consider it their job to fix the institution's broken data systems; that's an IT or business intelligence (BI) job. In addition, crossing the chasm between innovation and infrastructure requires a suite of skills not often present in research groups—

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skills that include professional software development, user experience and interface design, innovation advocacy, and behavioral science. It also requires a steady focus on the needs of the user community—what the Design-Based Implementation Research (DBIR) community calls the "persistent problems of practice." Mainstream deployment of analytics tools also entails extensive cross-campus liaison to build commitment from other academics and units. This is a long-standing challenge for learning technology research and development (R&D).[3]

Finally, colleges and universities want to see an impact on students. This impact comes in many forms: increasing student learning, providing more efficient instructional delivery processes, addressing inequities in student outcomes, maintaining finances, and improving retention and graduation rates. These practical outcomes are sometimes perceived by academics as counterincentives.

Academics may be cautious about claiming causal connections or about being pushed to justify their work in financial terms. When the mainstream application of analytics requires scalable infrastructure that academics can't deliver, what gets rolled out is commercial products. These may provide rudimentary dashboards that give analytics a bad name and that academics in turn don't want to associate themselves with, either as end-users or researchers. Products typically target the larger mainstream, conventional markets rather than the future-focused bleeding edge of teaching and learning.

Organizational Architectures

Our focus here is on organizational architectures that a college or university's leadership can consider in order to advance innovative analytics for its own mission and context. We are seeking to open a dialogue on organizational architectures and processes as a way to address educational challenges that often require systemic thinking and change. Such challenges may be faced by many colleges and universities, opening up collaboration opportunities. Moreover, if the innovation-diffusion challenges facing one institution can be taken as a microcosm for the challenges facing the learning analytics field as a whole, organization-level insights may scale to consortia or more open networks.

Surveying the current landscape, we see three broad organizational models that are being used to deliver learning analytics. These three models are largely role-aligned: (1) the *IT Service Center* model (primarily professional services staff); (2) the *Faculty Academics* model (primarily faculty researchers); and (3) the hybrid *Innovation Center* model (a mix of professional services staff and faculty researchers).

To what extent can these three different organizational models deliver both production-grade services and innovation with sustainable impact? We will start by discussing the two "standard" models before moving on to the much less common third model.

The IT Service Center Model

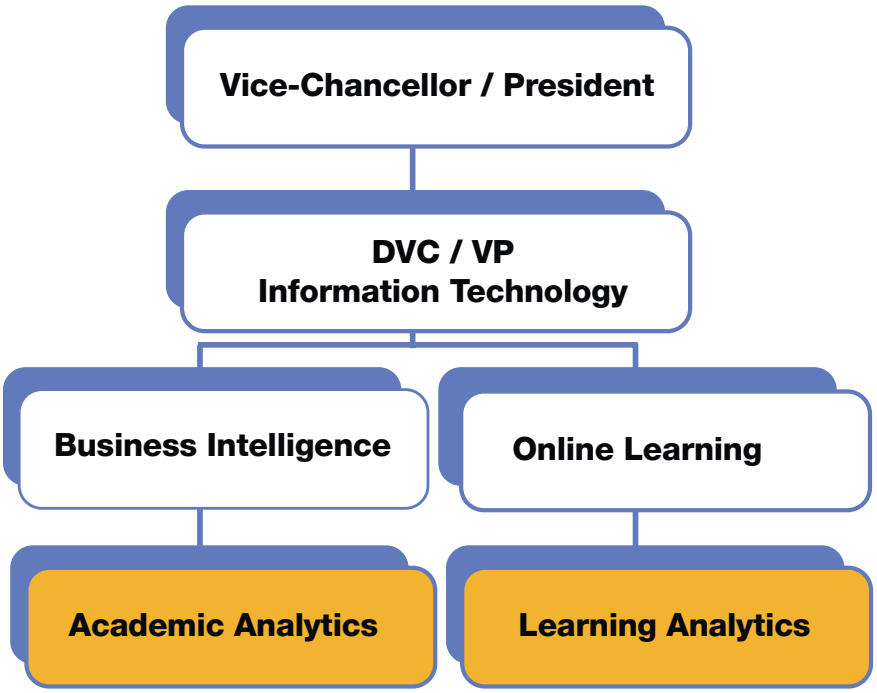
In this model, an IT service center delivers analytics from an enterprise platform. Examples include the following:

- The team delivering the learning management system (LMS) drives analytics provision, using/configuring the product's dashboards for academics (and possibly students).
- The enterprise data warehouse, BI, or institutional research (IR) team provides analytics by integrating data from the LMS and other data sources.
- A team in the teaching and learning support center works with the above units to help academics make use of analytics.

Pros and Cons

➕ The center is equipped to deliver production-grade analytics services, with close to 24/7 uptime and system support, available to all or a majority of students and staff as a core platform integrated with other institutional systems. The analytics typically cover "academic

Archetypal Organization Chart, IT Service Center Model



analytics" (conventional student demographics, enrollment, and grades) and various forms of learning analytics (finer-grained, midcourse student progress and activity data).

➕ Staff will innovate within the scope of what products can do and how they integrate with existing infrastructure.

➕ End-users will typically be academics, because to date, most LMS and other products deliver reporting dashboards to help educators track student progress.

➕ However, generic LMS products are beginning to provide student-facing dashboards (although poorly grounded in the learning sciences[4]), and if niche products are deployed (e.g., an adaptive tutor for a specific topic), this may deliver feedback to students as well, since there is such a rich model of the curriculum and students' mastery levels.

➕ If products permit report/dashboard customization, or facilitate data export, and if there is coding/analytical capacity in the center for subsequent analysis and visualization, there is scope to provide bespoke user experiences.

➖ Staff typically work only with data that products can provide, delivered via predefined user interfaces. It is very unlikely that a participatory design model has helped end-users to shape a product, with the risk that analytics services are procured with limited consultation and are then poorly received.

➖ Staff rarely have expertise in educational research, user experience, learning design or advanced analytics techniques, so the scope for analytics innovation within the center is limited accordingly. Such expertise must come from other groups, and most IT service centers have little heritage of collaborating broadly in their work.

The Faculty Academics Model

In the second model, faculty academics (possibly partnering with an IT service center) conduct applied research. Examples include the following:

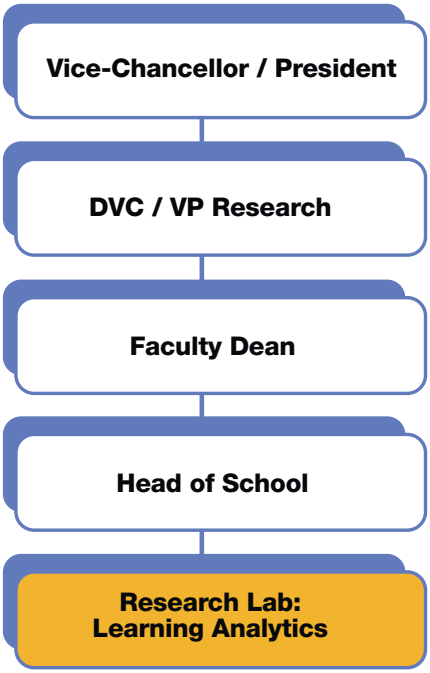
- Faculty academics develop innovative learning technologies (often externally funded) to support specific forms of learning not well supported by the LMS. This generates much richer data than typically comes from generic (i.e., discipline-agnostic) LMS products. This may serve as learning sciences research data, as well as data for feedback to educators and students.
- Faculty academics study the acceptance of analytics delivered by their institutional LMS and/or BI teams. They recruit early-adopter academics interested in piloting such analytics, study student responses, and perhaps engage other groups, such as student support teams.

Pros and Cons

➕ This model provides ample scope for radical innovation by academics, who can experiment with exotic sensors and advanced analytics techniques beyond current products.

➕ Empirical evidence is gathered about the adoption of vendor products,

Archetypal Organization Chart, Faculty Academics Model



typically identifying obstacles often relating to staff readiness, pedagogical practices that are incongruent with the analytics, or other organizational factors.

⊕ Evidence-based claims are likely to be made with a high degree of rigor, meeting the standards of the human-research ethics board and, when published, of peer-reviewed research.

⊖ The analytics are advanced but require corresponding researcher expertise to design, deploy, and maintain. This is often a scarce expertise, available on only a temporary basis.

⊖ Since the analytics are advanced, they attract early-adopter academics in pilot studies, but if those academics move on from teaching a subject, the trials end.

⊖ Typically, studies are relatively small scale, and/or use specific student cohorts, and/or are brief in duration (e.g., possible only until external funding expires).

⊖ Researchers are less likely to consider users' needs in design ("customer discovery"), so although prototyping analytics are conceptually interesting, they either are unusable or fail to address widely recognized needs.

⊖ Once the lead researcher or key project staff leave, there is nobody driving the vision for the analytics service. Vision is needed so that resources code maintenance, further grants, strategic visibility, and the all-important partnerships can sustain the innovation.

⊖ Developing a combined software/pedagogical innovation into an enterprise-wide infrastructure is a development task, which is not often rewarded in research metrics and which requires skills that research groups lack.

The Innovation Center Model

In our third model, a hybrid, autonomous innovation center is created to service the entire institution. These innovation centers operate outside—but in close partnerships with—faculty academics, college/university IT/BI/LMS teams, and other stakeholders. Fewer institutions appear to be experimenting with this model, which we now introduce in the context of our own two examples:

- An innovation center located outside the faculties, and autonomous from institutional IT/analytics, is staffed by research-active academics and data scientists, supported by professional staff. (Connected Intelligence Centre, University of Technology Sydney)
- An innovation center located outside the faculties, and autonomous from institutional IT/analytics, is dedicated to maturing and mainstreaming successful analytics innovations invented by academics, as well as innovating its own analytics services. (Digital Innovation Greenhouse, University of Michigan)

Connected Intelligence Centre, University of Technology Sydney

The Connected Intelligence Centre (CIC) at the University of Technology Sydney (UTS) is an innovation center charged with building the university's capacity to gain insights from analytics tools and techniques—spanning teaching and learning, research, and operational units.[5]

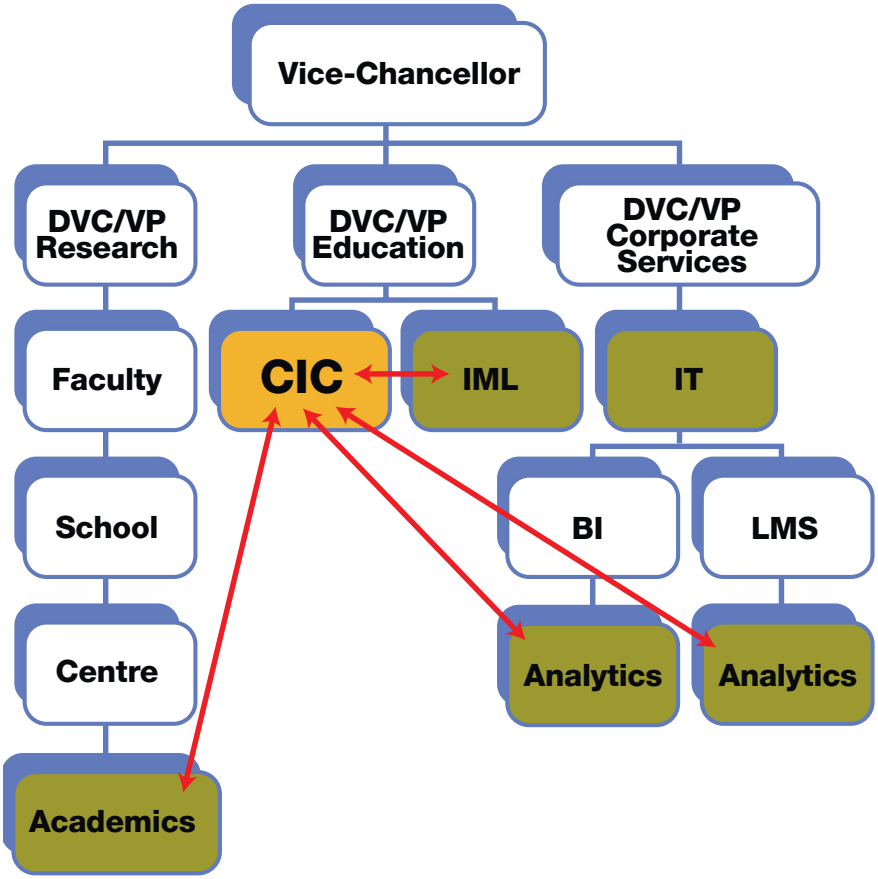
Staffing

CIC is a small center of about twenty staff (not all full-time). In many ways it looks like an academic group, with researchers at all levels, from PhDs to professors, plus professional support staff.

However, while CIC may look like an academic research group—since its mission is to create research-inspired, sustainable innovation within UTS—the academics are recruited not only for their research capability but also for their team-working ability, transdisciplinary outlook, and communication skills. The academics are also talented educators: CIC designed and launched the Master of Data Science & Innovation (MDSI) degree program in 2015, which is coordinated and largely taught by CIC's academics. This was the only degree program at UTS running outside a faculty until 2017, when UTS launched its Faculty of Transdisciplinary Innovation. This faculty will take over the administration of the MDSI program in 2018, but the current staff will continue to teach it.

CIC has thus operated like a mini-faculty, running the MDSI and an elective subject in quantitative literacy

Connected Intelligence Centre, University of Technology Sydney



and critical thinking ("Arguments, Evidence & Intuition") and launching its own Learning Analytics Doctoral Program in 2016. CIC's Academic Board of Studies is drawn from across UTS to reflect its transdisciplinary nature. These teaching programs generated revenue that gave CIC the capability to grow beyond the baseline funding from the university.

CIC reports to the Deputy Vice-Chancellor for Education. The CIC director thus has the privilege of being able to talk to the Directors of IT, Teaching & Learning Innovation, Student Support, and Library to overcome obstacles to accessing data, get servers running, convene meetings, and more. This opens opportunities at a strategic level that a faculty-based team would typically not access.

Navigating from prototype to (1) small-scale pilots, to (2) pilots with several hundred students, and on to (3) a mainstream rollout to thousands of students will be critical transitions for CIC. The center has managed the first two transitions and this year will move to the third. Moreover, students are starting to

Academic Team	Professional Services Team
Director & Professor	Senior Manager
Professor	Course Manager
Associate Professor	Marketing/Communications Officer
Senior Lecturer x2	Administrative Assistant
Lecturer	Cloud Integration Specialist
Research Fellows x2	Web Developer
Data Scientist	Software Developer
PhD students x4	Undergraduate Interns x2
2–3 Visiting Researchers/Students	

expect certain services to be always on, and they complain if there is downtime. CIC is typically pushing the envelope of new technologies (e.g., Amazon Web Services), with encouragement from and in partnership with the IT Division (ITD). But this type of exploration must maintain security and also requires a constructive, friendly relationship with ITD staff, who are finding that servicing CIC's requirements is preparing them for what faculty members will likely be requesting in the future. For example, CIC and ITD co-funded a cloud specialist to assist in supporting MDSI students, in the expectation that before long, other degree programs will be calling on this specialist for cloud services.

Cultivating Research-Grade Innovation in a Non-Faculty Center

Attracting and retaining high-caliber researchers for this work requires the creation of an academically stimulating culture that provides the opportunities and trajectory needed by researchers at different career stages. This includes generating national and international visibility through research conferences, the chance to bid for competitive grants, and time to think and write.

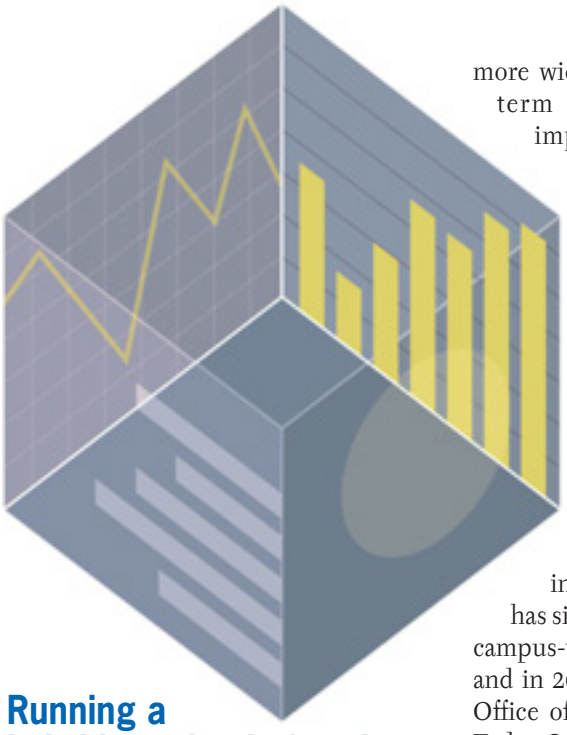
However, running a hybrid academic/service operation requires controlling the innovation/impact tensions mentioned at the beginning of this article. For instance, when is there "enough" evidence, by academic research standards, to scale a prototype that is exciting interest? CIC researchers understand that their work must be designed to add value into UTS, as the primary client, while working in close partnership with faculties and other client groups. Thus, all PhDs are in partnership with one or more faculty academics, providing authentic testbeds but introducing risk factors to a doctoral plan. Software is breaking new ground but is designed as early as possible in consultation with ITD staff, who are not used to any other unit running 24/7 student-facing systems. Analogous to the R&D centers in companies, the CIC mission is to enhance the efficiency of current services, as well as prototype future services, but it cannot chase "blue sky" ideas simply out of curiosity. CIC was created to build sustainable capacity in UTS staff and students to use data science and data analytics tools.

Digital Innovation Greenhouse, University of Michigan

Learning analytics activity at the University of Michigan (UM) began to emerge as a coherent theme of work in 2011, with SLAM: Student Learning and Analytics at Michigan (http://www.crlt.umich.edu/SLAM). This seminar series combined a forum for exchange of ideas and information among on-campus faculty and staff with an opportunity to connect with external speakers. In 2012, interest in SLAM prompted the UM provost to launch a three-year, faculty-led Learning Analytics Task Force (LATF), charged with promoting expanded use of data on campus and funding a series of learning analytics projects. These projects took two forms: analysis of data to inform policy and practice; and invention of tools designed to put data to work in support of teaching and learning. Several of these tools entered the classroom as pilot projects and attracted external research support.[6]

The Digital Innovation Greenhouse (DIG) was proposed in 2014 to solve a recurring problem that LATF projects had encountered. Faculty innovators and their research teams had designed, developed, and tested analytics-driven tools designed to improve teaching and learning on campus. These innovations were typically tested in the researchers' home environments, often in courses they had been assigned to teach. When news of their existence and impact became known on campus, interest in expansion to other areas emerged. The founding research groups, while often interested in this expansion, lacked the resources, skills, and/or reward systems needed to mature a seedling innovation into an element of the campus infrastructure.

Several of these projects attempted to grow to scale by handing off their tools to the campus-wide Information Technologies Service (ITS) unit. ITS as an organization is very good at staging and supporting *mature* software systems. Unfortunately, the unit's skills and organizational approaches are ill-matched to adopting the loose, rapid, "duct tape and chewing gum" development methods of researchers. Finally, to take advantage of the vibrant innovation community emerging on campus, DIG was created as a pilot in 2015. Its mission was to adopt a series of existing digital-engagement innovations from the research labs they had outgrown, carry them across the innovation "valley of death," and deliver them to ITS as infrastructural tools that could be used campus-wide. In doing this, DIG achieved both the immediate goal of making existing research tools much



Running a hybrid academic/service operation requires controlling innovation/impact tensions.

more widely available and the longer-term goal of demonstrating the importance of this greenhouse approach to the development of 21st-century digital-engagement tools.

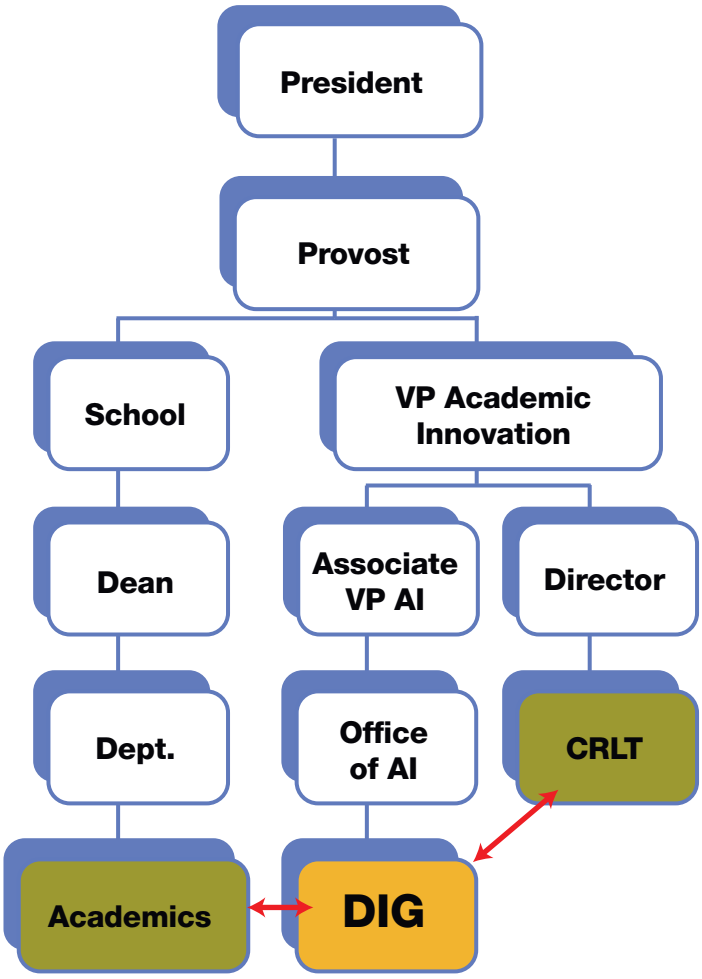
To create a home for DIG, the university turned to the recently formed Office of Digital Education and Innovation. This unit, which reports to the Vice Provost for Academic Innovation, was created in 2013, initially to provide a home for UM's newly emerging involvement in MOOCs. It has since become the focal point for campus-wide educational R&D efforts, and in 2016 the unit was renamed the Office of Academic Innovation (OAI). Today, OAI is home to teams working on three major themes: designing, developing, delivering, and experimenting with online and hybrid education; growing analytics-driven educational innovations to scale; and promoting gameful design of educational experiences. These teams often work in collaboration with the campus's long-standing Center for Research on Learning and Teaching (CRLT), especially on projects that focus on residential learners.

Staffing

DIG projects advance in a highly collaborative environment including at least four elements:

1. *Faculty champions and their research teams.* Each project enters DIG with a principal advocate drawn from the faculty, usually accompanied by members of the research team. DIG is now also exploring how to support innovations backed by students and staff. Innovators help to drive the vision for each project. In addition, they regularly lead efforts to research innovation design and impact, often with external support.
2. *The DIG team of software developers, user experience and interface designers, behavioral scientists, and innovation advocates.* This group provides the professional skills and reward system needed to mature innovations technically, in close interaction with the expanding

Digital Innovation Greenhouse, University of Michigan



user community. Full-time DIG staff are supported by an array of graduate and undergraduate student fellows who provide additional effort, a fresh design view, and close contact with DIG tools.

3. *An expanding campus community of users, from early adopters to those hoping to use DIG tools as infrastructure.* Continuous, intensive interaction with this community of faculty, staff, and students is essential to the success of DIG tools. The DIG team forms the liaison between faculty innovators and this community, putting in the time and effort required to establish and maintain deep and mutually beneficial relationships.
4. *The UM ITS organization.* The DIG team interacts with ITS both to obtain the required infrastructure support (e.g., servers, single-sign-in authentication, access to data) and to ensure that the development cycle for DIG tools stays within campus ITS structures.

Academic Team	DIG Staff
Faculty Director	Lead Software Developers x4
AI Operations Director	Software Developers x4
Faculty Champions x7	Lead Behavioral Scientist
	Behavioral Scientist
	Lead Innovation Advocate
	Data Scientist
	UX/UI Designers x3
	Student Fellows x10–15

From these four groups, only the core DIG team is officially employed within the OAI. Originally established as a team of three senior software developers, the DIG team now includes a continuously growing, full-time staff of fifteen.

Funds for this staff come from three sources: a UM Third Century Initiative grant that provided for the launch of DIG; additional investments made from the university through the OAI budget; and project funds obtained from various sources (NSF and other grants). Excellent administrative support comes from OAI and has proven essential to creating and maintaining a nimble, responsive organization within an occasionally leisurely and conservative campus community.

Engaging Faculty in Academic Innovation

DIG was established within the OAI as a staff unit, without official appointments for any members of the faculty. The model is predicated on close collaboration between faculty champions, their research groups, DIG staff, and the broader community of educational practitioners across campus. Although this model has worked well, it has created significant tensions for some faculty members, particularly those for whom education is not a research focus. They find themselves doing this work *in addition to* their existing responsibilities for research, teaching, and service. Championing an analytics-driven innovation as it expands across campus is not a small

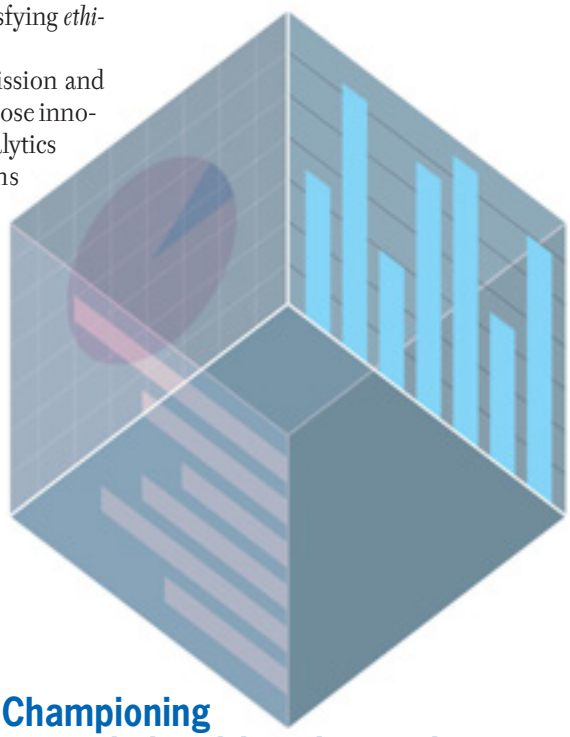
task, even when receiving the extensive professional support the DIG team provides. Indeed, the rapid pace of development and expansion that the DIG team can deliver makes the job of the faculty champion *more* challenging. For this reason, DIG has come to think of the activities taking place in the OAI as educational R&D—applied research aimed at reinventing higher education for an information age. With this lens, DIG and OAI can be seen as a research institute, akin to UM's long-standing Institute for Social Research or its Life Sciences Institute. These units provide associated faculty members with appointments of varying kinds, ranging from 100 percent salaried positions to 0 percent affiliated faculty status. In 2018, OAI will explore offering appointments of this kind to ensure that faculty champions have the support they need to accelerate innovations to scale.

Reflections on the Innovation Center Model

CIC and DIG started at different points and in response to different drivers. CIC has been home to research-active academics from its launch, running its own master's and PhD programs, but it now needs to build developer capacity as demand grows for its analytics tools. In contrast, DIG launched with technical staff to scale innovations from existing faculty academics, but it is now considering new models for engaging academics. Today, DIG and CIC seem to be moving toward common ground: *they are both autonomous centers reporting to a VP/DVC, tasked with innovating data and analytics infrastructure to tackle strategic teaching and learning challenges, while working in partnership with faculties, teacher professional development, and IT services.*

At this point, it is too early to declare these centers to be the blueprint for success; however, we can summarize the CIC and DIG hallmarks:

- Having the center report directly to a senior leader at the VP/DVC level provides the strategic positioning needed to effect change around, for instance, access to data and the provisioning of campus-wide analytics services or innovations.
- The center either incorporates academics and research students (CIC) or works very closely with them in their faculties (DIG). This enables the center to conduct *research-inspired* innovation, in analytics that are *grounded in educators' and students' needs*, leading to *evidence-based claims* and satisfying *ethical standards.*
- The center has the core mission and the capability to translate those innovative ideas into robust analytics services, to specifications approved by the IT division (e.g., security, architecture), integrating with the institution's enterprise infrastructure. As CIC's prototypes begin the transition to more widely scaled internal "products," it is recognizing the importance of having a DIG-scale software design, development, evaluation, and communications team.
- The center can supplement its institutional funding with other income including externally funded joint projects with faculty, internal strategic grants with faculty, student fees from formal teaching programs, and faculty buyouts of teaching time from the center's academics.
- By creating a campus-wide focal point for the development of analytics-driven tools, the center can create significant efficiencies of design and synergies of operation. For example, for access to campus data, the DIG team has developed a shared, extensible framework that can be used by all tools, preventing the need to re-create this framework for each tool. It has also worked to coordinate a toolkit of elements generally useful for education at scale in large foundational courses, increasing the adoption of the full suite of tools. Similarly CIC, having better understood the diverse needs of academics, has re-architected the writing-feedback tool to expand the range of services it can offer.



Championing an analytics-driven innovation as it expands across campus is not a small task, even when receiving extensive professional support.

- If (like CIC) the center is hosting its own academics and doctoral students, it looks very much like faculty research groups. Therefore, the center must be very clear that it is not simply doing research "business as usual" but is working on data challenges faced by the institution and is adding value through generic/customized analytics services for academics, students, and professional

business units from across the campus. All of the center's innovations must be conducted in collaboration with institutional "clients."

- If (like DIG) the center houses only staff and collaborates with faculty who are offered no official role in the organization, it may be placing a significant burden on both faculty innovators and early adopters from its community of practice. The reward systems for faculty members at research universities are finely tuned, leaving little allowance for the recognition of new forms of activity. Unless these innovative types of activities are accepted as either research or service by faculty members' home departments, the faculty must contribute effort without recompense.
- The center complements but does not duplicate the work of the campus division that is leading academic professional development in teaching and learning. These well-established teaching and learning centers bring expertise in pedagogy and academic development but do not have the capacity to develop the college or university's learning analytics capability. For example, CIC has worked very fruitfully with the UTS Institute for Interactive Media in Learning, whose *Academic Learning and Literacy* specialists have advised on the CIC automated writing-feedback tool and have coauthored research papers. DIG and its leaders are collaborating closely with UM's Center for Research on Learning and Teaching on the launch of a Foundational Course Initiative and with the Sweetland Center for Writing on the M-Write project.
- The center complements but does not duplicate the work of the IT division. Colleges and universities already have an established LMS and BI unit, but the center's focus is on modes of learning, forms of data, and analytics user groups not covered by such units. The center must liaise closely with other units and divisions that are concerned with data governance and may be developing novel services to test frameworks. Similarly, the center may well be the first non-IT group provisioning 24/7 student- or staff-facing software applications, requiring solid IT partnership to ensure security, network services, responsive maintenance, and so forth. The IT collaboration should be mutually beneficial. For instance, CIC and DIG have provided IT staff with secondment opportunities to work in an environment more akin to a startup, on different projects developing new skills.
- The center starts to develop platforms that advance the work of faculty researchers, in domains other than teaching and learning. For example, DIG's ECoach tool has been used as a platform for conducting experiments in social psychology, online engagement, and the visual display of quantitative information. Similarly, CIC's text analytics platform, social media activity aggregator, and multimodal collaboration analytics can be generalized to non-educational contexts, to benefit other UTS academics.

It is perhaps not a coincidence that both CIC and DIG have converged independently on common strategically important teaching and learning challenges.

Finally, it is perhaps not a coincidence that both CIC and DIG have converged independently on common strategically important teaching and learning challenges. We are excited about the potential for collaboration around the role that analytics can play:

- *Personalized messaging enabling feedback at scale.* Although all the educational evidence points to the importance of timely, actionable, and personalized feedback for effective learning, providing this feedback is particularly challenging in large classes. Both universities have developed platforms that permit academics to craft coaching messages to students contingent on their progress (e.g., over a week): UM developed the earlier noted ECoach platform, whereas UTS has been running its own personalized messaging platform for a decade and is a partner in the Australian national OnTask project developing an open-source tool. The role of the analytics is to analyze students' activity profiles from multiple data sources and compile the feedback into a personalized email, with a growing evidence base that this feedback is well received by students and improves their outcomes.[7]
- *Text analytics for student writing feedback.* Critical, persuasive, reflective, academic writing is hard to learn,

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UNCOMMON THINKING FOR THE COMMON GOOD

hard to teach, and hard to give rapid feedback on. Both universities are developing applications of Natural Language Processing to give instant formative feedback (not summative grades) on students' drafts as a way to encourage revision and reflection. These applications require scaleable text analytics platforms, tuned to the specific writing features that will enable actionable feedback. Common to both efforts (the UTS Academic Writing Analytics tool and research program and the UM M-Write initiative) is the recognition that such tools are most effective when aligned with good "'learning design"—that is, congruent with the curriculum, assignment activities, and grading rubrics.

- *Human-centered analytics.* Software design has gradually shifted from being technology-driven to human-centered, and it is no coincidence that both universities have academic professionals from human-computer interaction on their teams, as well as designers who care about the user experience. The human dimensions of learning analytics are diverse, from deciding what the overall user needs are, to designing the user interface and evaluating how users engage, to considering the ethics of data, algorithms, and visualizations. Finding ways to involve stakeholders early on, through participatory design methods, is critical to achieving these aspirations.[8]

Conclusion and Invitation

We have introduced the dilemma that higher education institutions face: how can they architect themselves organizationally to both innovate learning analytics (the traditional province of faculty researchers) and see the learning analytics deliver sustainable impact through mainstreamed services (the traditional province of LMS/IT units)—which, furthermore, are rigorously evaluated (a conventional faculty role)? We have documented two examples of a new model: the hybrid learning analytics innovation center, reporting to senior leadership and working in close partnership with faculties and service centers.

The hallmarks of our centers are from just two exemplars, and we recognize that these do not reflect the diversity of institutional contexts. Please treat this as an invitation to respond. We offer these reflections as a conversation opener, and we welcome feedback, including examples of other organizational models tackling this challenge. ■

Notes

1. Simon Knight and Simon Buckingham Shum, "Theory and Learning Analytics," chapter 1, and Ruth Crick, "Learning Analytics: Layers, Loops and Processes in a Virtual Learning Infrastructure," chapter 25, both in Charles Lang, George Siemens, Alyssa Wise, and Dragan Gašević, eds., *Handbook of Learning Analytics* (Beaumont, Alberta: Society for Learning Analytics Research, 2017).
2. Madeline Huberth, Patricia Chen, Jared Tritz, and Timothy A. McKay, "Computer-Tailored Student Support in Introductory Physics," *PLoS ONE* 10, no. 9 (September 9, 2015).
3. Barry J. Fishman, William R. Penuel, Anna-Ruth Allen, and Britte Haugan Cheng, eds., *Design-Based Implementation Research: Theories, Methods, and Exemplars,* National Society for the Study of Education Yearbook (New York: Teachers College, Columbia University, 2013); Eileen Scanlon et al., *Beyond Prototypes: Enabling Innovation in Technology-Enhanced Learning* (London: Technology Enhanced Learning Research Programme, [2013]).
4. Ioana Jivet, Maren Scheffel, Marcus Specht, and Hendrik Drachsler, "License to Evaluate: Preparing Learning Analytics Dashboards for Educational Practice" (preprint), in *Proceedings LAK18: International Conference on Learning Analytics and Knowledge* (Sydney, March 5–9, 2018).
5. For more details on the organizational history leading to the creation of CIC and the focus of its analytics R&D, see: Rebecca Ferguson et al., "Setting Learning Analytics in Context: Overcoming the Barriers to Large-Scale Adoption," *Journal of Learning Analytics* 1, no. 3 (2014); Riina Vuorikari and Jonatan Castaño Muñoz, eds., *Research Evidence on the Use of Learning Analytics: Implications for Education Policy,* European Commission Joint Research Centre (JRC) Science for Policy Report (2016).
6. For more details on the organizational history leading to the creation of DIG and its focus on growing analytics-driven innovations to scale, see Steven Lonn, Timothy A. McKay, Stephanie D. Teasley, "Cultivating Institutional Capacities for Learning Analytics," *New Directions for Higher Education*, no. 179 (Fall 2017).
7. Mary C. Wright et al., "Better Than Expected: Using Learning Analytics to Promote Student Success in Gateway Science," *Change: The Magazine of Higher Learning* 46, no. 1 (2014); Huberth et al., "Computer-Tailored Student Support in Introductory Physics."
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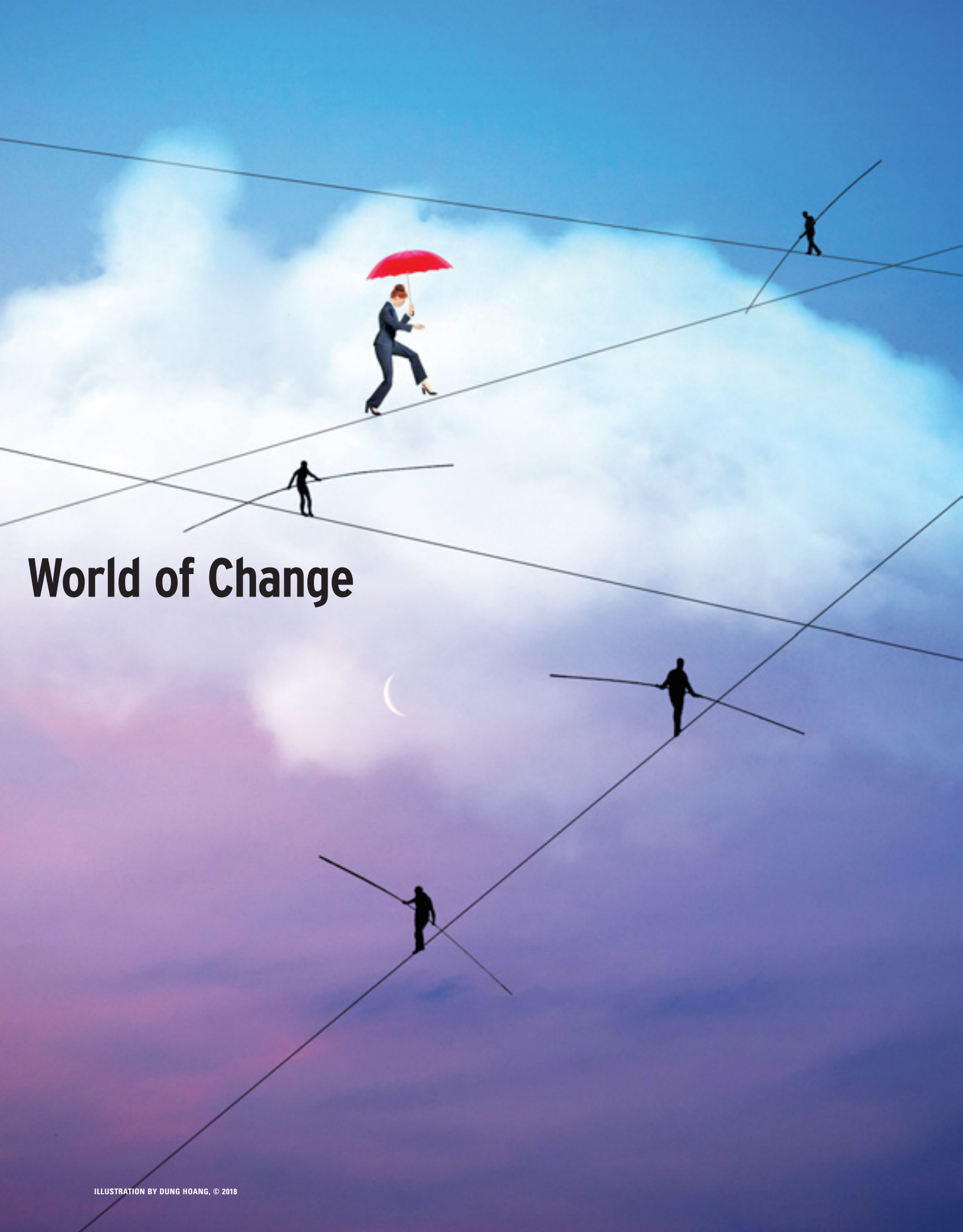
EDUCAUSE LEARNING INITIATIVE

This article is excerpted and synthesized from *Creative Know How—for a Novel, Complex World*, Report 8 of the MyWays Student Success Series.

Creative Know How: Competencies for Student Success in a

Grace Belfiore and Dave Lash

Creative Know How covers a wide range of skills, from those that have always been important (e.g., communication with others) to the ability to work in tandem with highly intelligent machines in ways that serve humanity, where even the questions to be asked are far from clear. Daniel Pink, when asked what he believed was the most important skill in today's environment, responded: "My first instinct is adaptability. You need to be able to change and adapt. I think people have difficulty with that. Dealing with ambiguity has become profoundly important today."[1] For this reason, we invite you to keep your eye out, when reading this article, not just for the mastery and craftsmanship involved in the Creative Know How competencies but also for the spirit of innovation and improvisation with which they are approached.



World of Change

ILLUSTRATION BY DUNG HOANG, © 2018

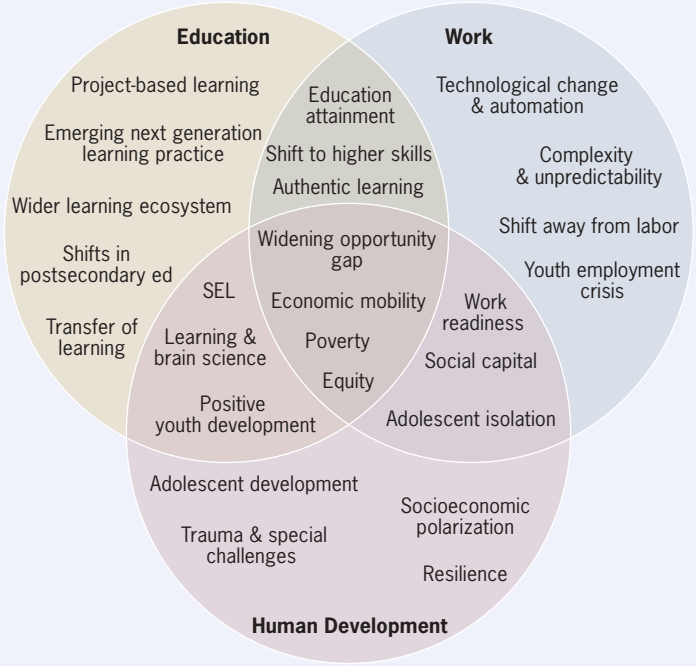
The MyWays Student Success Framework

Higher education leaders are asking important questions about the challenges facing students emerging from secondary and postsecondary education in a world of unprecedented, high-velocity change. What can schools and higher education institutions do to ensure that graduates enter their "wayfinding decade" with the competencies, learning orientation, and agility they'll need to be successful in the 21st century? For that matter, what are those competencies, and how are researchers, social scientists, employers, and educators defining them today?

Nearly three years in development, the MyWays project (https://myways.nextgenlearning.org/) from the EDUCAUSE Next Generation Learning Challenges (NGLC) initiative was designed to address these issues. It assembles, distills, and presents exhaustive research (see figure 1) on four essential questions that are increasingly taking center stage among elementary and secondary education reformers in the United States:

- Why the urgency to change? What are the profound new realities and conditions that today's students are encountering, and what are their implications for the kinds of competencies students should develop?
- What does success look like for students in a world of accelerating change? What competencies combine to reflect a broader, deeper definition of success?
- How can learning design help students develop these broader, deeper competencies? What implications does a radically different goal line and learning model have for the design of schools and the organizations running them?

Figure 1. Scope of the MyWays Research



- How should schools gauge student progress in developing these competencies? How can we measure and interpret a school's performance beyond proficiency in math and English or language arts to embrace whole-person development?

It is vital that higher education leaders understand these questions, since the answers will shape—and perhaps

Why Creative Know How Is So Important

The competencies that compose the Creative Know How domain are important for many reasons, including the fact that they are essential in addressing a range of issues and factors: the roadblocks to employment; the decisions needed to navigate the work/learn landscape; the essentials for cultivating social capital; and the developmental challenges that learners face as they transition to an increasingly volatile world. Students might ask themselves the following:

- Do I have the adaptability, the collaborative and entrepreneurial ability, and the tech/media skills to solve problems, develop new solutions, and create value—for myself, employers, and others in a rapidly changing environment?
- Can I work creatively and effectively with others, of varying backgrounds and skill sets, in face-to-face and digital settings, to help build and sustain teams, networks, and communities?
- Am I able to muster my critical thinking, creativity, and communication skills in pursuit of my postsecondary learning, my early employment opportunities, and my uniquely personal opportunity engine?
- Can I combine all these competencies with my knowledge of the real world around me to make that world a better place?

Creative Know How competencies—continuously coupled with those in the three other MyWays domains (Habits of Success, Content Knowledge, and Wayfinding Abilities)—empower us to escape old ways of doing things, solve current dilemmas, and invent new solutions. In many respects, the Creative Know How competencies are the everyday power tools of the information age.

Essential to Career Bootstrapping

Navigating the work/learn landscape is a perplexing "wicked problem" requiring extraordinary resourcefulness and ingenuity. Most postsecondary students are "working learners" today, but the jobs that many of them find are of only marginal benefit to their careers. More and more workers under the age of thirty are temporary, part-time, contingent, free-lance, or self-employed.[2] Skills

substantially change—incoming students' readiness to tackle college-level work as well as their expectations about what postsecondary learning should look like.

The MyWays Student Success Framework organizes twenty competencies into four domains—Habits of Success, Creative Know How, Content Knowledge, and Wayfinding Abilities—in the voluminous, open-access NGLC MyWays Student Success Series (see figure 2). These domains and competencies are a distilled, integrated composite of more than twenty-five research-based frameworks, composing a "Rosetta Stone" intended not to replace those frameworks but to increase their interoperability. *EDUCAUSE Review* readers who are familiar with the Lumina Foundation's Degree Qualifications Profile (DQP) will see parallels between that initiative and the MyWays research. Both are efforts to articulate a broadly accepted definition of the skills and dispositions that a diploma should represent—at the college/university and high school levels.

Unpacking, discussing, and applying these questions and this research is becoming of paramount importance to postsecondary institutions as the debate about the value of a college/university education continues to heat up. Higher education institutions could feel the first impacts of these movements in K–12 education soon: an initiative called the Mastery Transcript Consortium is working with independent and (soon) public high schools across the country, along with college/university admissions specialists, to reimagine and redesign the high school transcript around richer, deeper definitions of success—such as those reflected in the MyWays research.

—Andy Calkins, Director, Next Generation Learning Challenges (NGLC) initiative, EDUCAUSE

Figure 2. The MyWays Four Domains

Habits of Success are behaviors and practices that enable students to own their learning and cultivate personal effectiveness

Creative Know How involves skills and abilities to analyze complex problems and construct solutions in real-world situations

Content Knowledge focuses on subject area knowledge and organizing concepts essential for academic and real-world applications

Wayfinding Abilities cover knowledge and capacity to successfully navigate college, career, and life opportunities and choices

related to entrepreneurial thinking and creativity are especially in demand in such a world. All workers, even those employed by others, need to use entrepreneurial approaches to do their work and to advance their career. As Tom Friedman has advised: "More is on you."[3] Creative Know How competencies play a pivotal role in crafting a personal career-building *opportunity engine* of work experience, marketable competencies, degrees and credentials, and social capital.[4]

Coveted by Employers

Creative Know How encompasses most of the value-creating skills that employers, in the aggregate, say they want today. Sixty percent of employers say applicants lack interpersonal and communication skills. Seventy-six percent say 4C-related skills (critical thinking, communication, collaboration, and creativity) will become even more important over the next three to five years. Ninety-three percent say these skills are more important than college major.[5] These competencies are also vital to the challenges of automation and artificial intelligence (AI): solving problems that do not have clear answers, that computers and AI address poorly or not at all, and that rely more largely on human-to-human interaction.

Instrumental to Self-Development

Creative Know How competencies shape who we are and how we interact with others and the world. The pursuit of Creative Know How through authentic, active means—through maker spaces, entrepreneurial initiatives, collaborative projects, the use of emerging media, and/or community problem solving via service learning—is a way to put learners out into the adult world, where they can access mentors, see potential paths for interests and careers, and take new steps in their web of development. This aligns with Kurt Fischer's notion that opportunities expand as our know how advances: "Each one of us has our own web of development, where each new step we take opens up a whole range of new possibilities that unfold according to our own individuality."[6]

Given the importance of meaningful work to both adolescent development and the work/learn cycle, we give Bryan Goodwin and Heather Hein the parting word on why Creative Know How is

essential for our learners and our future: "Perhaps the most important pivot we might make (with all due respect to Friedman) is to fret less about how our kids will compete in a flat, hot, and crowded world and *more about how they can contribute to that world by solving complex problems.* We might start by telling our kids to do their homework because their neighbors—locally and globally—are counting on them."[7]

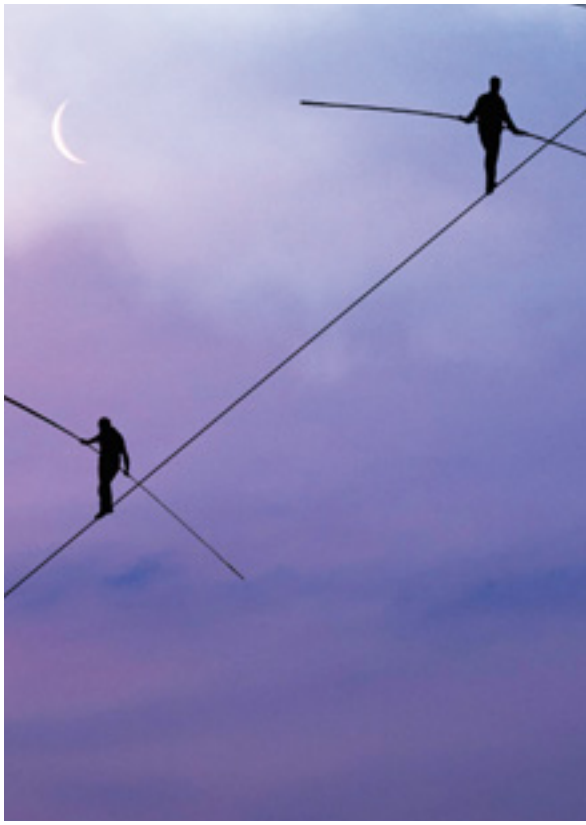
The Creative Know How Competencies

The five Creative Know How competencies[8] map out the kinds of skills learners will need in order to successfully address the two most pressing challenges of the world they will live in: relentless novelty and deepening complexity. These five skill sets can be developed only through real-world application and iterative practice in a variety of situations that promote transfer. The skills cluster into two groups. The first three competencies correlate well with the popular 4C skills noted above—often referred to as *21st-century skills*—with an added emphasis on entrepreneurship for the "more is on you" nature of the gig economy:

- *Critical Thinking & Problem Solving:* the ability to reason effectively, use systems thinking, and make judgments and decisions toward solving problems in educational, work, and life settings. Addressing this competency includes helping students to identify and define problems and propose solutions using analytical thinking approaches, systems thinking approaches, and design thinking approaches. (Design thinking is also included in the Creativity & Entrepreneurship competency.)
- *Creativity & Entrepreneurship:* the imagination, inventiveness, and experimentation to achieve new and productive ideas and solutions. Addressing this competency includes helping students to think creatively using design thinking and other approaches, work creatively with others, implement innovation, and develop entrepreneurial skills and mindsets to support new value creation.
- *Communication & Collaboration:* oral, written, and visual communication skills, as well as the ability to work effectively with diverse teams. Addressing this competency includes helping students to articulate thoughts not only orally but also in writing and nonverbally, listen effectively, use communication for a range of purposes, communicate in diverse environments, work effectively and with respect in diverse teams, show flexibility, assume shared responsibility, and value individual contributions.

Following our research on the full range of competency frameworks and the changes occurring in the economic and social spheres, we were compelled to include two further competency sets to complete the Creative Know How toolkit. First, media and technology are increasingly central to work in any field and to the participation in social and civic life. Second, the brains of twenty-somethings are still developing, and the disorderly gig economy and "more is on you" nature of learning and work paths are likely to pose new challenges to navigate in terms of health, housing, and other practical aspects of living. We therefore added the following Creative Know How competencies:

- *Information, Media & Technology Skills:* the ability to access, evaluate, manage, create, and disseminate information and media using a wide variety of technology tools. Addressing this competency includes helping students to develop information and media literacy, create media products for appropriate expression in diverse environments, and cultivate technology literacy, including computational knowledge and the ability to leverage the capabilities of augmented and virtual reality, big data, robotics, AI, and other emerging technologies.
- *Practical Life Skills:* the ability to understand and manage personal finances, health and fitness, and emotional, spiritual, and other aspects of personal well-being to enable and support a productive, effective life. Addressing this competency includes helping students to handle personal finances including credit and debt, manage their health, nutrition, and exercise, attend to their emotional, spiritual, and other aspects of well-being, and address practical life tasks that are evolving fast (e.g., ways to shop, find housing, and get around).



#StudentSuccess

Learning is not attained by chance, it must be sought for with ardor and diligence.

–Abigail Adams

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Key Principles for Addressing Creative Know How

Given the existence of a range of 21st-century skills frameworks, what are the distinguishing features of the MyWays Creative Know How domain? Our research tells us that efforts to support Creative Know How should incorporate *four key principles*:

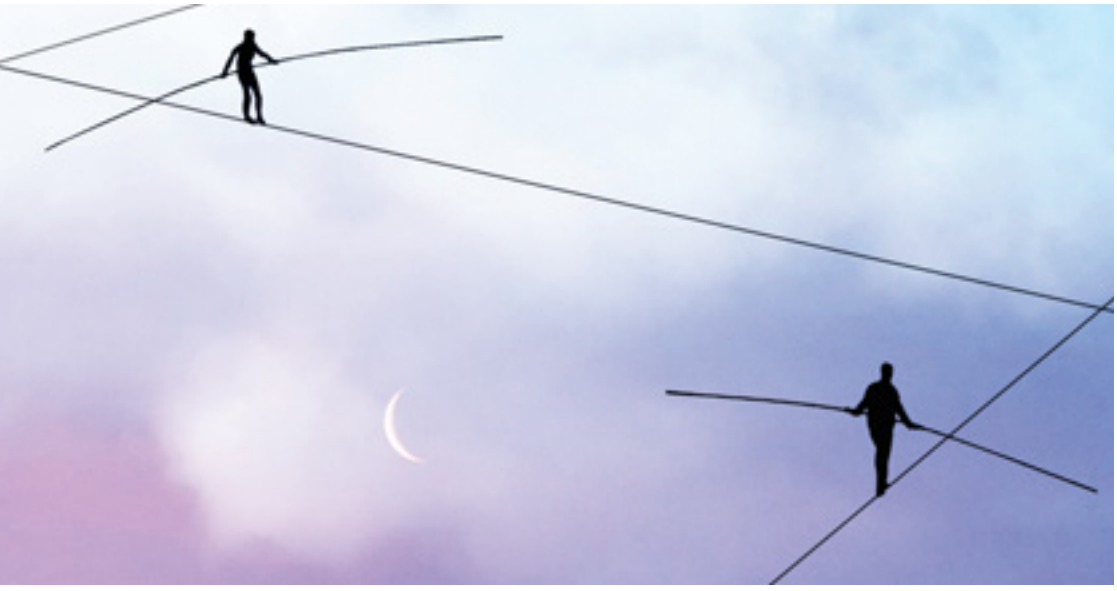
1. Develop and transfer competencies in novel, real-world contexts, incorporating a variety of complex and rapidly changing situations
2. Work on skills and knowledge in integrated ways—learners need to apply skills to and through content knowledge, in a virtuous cycle
3. Focus explicitly on these skills—naming, practicing, and reflecting on them, as well as being coached on them and receiving ongoing and effective feedback
4. Explore the ways in which Creative Know How competencies are intimately interrelated with each other and with the Habits of Success domain

Key Principle 1: Develop and transfer competencies in novel, real-world contexts, incorporating a variety of complex and rapidly changing situations

Change is accelerating in the lives of young adults. In a 2017 keynote address Tom Vander Ark, the author of *Getting Smart: How Digital Learning Is Changing the World* (2011), underlined how drastic and relentless this change is likely to be. After six months of investigating the state and direction of machine learning and AI, he concluded that the future is likely to bring significant changes and surprises and that what educators really need to "get kids ready for" is "novelty and complexity."[9] This echoes the concerns of other thought leaders who refer to the impact on education of some version of volatility, uncertainty, complexity, and ambiguity (VUCA).[10]

The concepts of novelty and complexity, and VUCA, have for some time been useful in describing the ways in which applying knowledge and skills in the "messy" realm of the real world differ from learning in a more bounded, inauthentic school setting. Recently, however, the evolution of cognitive computing, the Internet of Things (IoT), the flexible workforce, globalization, and other major paradigm shifts have taken VUCA and its cousin concepts to a whole new level. Vander Ark suggests, for instance, that the 4C skills of the early 2000s (communicating, collaborating, critical thinking, creativity) might now be replaced by a different type of 4Cs that instead describe the nature of the world we live in: "connected, contested, complex, and competitive." The result? As Peter Drucker concluded: "Since we live in an age of innovation, a practical education must prepare a person for work that does not yet exist and cannot yet be clearly defined."[11]

Promoters of 21st-century skills have always aimed to enhance transfer into novel, authentic situations that a learner might encounter in adult life. Now, as we are realizing that we can't even predict what those situations will be, attention to this approach is even more important. For this reason, Creative Know How requires us to focus on the following: student agency; real-world authentic learning; the availability of diverse opportunities to apply and improve competencies in iterative ways; a focus on contextual reasoning and conditional knowledge (which "includes knowing when and why to apply various actions")[12]; and of course, the goal of transfer itself (i.e., knowing how to apply those actions). In *Four-Dimensional Education: The Competencies Learners Need to Succeed*, Charles Fadel, Maya Bialik, and Bernie Trilling observe: "Research has shown that educational environments that emphasize students' active roles, that enhance students' self-regulation, that encourage communication and reflection skills, and are social and relevant to the learner (character qualities), successfully enhance the transfer of learning to new situations." The authors add: "In fact, the elusive goal of education transfer—applying what one learns in one setting to another different context—can be thought of as preparation for future learning. This view redefines learning transfer as the productive use of skills and motivations, to prepare students to learn in novel, real-world situations, or in resource-rich environments."[13]



Given the existence of a range of 21st-century skills frameworks, what are the distinguishing features of the MyWays Creative Know How domain?

Key Principle 2: Work on skills and knowledge in integrated ways—learners need to apply skills to and through content knowledge, learning both more deeply, in a virtuous cycle

Fadel, Bialik, and Trilling wisely note the following: "A long-standing debate in education hinges on an assumption that teaching skills will detract from teaching content knowledge. We believe this is a . . . false dichotomy. Studies have shown that when knowledge is learned passively, without engaging skills, it is often only learned at a superficial level (the knowledge may be memorized but not understood, not easily reusable, or short-lived), and therefore not readily transferred to new environments. Deep understanding and application to the real world will occur only by applying skills to content knowledge, so that each enhances the other." Knowledge and skills, they continue, develop together "in a virtuous cycle." For example, knowledge "becomes the source of creativity, the subject of critical thought and communication, and the impetus for collaboration."[14]

For a glimpse of how this cycle can work, see the Partnership for 21st Century Learning (P21) Skills Maps, which illustrate the intersection between 21st-century skills and the traditional content knowledge subjects of math, science, social studies, geography, English, languages, and the arts. These maps, developed with key national organizations that represent each core academic subject, provide concrete examples of learning experiences and outcomes at gateway grade levels—examples that integrate skills development in "authentic ways that enhance—not replace—robust science [or other subject] content."[15] Skill development in any one instance is embedded in the content-based learning activity, while the opportunity for transfer is increased by practicing the skill in multiple, varied learning experiences and by undertaking explicit coaching and reflection that adds a metacognitive element to learning the skill (see Key Principle 3).

Key Principle 3: Focus explicitly on these skills—naming, practicing, and reflecting on them, as well as being coached on them and receiving ongoing and effective feedback

In the words of Ralph Waldo Emerson, "Skill to do comes of doing."[16] Creative Know How skills are intellectual "muscles" that can be genuinely strengthened only through doing and practice and not exclusively through study—much like, say, taking good photos or kicking a football. Yet just "collaborating" or "problem solving" as part of learning experiences, like just throwing a football around with your cousins, is unlikely to lead either to optimal progress in mastering the competency or to a better chance of transferring that skill into novel situations.

Educators helping students to develop Creative Know How need to help the learners recognize, develop vocabulary for, and *practice* the skill, as well as to provide them with ongoing and effective feedback on these efforts. They also need to coach and model the skill, exposing learners to a novice-to-expert progression that moves from structured rules through analysis to intuition; from tinkering through focused practice to fluid expression; and from controlled context through near transfer to far transfer.[17]

Finally, in Creative Know How, learners need the means to collect evidence of process as much as product. Most importantly, learners need a structure to help them reflect on their progress in Creative Know How competencies, because reflection and metacognition are particularly important in enhancing transfer.

Key Principle 4: Explore the ways in which Creative Know How competencies are intimately interrelated with each other and with the Habits of Success

Within competencies consisting of linked skills—such as Critical Thinking & Problem Solving or Creativity & Entrepreneurship—the pairs are intimately interrelated, even as they feature elements of their own. Indeed, even across the five competencies in each domain and the twenty competencies across domains, there is overlap in some aspects. While the framework is useful for designing goals and tracking attention and progress, it is not always possible or desirable to try to tease out the threads of one competency from the other for the purposes of learning or, in particular,

assessment. The value of MyWays lies in its use for planning and tracking the availability of learning experiences within which students can develop, practice, and reflect on their progress in the various competencies.

A particularly strong synergy exists between Creative Know How and another MyWays domain: Habits of Success. Because both can be developed and practiced only within active, authentic learning, their competencies are often interwoven. The Habits of Success, for example, which include those competencies related to students' social-emotional health, directly impact students' creativity, their critical thinking skills, and how students collaborate. We should also highlight that self-directed learning, a competency often grouped with 21st-century skills in other frameworks, appears in the MyWays Habits of Success domain. We placed it there because self-directed learning is central to the Habits of Success, which focus on "behaviors and practices that enable students to own their learning and cultivate personal effectiveness." Of course, placement in a conceptual model in no way separates competencies in the real world of learning and work.

Conclusion: Skills and Improvisation

> *"To be successful in the emerging society and economy, young people will need skills that previous generations did not. They will need to solve problems that do not have clear answers and that computers address poorly, if at all. . . . It's not just jazz musicians who need to learn how to improvise."*
>
> —Elliot Washor and Charles Mojkowski, *Leaving to Learn*[18]

The Partnership for 21st Century Learning (P21) came out with its framework of 21st-century skills more than a decade ago. While the skills it outlined were not new, the movement it launched succeeded in establishing the need for schools to address "know how" as well as knowledge. Ten years later, we are beginning to realize just how creative (or adaptive and transferable) that know how must be to prepare learners, in essence, for the unknown—for jobs not yet invented, for the impact of AI, and for engaging with others in ways that evolve every few years.

Already we see glimpses. Who was expecting the major impact of robots and AI? By 2033 (about when today's first-graders will finish four-year degrees or apprenticeships), economists predict that tech innovation could convert 30 percent of existing occupations into services completed "on demand" through a mix of cognitive computing and human labor.[19] With the rapid evolution of AI, these will include "thinking" as well as "doing" jobs—from med techs and paralegals to marketers and financial advisors. Indeed, IBM's Watson is solving medical cases that doctors cannot. Those who want to stay relevant in their professions will need to focus both on motivating and interacting with human beings and on working with AI.[20]

Or, indeed, who was expecting the disruptive power of fake news? Media literacy, a growing concern for over a decade, became a hot issue during the 2016 U.S. presidential election. Increasing reports of "fake news" coincided with attention to research indicating just how ill-equipped young people

We are beginning to realize just how creative (or adaptive and transferable) "know how" must be to prepare learners, in essence, for the unknown.

are to critically evaluate information they encounter online and via social media. A Stanford team, led by Sam Wineburg and Sarah Cotcamp McGrew, field-tested news-literacy tasks of varying difficulty. More than 80 percent of middle-schoolers were unable to distinguish a "native advertisement" (ads masquerading as articles) from real news, and nearly 70 percent of high-schoolers identified a Shell advertisement on climate change as a more reliable source of information than an *Atlantic* magazine news article.[21]

Preparing for the increasing number of such hard-to-predict, consequential developments—in other words, learning to improvise—will always be an art rather than a science. But it requires skills and competencies. How to address the challenge of AI? Have a look at the Creative Know How competencies of Critical Thinking & Problem Solving, Creativity & Entrepreneurship, and Communication & Collaboration. How to tackle false news? Cue Critical Thinking & Problem Solving, Communication & Collaboration, Information, Media & Technology Skills, and Practical Life Skills.

Some worry that the focus on Creative Know How is overly driven by economic changes and vocational concerns. We see a bright side. Twenty years ago, the educational psychologist Lauren Resnick reflected on the "high-performance workplace," which "calls for the same kind of person that Horace Mann and John Dewey sought: someone able to analyze a situation, make reasoned judgements, communicate well, engage with others to reason through differences of opinion, and intelligently employ the complex tools and technologies that can liberate or enslave, according to use . . . people who can learn new skills and knowledge as conditions change—lifelong learners, in short." In this world of change, "preparation for work and preparation for civic and personal life no longer need be in competition."[22] We strongly believe that the five Creative Know How competencies are the basis for this kind of preparation. ■

Notes

1. Daniel Pink quoted in Bill Sheridan, "Today's Top Skills: Adaptability, Lifelong Learning," MACPA (website), November 1, 2012.
2. For more information, see: MyWays Report 2, *5 Roadblocks to Bootstrapping a Career*; Robert Kuttner, "Why Liberals Have to Be Radicals," *The American Prospect*, July 21, 2015; Gerald Friedman, "Dog Walking and College Teaching: The Rise of the American Gig Economy," *Dollars & Sense*, March/April 2014.
3. Thomas L. Friedman, *Thank You for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations* (New York: Farrar, Straus and Giroux, 2016), 229. See also the discussion in MyWays Report 10, *Wayfinding Abilities for Destinations Unknown*.
4. For more on the *opportunity engine*, see MyWays Report 2, *5 Roadblocks to Bootstrapping a Career*, and Report 3, *5 Decisions in Navigating the Work/Learn Landscape*.
5. Martha C. White, "The Real Reason New College Grads Can't Get Hired," *Time*, November 10, 2013; National Education Association, "Preparing 21st Century Students for A Global Society: An Educator's Guide to the 'Four Cs'" (n.d.); Hart Research Associates, *It Takes More Than a Major: Employer Priorities for College Learning and Student Success* (Washington, DC: Association of American Colleges and Universities, 2013).
6. Kurt Fischer quoted in Todd Rose, *The End of Average: How We Succeed in a World That Values Sameness* (New York: HarperOne, 2015), 138.
7. Bryan Goodwin and Heather Hein, "Research Matters: What Skills Do Students Really Need for a Global Economy?" *Educational Leadership* 74, no. 4 (December 2016/January 2017), emphasis added.
8. For expanded descriptions of each competency, see the one-page competency primers at the end of Report 8, *Creative Know How—for a Novel, Complex World*.
9. Tom Vander Ark, "The State of the Edtech Marketplace," LearnLaunch Across Boundaries conference, Boston, February 2, 2017.
10. Use of the VUCA acronym derives from a 1990s U.S military study analyzing the implications of rapid change brought about by the information age. For a business take on VUCA, see Nathan Bennett and G. James Lemoine, "What VUCA Really Means for You," *Harvard Business Review*, January–February 2014; for the psychological perspective, see Michael Woodward's interview of David Smith, "How to Thrive in a VUCA World: The Psychology of Navigating Volatile, Uncertain, Complex, and Ambiguous Times," *Spotting Opportunity* (blog), *Psychology Today*, July 31, 2017. Both of these approaches share a lot of characteristics with core concepts embedded in the four MyWays competency domains, as well as the kind of adaptability, big-picture view, and design thinking underlying MyWays learning design.
11. Vander Ark, "The State of the Edtech Marketplace"; Tom VanderArk, "Five Trends Demand Smart States," *Vander Ark on Innovation* (blog), *Education Week*, June 1, 2015; Peter Drucker, quoted in Bernie Trilling and Charles Fadel, *21st Century Skills: Learning for Life in Our Times* (San Francisco: John Wiley & Sons, 2009), 151.
12. Scott G. Paris, Marjorie Y. Lipson, and Karen K. Wixson, "Becoming a Strategic Reader," *Contemporary Educational Psychology* 8, no. 3 (July 1983), quoted in Grant Wiggins, "On Reading, Part 5: A Key Flaw in Using the Gradual Release of Responsibility Model," *Granted, and...* (blog), March 30, 2015.
13. Charles Fadel, Maya Bialik, and Bernie Trilling, *Four-Dimensional Education: The Competencies Learners Need to Succeed* (Boston: Center for Curriculum Redesign, 2015), 105–106.
14. Fadel, Bialik, and Trilling, *Four-Dimensional Education*, 106, 121.
15. P21 Skills Map for Science.
16. Ralph Waldo Emerson, "Old Age," *Atlantic Monthly*, January 1862.
17. For more on the novice-to-expert progression, see the "Levers for Capability and Agency" section in Report 11, *Learning Design for Broader, Deeper Competencies*.
18. Elliot Washor and Charles Mojkowski, *Leaving to Learn: How Out-of-School Learning Increases Student Engagement and Reduces Dropout Rates* (Portsmouth, NH: Heinemann, 2013), 58, 73.
19. Mary L. Gray and Siddharth Suri, "The Humans Working Behind the AI Curtain," *Harvard Business Review*, January 9, 2017.
20. Megan Beck and Barry Libert, "The Rise of AI Makes Emotional Intelligence More Important," *Harvard Business Review*, February 15, 2017.
21. This paragraph summarizes reports on the Stanford study and other research from Benjamin Herold, "'Fake News,' Bogus Tweets Raise Stakes for Media Literacy," *Education Week*, December 8, 2016, and Chris Berdik, "How to Teach High-School Students to Spot Fake News," *Slate*, December 21, 2016. For the Executive Summary of the Stanford report, see *Evaluating Information: The Cornerstone of Civic Online Reasoning*, Stanford History Education Group.
22. Lauren B. Resnick, "Getting to Work: Thoughts on the Function and Form of School-to-Work Transition," in *Transitions in Work and Learning: Implications for Assessment*, ed. Alan Lesgold, Michael J. Feuer, and Allison M. Black (Washington, DC: National Academies Press, 1997), 258.

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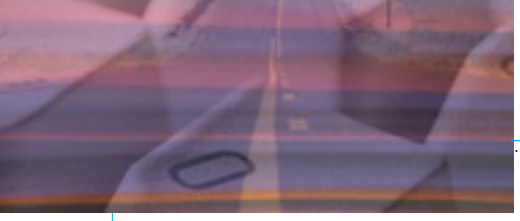


When Accessibility Doesn't Make It into the EDUCAUSE Top 10: Turn It Up to 11

The mission of community colleges has always been to serve their communities. As almost every *EDUCAUSE Review* Connections column has noted, this open-door admission policy reflects the community college value of making postsecondary education an option for anyone, including historically underserved populations. Community colleges strive to accomplish this mission by providing an affordable, flexible, and supportive alternative to the larger public universities and more expensive private colleges and universities. In Washington State, for example, we have worked to support our students' unique needs and experiences by offering prior learning credit, competency-based certificates, and fully online and low-residency online certificates and degree programs, as well as programs dedicated to first-generation college students and low-level English language learners. Yet as vital discussions around diversity and equity have moved into the spotlight, people with disabilities have frequently remained an afterthought, reflecting an ongoing societal struggle to adequately recognize their rights.

> As national-level conversations continue to take shape around supporting accessibility and sharing resources, community colleges must be included.

The ways in which staff in various campus departments talk about accessibility further reflect an inconsistency in institutions' commitment to accessibility. Depending on which stakeholder is speaking, accessibility may be embraced as a civil rights issue, or regarded as risk mitigation, or called (as was the case in a recent posting to a web developers listserv) a "suffocating noose of restrictions upon all the beauty a well-designed and well-built website has to offer," or—in the worst-case scenario—considered irrelevant and pushed back to staff members in the disability support services office as "their issue." These reactions, ranging from the appropriate to the offensive to the absurd, may seem better suited to a Christopher Guest mockumentary.

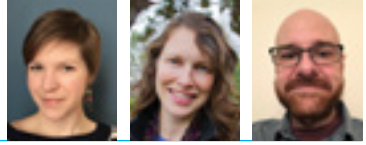
Regardless of how accessibility is regarded, there is consistency when it comes to the frustration that community college leaders face when trying to incorporate the work of "unfunded mandates" into their already short-staffed offices. Budget cuts have left many of e-learning, public information, IT, and disability services offices stretched thin and unable to take on the additional burden of making all digital content accessible. Faculty at community and technical colleges carry larger teaching loads for less pay than faculty at four-year colleges and universities. For full-time faculty, non-instructional work hours are often consumed with advising, participating in institutional governance, and other administrative responsibilities such as scheduling, hiring, and peer evaluations as well as program and curriculum review and development. The heavy reliance on adjunct labor in community colleges only increases the likelihood of a faculty body that has largely not been granted the time and resources necessary for learning accessible practices or for evaluating whether or not their increasing reliance on web content and applications is marginalizing a portion of the student body. As a result, this work is done piecemeal—reactively rather than proactively—and often is not done at all.

Another issue community colleges face is relative size. In Washington, the average FTE for our two-year colleges during the 2015–16 academic year was 5,338, compared with 47,006 FTE at the University of Washington. When products or services are based on an FTE cost model, and when discounts deepen the higher the FTE, small institutions are left paying a much higher cost per FTE to implement solutions that support accessibility. And although we are proud of the work done at all community and technical colleges, partnering with a single, small rural college does not have the same appeal to vendors as partnering with an Ivy League or Big 10 school. As a result, when working with vendors or publishers on issues related to accessibility, a community or technical college's request for accessibility remediation is rarely given the same consideration it would receive if it had come from a larger or more prestigious institution.

In addition to these challenges, research has shown that students with disabilities are more likely to enroll at a community college: "Among students with disabilities, an estimated 54 percent were enrolled at community colleges (Raue & Lewis, 2011), compared to 36 percent in the student population as a whole (Knapp, Kelly-Reid, & Ginder, 2011). Likewise, a recent study of young adults with disabilities indicated they were more than twice as likely to have attended a two-year college at some time after leaving high school (44 percent) than young adults in the general population (21 percent) (Newman et al., 2011)."[1]

Given these realities, when those of us in community college systems see that digital accessibility is yet again missing

Connections Editor: **Bret Ingerman**



from EDUCAUSE's annual list of Top 10 IT Issues, we may find ourselves asking why. But more often when we realize that students with disabilities are overrepresented, and potentially underserved, at our institutions, we do not ask why. Instead we ask: "What can we do about it?"

Stakeholders have begun to recognize that digital accessibility is a fundamental aspect of access to information and education and that digital accessibility makes for a better experience for *all* students. This is often cited as a reason to adopt accessible practices and as a way to align digital accessibility initiatives with the larger community college mission.

Captions are a prime example of how accessible strategies can benefit the populations served by community colleges. Captions visually reinforce vocabulary and spelling for English language learners, international students, and returning adult students encountering new vocabularies. Military veterans are significantly more likely to benefit from captions: according to the Centers for Disease Control and Prevention, those who served between September 2001 and March 2010 were "four times more likely than nonveterans to have SHI [significant hearing impairment]."[2] Captions also support students who are trying to study in a loud household or late at night or who are watching videos on their bus commutes between college and work.

Some of the resource disadvantages that community and technical colleges face can be addressed when colleges harness their system, state, or district identities to approach accessibility as a collective force. For example, whereas the Washington State community college average FTE is 5,338 (noted above), as a system the 2015–16 FTE count was 181,451. That collective FTE count can be a great benefit when looking at products or services where the pricing structure is tiered to reward larger institutions.

Community college systems can further leverage their size and power to collaborate with other higher education institutions and state lawmakers. In Washington, the legislature enacted House Bill 1509, which (1) allowed public institutions of higher education to enter into an interlocal cooperation agreement to jointly develop and utilize purchasing contracts and (2) created the Washington Institutions of Public Higher Education (WIPHE) contracts clearinghouse. This means that any solicitation or contract has the potential, if WIPHE language is included, to be a contract used by all public two- and four-year colleges and universities in Washington State. This makes each of us a very attractive potential client—and one that may have more sway when it comes to requiring that products be made accessible for students, faculty, staff, and community members.

Staffing limitations can also be mitigated through collective efforts. Although many people tasked with leading accessibility efforts must do so while wearing multiple other hats on their campuses, a dedicated position or office at the system, state, or district level can help coordinate collaboration across multiple schools and can represent the power of the collective identity.

A coordinated effort with dedicated staffing can promote efficiency and reduce duplication. However, simply creating a position for an "accessibility person" is not going to get the job done. This position—whether at a central office or on a campus—cannot carry or own the work but must focus on building capacity and expertise across institutions. As a central agency, the Washington State Board for Community and Technical Colleges has been able to develop a position, at the system office, dedicated to accessible technology initiatives. This position has been responsible for developing system-wide accessibility training, pulling together all public colleges and universities in the state to identify a vendor for a statewide captioning contract, procuring and subsidizing a system-wide contract for Ally (an accessibility checking and remediation tool), and managing Access360, a cross-functional capacity-building program that has helped to identify opportunities for collaboration and greater centralized support. Lastly, the Committee for Accessible Technology Oversight, composed of Washington State Board staff and of members from community and technical colleges, is working to develop a tool for system-level accessibility compliance testing and tracking, in addition to establishing a trusted tester certification and network to build capacity and distribute testing among the system (and ideally, the larger state).

As national-level conversations continue to take shape around supporting accessibility and sharing resources, community colleges must be included: the issues are too critical to us and to the populations we serve to not have our voices heard. And just as we must insist on being considered as systems in order to build our resources and our capacity for influence, likewise when we consider a list like EDUCAUSE's Top 10 IT Issues, we must redraw the boundaries. We must collectively blink, stare back, and paraphrase Nigel Tufnel: "But our list goes up to 11." ■

Notes

1. Michelle Van Noy, Maria Heidkamp, and Cecilia Kaltz, "How Are Community Colleges Serving the Needs of Older Students with Disabilities?" issue brief, NTAR Leadership Center, April 2013.
2. Centers for Disease Control and Prevention, "Severe Hearing Impairment Among Military Veterans—United States, 2010," *Morbidity and Mortality Weekly Report (MMWR)*, July 22, 2011.

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Moving Ahead with Support for Digital Humanities

Many institutions, from research universities to mid-sized state colleges to liberal arts colleges to community colleges, are struggling with how to support digital humanities (DH) as part of the research and teaching & learning programs of the institution. Whereas a small number of faculty have pioneered development of DH projects and tools for over two decades, they have often done so through their own commitment of time and resources or through the limited grant support available from public and private funders. In fact, two key reasons motivate colleges and universities to undertake comprehensive planning for support of DH: (1) much lower availability of external funding for DH researchers, compared with funding for researchers in the sciences; and (2) humanists' greater need for support around all areas of technology, compared with the need of those in the sciences. As more faculty in the humanities show interest in incorporating DH projects into their class assignments and consider how they might use DH tools in their own research, they seek access to expertise, tools, hardware, and data storage, beginning locally where possible. Often they find that it is difficult to identify how to get support from their institution or even whom they can contact for some initial information about which technologies might be valuable for their work. DH incorporates a wide array of methodologies, including text mining, data visualization, 3D modeling of historic buildings or archaeological sites, complex maps, interactive timelines, and content that combines text and other media in complex ways. These tools are used in service of exploring research questions in ways that are not feasible without the use of new technologies.

> IT and library professionals need to engage as key partners to achieve coordinated, visible, and sustained support for digital humanities at an institutional level.

There is no simple, one-size-fits-all solution to supporting DH at an institutional level. In 2017, an EDUCAUSE Center for Analysis and Research (ECAR) working group, developed with the Coalition for Networked Information (CNI), produced the paper *Building Capacity for Digital Humanities: A Framework for Institutional Planning.*[1] As co-chairs of this project, we guided the team of information technologists and librarians who formed the working group to develop this paper, which included sections on funding and institutional investment, governance, infrastructure, roles and capabilities, communication and outreach, and DH acceptance and support. As we developed the paper, we discussed the interrelationship between the kind of support needed for DH and the support required for the social sciences and sciences, and we realized that there are many similarities among the infrastructure and the tools used across disciplines. For example, an increasing number of disciplines in all areas are using mapping tools and statistical analysis tools. However, since we realized that the humanities researchers were often the most underserved in technology-related areas in the institution, we decided to focus the paper on DH.

Infrastructure for DH incorporates technology elements such as network availability and capacity, access to expensive hardware and specialized software, and in many cases, a physical facility in which to work. The human component of infrastructure is as important as is access to technology. Availability of expertise to guide scholars' choice of appropriate tools, creation of metadata, project management, curation of content, and mechanisms for publishing or disseminating the project content are all important components of support for DH.

At many institutions, humanities-based IT groups and specialized groups within the library have traditionally taken the lead in defining and addressing the infrastructure needs around DH. However, DH project needs have been growing more complex as humanists—like scholars in many other fields—tackle research questions with larger-scale data than was previously possible. From issues of long-term data storage, organization, and access; to scalability and sustainability of digital publishing platforms; to computationally-intensive text analysis, optical character recognition (text digitization), and 3D modeling work that can leverage high-performance computing (HPC) clusters and cloud computing resources, there are increasing opportunities for IT and library professionals, throughout their respective organizations, to engage as key partners in DH support. Consequently, IT and library professionals may find their efforts to engage with the campus DH community are received with more enthusiasm than five or ten years ago.

The ECAR/CNI paper was written to serve as a starting point for IT professionals and librarians who want to engage with their local DH communities. Some of the sections—such as infrastructure and roles/capabilities—directly pertain to information

E-Content Editor: **Joan K. Lippincott**

By QUINN DOMBROWSKI and JOAN K. LIPPINCOTT

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technology and can serve as the basis for internal IT or library discussions about what technology and expertise a central IT organization, or the library as a whole, can realistically offer the campus DH community. It is important to approach these conversations with a user-centered design mentality and to resist the urge to conclude that because the IT organization already offers a particular service (e.g., database or web hosting, or an HPC cluster), no further work is needed to make that service truly accessible and useful for the DH community. Similarly, there may be tools and processes that the library systems group has used only internally but that could benefit the DH community if made available in some form. Meaningful engagement with DH may require service owners to rethink the conditions under which a service can be offered or the kinds of support that they are willing to provide to users who are less familiar with the technology. This can spur discussions of what funding and institutional investment—also addressed in the ECAR/CNI paper—looks like from a central IT or library perspective. Examples may include exploring opportunities for treating some services as common good under certain conditions, reducing cost barriers to adoption, or making internal services accessible in limited ways. A growing number of research IT and library organizations have hired humanists in research facilitator roles to help with the translation work between humanists' needs and available resources. Although it may be tempting to seek out grant or other one-time funding for such a position, this incurs the same set of liabilities as funding any long-term need with short-term money and is best avoided when possible. While the paper's framework for assessing DH acceptance and support within an institution is most consequential for the scholars themselves, one measure of institutional support for DH is the degree to which doing DH support work is a clearly identified part of people's roles, rather than something done "on the margins" of another job. These factors are worth considering as an IT organization or library develops its preliminary plan for how to engage with the DH community.

Understanding both the broad DH landscape and the local institutional context is important in developing a plan for support. Once an organization has attained enough internal consensus around what it can offer the DH community, the next step is to engage with other groups already involved with DH support—whether through a defined program or center or simply through work with individual faculty members. Ideally, a campus team composed of individuals from sectors representing faculty, students, information technology, and the library, as well as other appropriate units, would work together to determine where the institution fits in the landscape of current trends and activities in DH. By scanning popular DH websites and blogs as well as participating in local, regional, national, and even international DH groups, the campus can develop a perspective of its own strengths and interests. The National Endowment for the Humanities publishes information about all the projects it has funded; taking the time to set up a meeting with recent DH grant recipients at an institution can often provide a crucial faculty-level perspective on unmet needs. Similarly, looking through departmental and campus-level event listings for DH-inflected talks can be a valuable way to identify who is already doing DH work; attending those talks, and engaging with other attendees, is worth the time investment. These conversations are an opportunity to get feedback on an organization's preliminary plan for DH engagement, which may need to be revised iteratively in light of the needs and priorities of the DH community specific to the campus.

Sharing the ECAR/CNI paper with the leadership of partner organizations is the next step, in order to establish buy-in for a holistic, collaborative effort to support DH at the campus level. While it may not be possible to get all potential partners to participate to the same extent, even a subset of organizations—representing different kinds of expertise—can move forward with better coordinating support between them. Achieving coordinated, visible, and sustained support for DH on campus will provide a true service to the community. ■

Note

1. Kirk Anne et al., *Building Capacity for Digital Humanities: A Framework for Institutional Planning* (Louisville, CO: ECAR, May 31, 2017).

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By JENNIFER SPARROW

Digital Fluency: Big, Bold Problems

The 2017 report *The Next Era of Human/Machine Partnerships* states that 85 percent of the jobs that will be available in 2030 haven't even been invented yet.[1] These types of predictive hypotheses often cause me to do a reality check. As I took time to reflect on the fact that 2030 is (incredibly) only 12 years away, I tried to think about the jobs that had not been invented 12 to 15 years ago. Did any child in 2003 say they wanted to be an offshore wind engineer, a drone operator, a data scientist, or a Lyft driver? These jobs are all new in the last 15 years. These careers exist because a person, or often a team of people, created big, bold problems for us to solve. So how do we in higher education help students prepare for this future, help them become not only problem solvers but also problem creators?

One way to provide students with a breadth and depth of skills to become big, bold problem inventors is by offering a diverse set of opportunities to master digital fluency. *Digital fluency* is the ability to leverage technology to create new knowledge, new challenges, and new problems and to complement these with critical thinking, complex problem solving, and social intelligence to solve the new challenges. Digital fluency also requires excellent communication skills, new media literacy, and cognitive load management to address the issues, and concerns we face today and in the future.

How is digital fluency different from digital literacy? In learning a foreign language, a literate person can read, speak, and listen for understanding in the new language. A fluent person can *create* something in the language: a story, a poem, a play, or a conversation. Similarly, digital literacy is an understanding of how to use the tools; digital fluency is the ability to create something new with those tools. Digital fluency can be viewed as an evolving collection of fluencies including, but not limited to, curiosity fluency, communication fluency, creation fluency, data fluency, and innovation fluency.

Curiosity fluency involves having questions and a desire to answer those questions. It prepares students not to just Google an answer but to be aware they are capable of developing their own answers to questions. Opportunities for developing curiosity fluency include providing students with practice and deep immersion in design thinking throughout their education and with an unbound, rules-free environment to think differently about the challenges we face in the 21st century.

Communication fluency is the ability to communicate new knowledge across diverse populations and to choose a medium that is appropriate and most impactful for a given audience. Digital storytelling is one means of communicating new research findings. Additionally, students can use virtual reality and augmented reality. Using VR or AR to tell a story, learners need to understand not only how the technology works but also the impact on the reader and the fact that this medium can change how a story might be told.

Creation fluency, or maker fluency, is a deep understanding of how to create and leverage knowledge to make something new. These creations can by physical or virtual and can include 3D printing and programming. In higher education, we are widely implementing maker spaces, which lower the barrier of entry to creation fluency. These spaces provide access to tools and expertise to allow learners to be inventors. By including programming fluency in creation fluency, we can help students learn how to create in the app economy.

Data fluency is the capacity to use data sets to make informed decisions, along with the knowledge to push the boundaries of what the technology can do to process the data to ask new questions. If learners have access to cloud computing resources, data science knowledge, and big data sets, the types of questions they will ask will be bound only by their imaginations.

Innovation fluency includes the realization that failure is a valuable part of the learning process. To innovate, students need to take risks, fail, learn from those failures, and iterate the process to bring a new idea to fruition. For many years, educators have utilized metacognition in the learning process: learning how someone learns and reflecting on that learning are key to applying what was learned to new situations.

In higher education, students are supported as they learn to master these fluencies. We are offering learners the chance to push the boundaries, test new ideas, fail in a safe environment, learn from experts, solve problems, and create new problems to be solved. In the process of acquiring these fluencies, learners should have in-depth opportunities to explore ethical decision-making, critical thinking, courageous leadership, and cultural awareness. Learners should be prepared not only to take on the jobs of the future but also to be entrepreneurs, activists, researchers, and lifelong learners. Our call in higher education should be to help students learn to address the challenges not just of this century but of the 22nd century. We need to be looking to the horizon and evolving curricular and co-curricular learning engagements to provide students with the time to learn, practice, and master digital fluency so that they can invent the big, bold problems of the future. ■

Note

1. Institute for the Future and Dell Technologies, *The Next Era of Human/Machine Partnerships: Emerging Technologies' Impact on Society and Work in 2030*, July 12, 2017.

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Innovation in the Business of Higher Education

Innovation in higher ed? Are you kidding? The business of higher education is so *not* innovative. To suggest that higher education is innovative is like suggesting that ham sandwiches can fly.

Okay, maybe that's an exaggeration. Take me to task: what is my definition of *innovation?* To be clear, when I'm talking about innovation in higher education, I'm talking about "a new idea, method, or device." Or, to offer a synonym: "novelty."

Sure, in higher education we teach classes on entrepreneurship and innovation. Some of our institutions may even have a program or two that we consider to be novel in the way they sequence the learning or in their formative methods such as hands-on apprenticeships, internships, student-led research, and so on. But we must not fool ourselves: such innovation is not applied to the *business* of higher education.

Sadly, if we don't change how we do business, many of our institutions won't be here in another five years. I'm *not* talking about Clay Christensen's *disruptive innovation,* in which "disruption is a predictable pattern across many industries in which fledgling companies use new technology to offer cheaper and inferior alternatives to products sold by established players."[1] If I were talking about that (and I'm not), I would be talking about how our established institutions would be put out of business by others offering cheap and inferior product. Instead, I want to focus on those of us in higher education and on what we do to continuously improve—to repeatedly make new—the product we offer to our customers: our students. I believe the colleges and universities that are no longer here in five to ten years will be gone not because they failed to compete with cheap and inferior offerings but, rather, because they failed to distinguish themselves in a saturated marketplace. They failed to renew their product offerings. They failed to deliver to hopeful graduates the career-readiness those students expected, using methods those students could best absorb, respond to, and learn from—learn from!

Getting back to higher education's failure to innovate. . . . What about online learning? Wasn't that an innovation? Not really. For one thing, it didn't originate with higher education: we borrowed it from the corporate world. We can't claim it as our own business model. Nor did it fundamentally change the way *we* do business. Call it a bolt-on to the "same ole, same ole." Higher education is exceptionally slow to adopt new methods, devices, and practices. In general, something new has to be proven in the corporate world and at one or two colleges/universities that we consider peers before a case can be made to try it out at our own institution. That's because the case will involve assessing risk to

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By LAURA GEKELER

the institution, and we can't do that until we have the data borrowed from those first adopters.

I'm involved in educational technology—in facilitating and building awareness, among my faculty, of technology that enables new methods of teaching and learning. Yet sadly, even the innovations in that slice of the business cannot be said to originate within higher education, with the one exception of student-led startups. If the students themselves can gain traction with an idea, then the risk footprint to the institution is already small in terms of cost, damage to reputation, and failure to launch, since those are all borne by the student principals of the startup.

Within our institutions, even our research institutions, we have no incentive, and certainly no straightforward process, for entrepreneurial research that can become the new de facto "business" of higher education.

Every generalization has its exceptions, of course. In this case, one exists at Georgetown University. Under Vice Provost Randy Bass, the Designing the Future(s) initiative (https://futures.georgetown.edu/) is an incubator seeking to answer the question, "What should a Georgetown education look like in the next ten or fifteen years?" This effort fits my definition of *innovation* because it is a novelty: it begins with the current business fundamentals and deconstructs them all to see if they are still serving teaching and learning. No rule is sacrosanct, be it the 16-week semester or the credit hour or the 9-month calendar. The innovation that Georgetown hopes to foster is being created by higher education, to be applied to higher education business. And that is true innovation by any definition of the word.

Are there other examples of ham sandwiches that can fly? I came across a promising one when I attended the EDUCAUSE Learning Initiative (ELI) Annual Meeting in January 2018. I was introduced through Kristen Eshleman, director of digital innovation at Davidson College, who led a session. At Davidson, Kristen leads efforts to define and pilot discrete manageable experiments in change. The experiments are mission-aligned, have accountability and metrics built in, and are designed to manage risk while finding the change points that Davidson's traditional liberal arts mission can use. It's a different approach from Georgetown's but does create the requisite siloed "R&D" department that can lead to transforming the way Davidson does the business of higher education. In addition, Eshleman is involved in the 2018 version of an event called the Harvesting Academic Innovation for Learners (HAIL) Storm (http://thehailstorm.org). Georgetown will be represented at the gathering as well. This small but powerful event is held annually by invitation only. And that's probably because such a small number of us have begun to think the way they are thinking.

Would you be one of them if you could? Do their stated goals below scare you? Or invigorate you? Do you have other ideas for effective innovation in the business of higher education?

Share learnings from across our community on successes—and more importantly, failures—within experimentation efforts for the purpose of institutional transformation.

Establish communities of practice around the most pressing opportunities and challenges facing innovation leaders within higher education (e.g., new business models; culture change; moving from pilot to scale; innovation accounting; etc.).

Address external disruption by building the case for advancing institution-led innovation, both within our individual institutions and across the sector. ■

Note

1. *Disruption* as defined in the *New York Times* "Innovation" report, March 24, 2014, p. 16.

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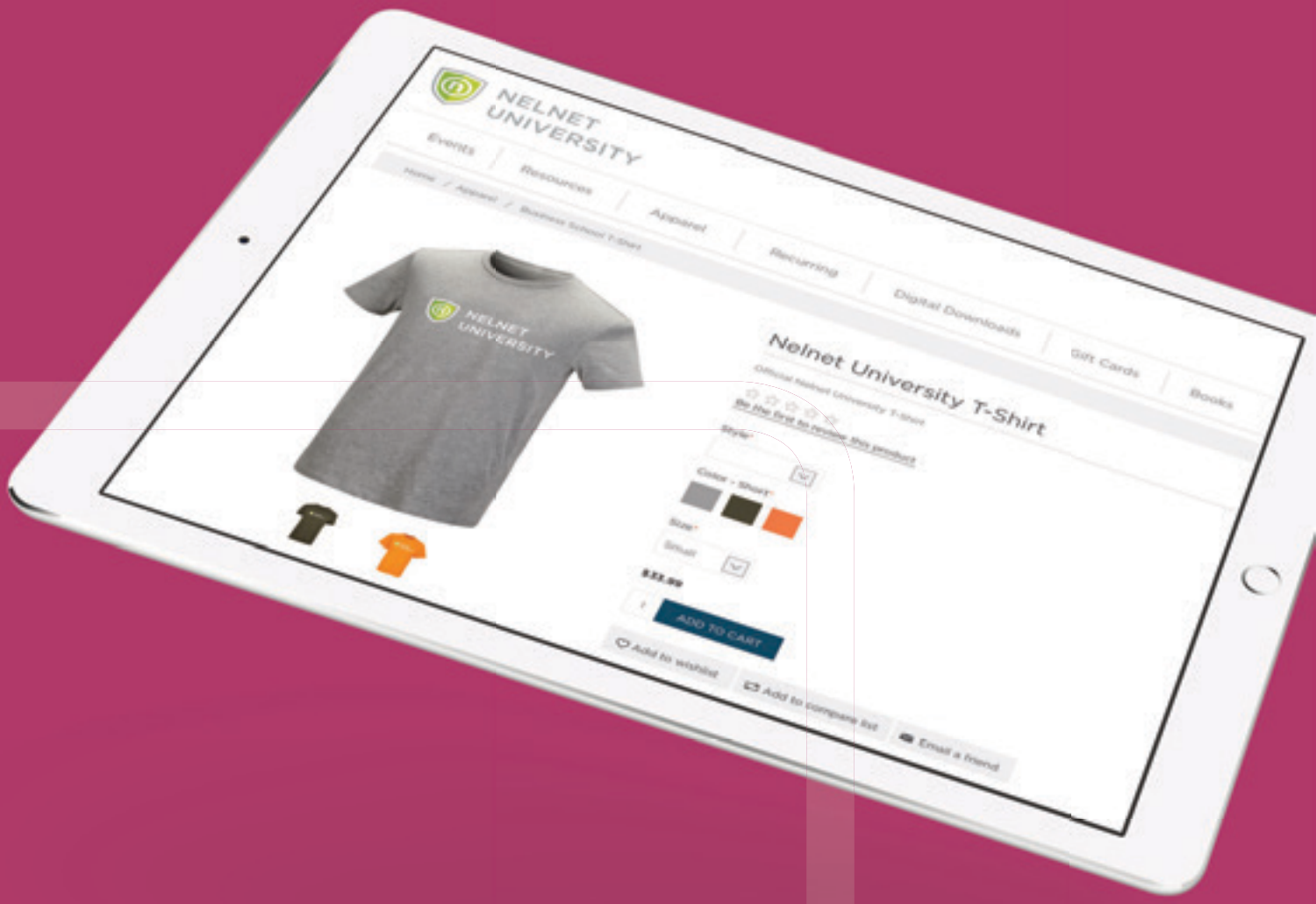

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