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It’s Not About Making Stuff
Makerspaces and 3D printing have come a long way in higher education, from early excitement over 3D-printed learning objects to a focus on creativity and higher-order thinking.

ONE OF THE FIRST ARTICLES Campus Technology ran about 3D printing was back in 2007, when our IT Trends newsletter columnist Terry Calhoun enthused about “A New Dimension in ‘Printing.” Like most techie people in those days, he was impressed with the Star Trek replicator-style ability to produce objects on demand, whether they be toy soldiers, Lego bricks or monogrammed flatware. At the time, 3D printers carried a hefty price tag, but Calhoun correctly predicted that the devices would become more affordable in the near future.

By 2013, 3D printing started to gain traction in higher education. The NMC Horizon Report that year named 3D printing as a key technology to watch in higher education, linking it to the “Maker culture, a technologically savvy, do-it-yourself community dedicated to advancing science, engineering and other disciplines through the exploration of 3D printing and robotics.” Still, the focus was mainly on how 3D-printed objects could impact teaching and learning. According to the report, “One of the most significant aspects of 3D printing for education is that it enables more authentic exploration of objects that may not be readily available to universities. While 3D printing is four to five years away from widespread adoption in higher education, it is easy to pinpoint the practical applications that will take hold. Geology and anthropology students, for example, can make and interact with models of fragile objects such as fossils and artifacts.”

In the past few years, the thinking around 3D printing has shifted, as the technology has become more or less intertwined with the idea of makerspaces and the maker movement. The “stuff” that students create in makerspaces, via 3D printing or other technologies, is now less important than the overall “maker” experience — interdisciplinary collaboration, hands-on problem-solving, digital literacy, entrepreneurship and more. As the 2016 NMC Horizon Report noted, “Regardless of what they encompass, the general purpose of makerspaces is to provide a place for users to engage in self-directed activities that spark their curiosity, help them identify passions, and build a habit of lifelong learning. By participating in hands-on design and construction in makerspaces, students engage in creative problem-solving and higher-order thinking.” (See our analysis of the full 2016 Horizon Report: Higher Education Edition on page 29.)

In this month’s C-Level View (page 34), Kyle Bowen, director for teaching and learning with technology at Penn State, gives that purpose of makerspaces a name that I had not heard before: maker fluency. As he explained, the most important thing that makerspaces provide is the opportunity to be creative, hone 21st-century skills and understand the when and why of maker thinking — not the technology itself or the physical products that are generated.

In other words, it’s no longer about making stuff. “The bottom line is that students will begin to apply maker fluencies in many different areas now — but they will also develop abilities they can draw on long term, to solve problems far into the future,” Bowen told us. “We have to realize that the technologies our students will be working with after graduation and beyond haven’t been invented yet. But the fluencies they develop now will serve them for a long time.” CT

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GOING PRO. Florida’s Lynn University is upgrading its iPad initiative by providing all undergraduate day students and faculty with an iPad Pro, Apple Pencil and Smart Keyboard. The reasons for the switch include improved device performance and support for multitasking. Lynn also introduced the full-size Smart Keyboard because it “makes it easier for students to draft essays, complete tests and build complex spreadsheets from anywhere,” and the “Apple Pencil expands the power of Multi-Touch and supports creative learners by providing them with a new way to capture ideas as notes, sketches or diagrams,” according to the university. Read the full story online.

SOMETHING’S PHISHY. Phishing attacks are up 13 percent and spear phishing attacks are up 22 percent from 2014, according to research from Wombat Security Technologies. According to the company, “the most popular phishing attack templates with the highest click rates included items employees expected to see in their work e-mail, such as an HR document or a shipping confirmation.” While users were more cautious when receiving “consumer” e-mails such as gift card notifications or social network notifications, an “urgent e-mail password change request” had a 28 percent average click rate. Read the full story online.

DATA DIFFICULTIES. Although educational institutions and other organizations are making greater use of data to support business outcomes, in many cases the quality of that data is not high enough to support goals such as improved customer experience, decision-making and governance, according to a report from Experian Data Quality. “Organizations still are struggling to find data issues and correct them across the business,” said Thomas Schutz, senior vice president and general manager for the company. The most common data errors for higher education institutions include incomplete or missing data and outdated information. Read the full story online.

SUPER SMART. Utica College (NY) has built a “super” smart classroom to support its blended Master of Business Administration program, a “flex MBA” that allows students to participate in classes in person, online or both. The space uses a combination of robotic cameras mounted on the walls and webcams to allow remote students to participate in classroom activities in real time. James Norrie, dean of Business and Justice Studies at the college, refers to the facility as a “super” smart classroom because of the sophisticated technology involved: “To the best of our knowledge, we’re the first institution in upstate NY to actually make the investment in this type of classroom.” Read the full story online.

REVAMPED APP. Students at Colorado Technical University can connect with their school, track grades and degree progress in real time, and participate in their courses any time, anywhere, all through a mobile device. The institution recently launched a newly redesigned mobile app, dubbed CTU Mobile, for Apple and Android phones and tablets. Designed to help students “better fit
education into their lives," CTU Mobile was developed with input from current CTU students, who shared their challenges and desired features in collaborative focus groups.

Read the full story online.

TECH IN CLASS. Most teachers in the United States worry more about the potential for technology in the classroom to distract students than about privacy and security, according to a new survey from Instruction. Respondents also said, however, that they are optimistic about technology’s potential to improve learning outcomes, increase access to education and boost the efficiency with which it’s delivered. Ninety-four percent of respondents from the United States said that technology’s effects in the classroom are an overall positive. Read the full story online.

Panasonic’s new PT-RZ570U laser phosphor projector offers 20,000 hours of maintenance-free operation and 5,000 lumens of brightness. Read the full story online.

The panOpen platform combines open educational resources with tools such as content customization, LMS integration, self-grading quizzes, note-taking, real-time chat and data analytics. Read the full story online.

The TravelMate B117 Windows 10 Pro notebook from Acer is the first to support TeachSmart, the company’s cloud-based service that keeps students and teachers connected. Read the full story online.

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6 Ways to Bridge the Gap Between Faculty and IT

Finding your own “unicorn” and other ways to create healthier relationships between academia and the IT department.

THE RELATIONSHIP between academia and technology is notoriously complicated. Faculty often view IT staffers as gadget-mongers eager to roll out new tech regardless of its value to teaching and learning, while technology specialists are certain they could make life easier for those on the other side — if they’d only listen!

“We’re talking a similar language,” said Rovy Branon, vice provost for educational outreach at the University of Washington, “but sometimes we’re talking past each other.”

In some cases, people with conflicting goals and worldviews manage to coexist peacefully. However, as technology permeates society and becomes more accessible to more individuals, and as Big Data, massive amounts of information, becomes available to researchers — largely because of the advent of advanced technologies — the need for professors, researchers and IT professionals to work together becomes more urgent.

Many of the problems the two camps have in working together are rooted less in any unique characteristics associated with academia or technology, but derive simply from the fact that human beings, with all their foibles, are involved. Indeed, professors and researchers often are as stressed about their workloads as anybody and don’t always see the value of investing time in learning a new technology, even if they’re told it could make life easier for them.

“Faculty members are busy,” said Paul Kim, chief technology officer at the Stanford University (CA) Graduate School of Education. “They are pressured to produce a lot. It’s difficult for them to spend a lot of time learning something new.”

Complicating matters is another very human problem: poor communication skills. Users of technology everywhere often find it hard to explain what they want and technology providers can’t always read people’s minds. There is also the tendency to worry that the use — or non-use — of new technology may threaten one’s job security.

“People ask themselves, ‘Does this eliminate my job?’” Branon noted, “or change my job to the extent that it’s not what I signed up for?’”
Finally, there is often just a clash of priorities.

“On the academic side, the priority is teaching and delivering learning experiences,” said Andrew Feldstein, associate vice president of the Learning Technologies group at Fort Hays State University (KS). “On the technology side, there are infrastructure issues that have to be taken into account. What’s expedient for the academic side may not be expedient for the technology side and vice versa.”

But there are workarounds and strategies — and sometimes just tricks — that colleges and universities have found to make the interaction between the academic and technology worlds more comfortable. Here are six suggestions from faculty and IT professionals who have worked to resolve the dilemma.

1) Educate the IT Side

Before Branon took his current position at Washington, he had experience as both a faculty member and a technology professional. He’d also worked in business. He said the academia-IT gap is not always caused by intractable faculty and, if IT were able to understand a bit more about the larger goals of the university, it might be easier to offer and explain what it can provide.

“I’m increasingly saying to IT that it has to not just present solutions, but to understand the business of what we do and not just say, ‘Here’s the solution,’” Branon said.

Nobody trains to become a professional translator between academia and IT, but that doesn’t mean the role is impossible to fill.
2) Appoint an Official Go-Between
That’s what Fort Hays did when it hired Feldstein late last year, with the specific charge to help academics and IT understand each side’s needs and priorities a bit better.

“The Learning Technologies group is where learning and technology intersect,” he noted.

Of course, somebody with the skills to talk to both sides is not always easy to find. “They’re the academic version of the unicorn,” Branon suggested.

He pointed out that the business world has the same challenges and when a person comes along who can represent the interests of both sides at once, it’s often at their professional peril.

“People get trapped into that role because somebody else doesn’t want to lose their translator,” Branon said.

So sometimes you have to find informal “translators.”

3) Use Your Own Homegrown Talent
Certainly, nobody trains to become a professional translator between academia and IT, but that doesn’t mean the role is impossible to fill. Oftentimes, it will be a faculty member who seems to have a natural proclivity for technology that others may not share. It’s just a question of identifying the right individuals.

Maybe they come to the technology presentations that the IT department holds and wishes were better attended.

Maybe they are frequent winners of awards for innovative uses of technology in learning. Maybe you even need to initiate that kind of awards program at your institution if it doesn’t already exist.

“When you see some of those same faces popping up, that’s where you might find your unicorns,” Branon said.

4) Recognize Those Who Are Reaching Out to the Other Side
Stanford’s Kim even jokingly called it a “form of pressure.” His department publishes a regular newsletter in which it holds up as examples certain faculty members who do outstanding things with technology.

“We write about Professor XYZ who did this or figured that out,” he suggested. “The hope is that others will read it and think, ‘Oh, if I don’t do this, I’m going to be left behind.’”

5) Employ Students in the Effort
Kim also pointed out that often students are professors’ primary link to the outside world and can communicate with them in a way the IT professional can’t. At Stanford, he directs much of his outreach efforts to teaching assistants who are often “digital natives” anyway and already have good rapport with their instructors.

“Leverage the students,” Kim suggested. “Since they interact with faculty more than you, it’s always good to use them.”

When it reaches the point where either side is using terms like “never” or “always,” it’s time to sit down at a table and patiently hash issues out.

6) Talk About the Problem
As a last resort, tackle the issue head-on with a frank conversation. But, “Take a step back when it gets to finger-pointing,” Branon suggested.

As is the case with every human interaction, there will be disagreements and occasional miscommunication that must be worked through. However, when it reaches the point where either side is using terms like “never” or “always,” it’s time to sit down at a table and patiently hash issues out.

“Both sides have to work at it too,” he said. “You may be doing brilliant work in the server room, but you are going to have to reach out across the business. And on the teaching side, sometimes you have to say that you are willing to find ways to do things differently.”

Michael Hart is a Los Angeles-based freelance writer and the former executive editor of THE Journal.
After borrowing a 3D printer for three weeks for his fifth-grade classroom last year, Vincenzo La Ruina knew he needed to have one available all the time. While something as sophisticated as a 3D printer might seem like overkill for kids as young as fifth-graders, La Ruina had them doing some impressively creative projects.

At first, the kids at Gardiner Manor School in Bay Shore, Brooklyn, NY spent some time getting used to the technology. They experimented with the technology to print relatively simple things like a 3D rocket, ring or dog tags. La Ruina held contests in his classes to help them select what they would print. After they quickly became comfortable with their 3D printer, the list of possible projects expanded both in number and in scope.

Their design priority list included designing a logo for their school, a car, a spaceship, something you can wear, a house, a bridge, a plane, a unique shape, an animal, a pencil holder, a small monster, a plant, a robot, a boat that will float, a tree, a chair, a bowl, a sculpture, a new tool that can be used for something, and a LEGO person.

They had fully embraced 3D printing technology, and La Ruina was putting it to work and doing innovative projects with his math and art classes. I was inspired by a workshop I went to,” says La Ruina. “I like the idea of kids being able to make what they want. They can articulate an idea onto a 3D printer. They can take an idea and make it 3D. I am excited to help these kids solve these problems.”

Gardiner Manor School has third through fifth graders. The older kids use Tinkerbot to create their designs prior to printing. The younger kids use Cubify, which is easier for them to operate. One of La Ruina’s students wanted to make a soccer ball, so he helped him decide whether they should start with a square and trim the excess material off, or start with a polygon and build it up. It’s that kind of abstract conceptual thinking in which La Ruina enjoys engaging his students. “They’re learning to make and design things,” La Ruina says.

“I want everyone to have a chance to use this,” says La Ruina. “They can do it on their own. They can come to me for help. It’s not too much effort. If you give them an hour, they can get started.”

La Ruina is looking forward to putting this more sophisticated Stratasys Mojo 3D printer to work with his classroom projects. The first 3D printer the school borrowed was indeed brand new, but required frequent maintenance. With his experience, he is also much more familiar with the 3D design and printing process. “My knowledge has grown since writing the essay,” he says. “We will be able to be more precise.”

La Ruina won the Stratasys Mojo 3D printer after winning an essay contest sponsored by Stratasys and Campus Technology.
Will Unbundling Kill Higher Ed as We Know It?

The competency-based education model eschews the bundled approach of traditional degrees, instead promising to produce workers adept in just the right skills employers want. One education expert believes that unbundling could destroy all but a handful of colleges and universities.

IF THE UNBUNDLING of higher education were like the unbundling of a cable package, most TV viewers would relinquish the Golf Channel and QVC, and so might just as many students give up ample office hours, support from IT, the library, athletics and on-campus social activities in return for a big reduction in tuition and fees. In fact, that’s exactly what England’s Coventry University has done, according to Ryan Craig, as noted in his 2015 book, College Disrupted: The Great Unbundling of Higher Education.

Craig is the founding managing director of University Ventures, a private equity fund that invests in post-secondary education companies through partnerships with traditional colleges and universities. Current investments include medical universities; UniversityNow schools, which use a competency-based approach; ProSky and Galvanize, which provide “top-up” skills in technology, entrepreneurship and marketing; and e-portfolio vendor Portfolium, among other organizations.

As Craig explained, “Bundling transfers consumer surplus to producers.” Cable operators “inordinately” benefit from selling cable bundles to customers, whereas unbundling returns that surplus to the consumer — in the case of higher ed, the student. But the concept goes beyond basic economic considerations.

It’s Craig’s belief that students may one day find they don’t need a bachelor’s degree to become employable. When that day comes, the traditional four-year college experience could be considered as “old-fashioned and elitist” as a debutante ball. While Craig wouldn’t be pinned down on a date by which this unbundling of higher ed will take place, he did offer clues to help us recognize its inevitable arrival.

Insurgent Activities Working Against Degrees
Currently, hiring managers continue using the bachelor’s degree as a primary screening mechanism. It has become, said Craig, “the price of entry for a white collar career.” But a lot of employers are “very frustrated” with that state of affairs, he added. Most institutions develop their degree programs — “product” in Craig vernacular — based not on what employers need or want but on what faculty want.

Now that more schools are adopting data-informed processes to help re-architect their programs, he asserted, colleges can use data to shift the emphasis from that faculty-centered model to “what competencies students...
actually need, what competencies employers actually want.” As a result, “We’re seeing all kinds of insurgent activity acting against the degree.”

Craig offered these examples of “insurgency” as evidence:

- **Just-in-time coding bootcamps** that have the potential to train tens of thousands of people for “remunerative careers” in technology. Many bootcamp students already have degrees, often from elite universities. But not all. In March 2015 the White House announced a “TechHire” initiative that would put people (including the near-unemployable — those with criminal records) into “fast-track training” through coding boot camps.

- **The use of “nanodegrees”** at Udacity and “specializations” from Coursera that bundle specific groups of courses. These options received a boost when Google both teamed up with these MOOC companies and created custom assessments for its own hiring practices — which indicates, Craig pointed out, “that they’re no longer taking the degree at face value.”

- In its United Kingdom operations, consultancy EY is **removing academic qualifications from its entry criteria.** “They’re keeping that hidden from the hiring manager because they believe it is absolutely not indicative of performance in the job,” said Craig. Instead, the company is opting to put every candidate through a suite of custom-developed “strengths assessments and numerical tests,” an approach it has been testing since 2008.

The college degree has acted as a “signal” to employers about what they can expect to receive from candidates, Craig explained. “Until now it has been the best signal — the highest fidelity signal — that employers have had. That’s why it has become the default currency of the labor market.”

But Google and Ernst & Young have found a “better signal,” he noted. As more employers join their ranks and adopt similar practices, the idea that students need a traditional degree will be chipped away, Craig predicted, ushering in the era of the “competency marketplace.”

### Competency Currency in Play

Craig doesn’t care for the word “competency,” because it tends to denote vocational skills. But it’s the best there is, he added, for describing “anything that can be assessed, up to and including high-level cognitive skills — problem-solving, critical thinking and so forth — that are predictive of one’s career trajectory.”

The idea of the competency marketplace or “competency currency” is to help employers identify candidates who are close matches for positions based on the competencies those open jobs require. Craig is convinced that LinkedIn is the closest to delivering on that promise. “A competency marketplace is a LinkedIn on steroids,” he declared. (Craig said neither he nor his company has investments in LinkedIn.)

In 2014, LinkedIn bought Bright.com, a job search start-up that had developed algorithms for parsing and extracting competencies from résumés and job descriptions. Eventually, Craig suggested, LinkedIn will ask its individual members to allow it to use that technology to pluck out competencies based on their professional experience. (The social network had long ago begun that work with its skills and expertise endorsements that currently appear on individual profiles.)

As Craig explained, LinkedIn will be able to create competency profiles based on the skill sets and other qualities possessed by the tens of thousands of members who already have a particular kind of job. On the member side, somebody who is interested in developing his or her career or doing a career change will be able to turn to LinkedIn to identify the gaps “between where you are and where you need to be.”

People will remediate those deficiencies not by getting a four-year degree, Craig said, but by pursuing “a series of short discrete learning experiences — courses, assessments, MOOCs and so on.”

In other words, LinkedIn is well positioned to help employers identify the best candidates for a given job opening and to help job seekers figure out what they need to do to get the jobs they want. At some point, Craig
expects the company will also have ties to providers of those learning experiences.

Unbundling in higher education will happen, he predicted, “when the fidelity of the signal that employers receive from a competency marketplace is better than the signal they’re getting today from degrees.”

**Institutions Remain Unconvinced**

Not every college or university will lose out to the competency marketplace, however. Craig said that for the foreseeable future “elite universities” are safe. Students raised in the “hothouse environment” of a **Yale** (CT) or **Harvard** (MA) or **Stanford** (CA) will continue to flourish in the job market.

But not so with everybody else. Institutions that want to survive, Craig insisted, will need to “differentiate, distinguish, innovate in terms of programmatic areas, connection with employers [and] modes of delivery — but also in terms of what the actual product is.” Increasingly, it will be something shorter and “easier to complete” than a four-year degree.

In particular, those schools that can somehow co-opt the ownership of metadata related to a person’s competencies will be in an excellent position to keep a student as a “customer for life” by recommending continuing education at strategic points in his or her career.

This past October, Craig emceed a panel at a LinkedIn education event that featured representatives from two of those “elite” universities — **Duke** (NC) and the **University of North Carolina** — and the for-profit **Kaplan University**.

Of the three, Kaplan came off as sounding like the closest fit for the unbundled world of education. According to Tere Traub, an executive director, Kaplan’s students are older and predominantly female; they’re working; they may be single parents; and they either want to get promoted on the job or change careers. Her university has already instituted the competency model to teach its students skills around such areas as teamwork and communication. “Our obligation is to teach the students how to think, because ultimately, things are changing so quickly,” said Traub during the panel discussion. “If you can’t adapt, you’re not going to survive, no matter what you’re being taught.”

The reps from the two elite institutions weren’t convinced that unbundling was a foregone conclusion for any kind of school. One argument against a competency marketplace, noted Michael Schinelli, chief marketing officer at the UNC Business School, was that competencies will be ever-evolving. “When someone gets into their 10th, 15th, 20th year where they’re in their prime earning years, to model their entire educational experience on competencies we have now is a risk.” Better, he said, to remember that college in all of its variations and layers is meant to help students learn how to think. “If you learned how to think, that’s the best equipped graduate we can produce.”

The other argument came from Elizabeth Hogan, associate dean in Duke’s School of Business: Work is about more than mastering a set of competencies and plying it for the highest ROI. “What’s the definition of return on investment? There are certainly lots of MBAs that think their ROI is starting salary. There are lots of other MBAs in the Peace Corps who are there to help.” The job of the Dukes of the world — and any other university — is to “create knowledge and make the world a better place,” she said. “In the sense that we’re continuing to make that work for the many different flavors of students who want to come to Duke, that’s where we’ll be focused.”

Craig is unfazed. As he told the LinkedIn audience, “Degrees are essentially a version of enterprise software. The way enterprises bought software five, 10 years ago, you had to buy a huge package that some would call ‘bloatware.’ You would spend hundreds of thousands of dollars on it. You’d have huge annual maintenance fees. But you bought it once. Well, we have a product that people buy once. It’s called a degree.” **CT**

Dian Schaffhauser is a senior contributing editor for Campus Technology.
How to Launch a Campus Innovation Center

Creating a physical hub of innovation on campus can support creativity, collaboration and entrepreneurship. Here are things to consider before getting too far into the process.

Almost every week brings news of another campus opening an innovation center. Community colleges, liberal arts schools and research universities are all carving out intentional spaces for creativity and collaboration. Driven in part by the rapidly changing needs of employers, higher education is seeking to make its spaces more reflective of a work environment that places a premium on entrepreneurship. Most of these centers feature modern furniture, whiteboards and prototyping equipment like 3D printers. But architects and designers suggest university leaders ask themselves several key questions before getting too far into the process.

Jill Goebel, design director and the Southeast region education and culture practice area leader for Gensler, an architecture, design, planning and consulting firm, thinks that there may be some confusion around the lexicon. “There are innovation centers, makerspaces, accelerators and incubators,” she noted. “Sometimes the language is muddied because people use the terms interchangeably.”

But just because you create something that looks hip and cool does not mean that innovation happens there, Goebel warned. “There has to be a driving mission and vision behind it. We work with campuses on visioning sessions and interviews to unpack their culture and discover who is ready for it — what programs and leaders within the university have a willingness to be adaptive and go in and try things. You can’t just plunk this in the middle of campus and think something is going to happen. It takes leadership.”

Brad Lukanic, executive director of CannonDesign’s education practice, also starts his work with universities with a visioning exercise. Among the questions he asks is: As an institution, how interdisciplinary do you want to be? depending on what programs are involved or if the provost or deans are in the room, you get very different answers,” he said. Other questions he asks include how the new center aligns with the strategic mission of the institution and who will be responsible for the curation of content. “One of the potential pitfalls is you make these spaces but there is no ownership in terms of who manages and operates it,” he explained. “You have to look beyond day one.”
GOING BIG WITH 3D PRINTING

SOME CAMPUS INNOVATION CENTERS have put an emphasis on the potential of 3D printing to allow students to innovate, rolling out large numbers of machines to support heavy use. With its 31 MakerBot 3D printers, Xavier University (OH) has created a 3D printing service available both to campus users and to the public. The facility gives students the opportunity to craft material to help businesses solve real-world problems.

“We are working on a project with an electrical company remodeling a couple of pieces of equipment on their manufacturing floor,” said David Zlatic, director of the Xavier Center for Innovation. “They had a piece that wasn’t working right. We redesigned it and printed out three different options for them at a much cheaper cost than going out and having extrusion done. They picked one they liked and we are going to reproduce more of those.”

While Zlatic heads up the initiative, six paid student interns operate the space. “I get the file and hand it to them and they figure out how to slice it, prepare it to print and print it,” he explained. “I give them the basics of the job and the parameters and they take it and run with it.”

Zlatic said there were few logistical challenges in setting up a large 3D printing operation. The innovation center’s space is about 12,000 square feet and 3D printing takes up only about 1,000 square feet of it. “MakerBot supports a Web interface that allows us to send jobs to the printers and monitor them remotely,” he added. “I can send a job and watch it print from my house.” The only challenge was finding enough students who had some kind of experience in the 3D printing realm, he noted. “Thankfully there are students coming out of high school with some experience. I have a staff of six students, and five of them are freshmen.”

At the University of Massachusetts-Amherst, a large 3D printing operation inside the library is part of an effort to integrate 3D printing into the curriculum. Printing an object can be a time-consuming process, and UMass officials and faculty realized that they would need a fairly large number of

Lukanic said questions about the look and feel start with: Is it in a new facility or in a renovated facility? What do you want the front door and image to say? Is it about boundary crossing between departmental silos and interconnectedness? The look and feel is often intentionally different than what a school of business or engineering normally looks like, he said.

Why Build an Innovation Center?

CT spoke with several innovation center executives about what’s driving the trend toward the creation of so many new innovation centers and what makes their spaces unique.

Lindsay Siegel, executive director of the 3-year-old Zahn Innovation Center at the City College of New York, said there are a number of reasons why a campus would want to have a physical hub of innovation on campus. One is to signal that the campus has a real investment in innovation.

The Zahn Center functions as a startup incubator, offering student teams mentorship and pro-bono services, networking opportunities and rapid prototyping facilities. It has two spaces on campus. One is an engineering-focused makerspace and the other one is a sleeker co-working office space with whiteboards and modular furniture.

“If you have startup teams looking to have a creative outlet, there is real importance in having a physical space for them to find each other and start working
together and access prototyping equipment,” Siegel added. “What we find in running an incubator is that so much of the value of our program comes from there being a community of other students also trying to come up with innovative new technologies. Being able to co-locate and work together is invaluable to the experience.”

Siegel said the center’s role on campus keeps expanding. “We have gotten involved in academic programming and bringing in speakers, expanded the mission to include software-based startups and social enterprise,” she explained. “We partner on grants involving multi-disciplinary courses co-led by faculty. Faculty in business, computer science and electrical engineering can all work together to bring innovation into their classrooms. Because we are this resource on campus and don’t have a home within any single school or discipline, it opens those doors a bit more.”

A Student Focus
Charles Hasemann of the Michigan State University Innovation Center sees his facility as a response to student demand. “The students told us this is something they needed,” said Hasemann, who serves as MSU’s assistant vice president for innovation and economic development. “They want to have more control of their future. They see it is probably a good idea to have a skill set where they can make their own future and be adaptive. From the university’s perspective, it is an opportunity to give students an extra set of skills — an understanding of markets, of the private sector, as another dimension of being a good graduate.”

An innovation center at a large research university such as MSU is much more involved than at a smaller school, according to Hasemann. It combines several entities: One is a cor-
Corporate engagement office, charged with creating partnerships with business and working with startup companies to help them gain access to people and the technology created at MSU. The technology transfer office is located in the innovation center to help faculty-created inventions find a way to the marketplace and societal benefit. That process also involves supporting startups. “We have to have a startup engine to bring talent, funding and planning to that effort,” Hasemann explained. “Faculty members usually don’t have the skill set. We have to provide that backbone.”

Layered on top of those efforts is the student-focused aspect. An incubator for student entrepreneurs helps graduate and undergraduate students get internships to get involved in the process of researching markets, building business plans and finding likely clients for MSU startups.

All these efforts are co-located in one building off campus, next door to a community technology incubator. “Many universities have all these parts, but they are not physically co-located and I think they lose a lot of potential,” said Hasemann. “Faculty members usually don’t have the skill set. We have to provide that backbone.”

For institutions that are considering establishing an innovation center, case studies of types of incubators and innovation spaces that align with your academic goals can be a good springboard. Consider looking beyond higher ed: Models for how to think about innovation center workspaces are coming from both workplace and K-12 settings, said Cannondesign’s Lukanic. “If you look at the Googles and Facebooks of the world, how people are connecting and collaborating is fundamentally different, so the industry partners are leading this,” he said, adding that it can also help to look at what some of the innovative charter schools are doing, such as the incubator school in Los Angeles. “In some ways, the schools sending you incoming students are great resources for ways to see what students are coming prepared for in terms of thinking.”

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THE HIDDEN COST OF OUTDATED TECHNOLOGY

When legacy campus infrastructures are past their prime, there are unseen costs beyond performance and capacity.

DATA IS PILING UP on campus technology infrastructures across the country. This data avalanche is driven by the dramatic rise of output generated by online courses, the growth of data usage in research and other digital innovations changing the landscape of education. Yet much of this data is maintained in virtual environments connected to legacy storage technology—those massive racks filled with spinning disks. This is where the cost of staying with outdated technology can remain hidden.

Like other server components, storage typically follows a three-year replacement cycle. IT organizations that try to hold out longer face increased upkeep costs (just examine your own storage vendor maintenance agreements for confirmation) and miss out on technology innovations that can significantly boost productivity.

Even when IT decision-makers recognize that’s the case, they still pursue refresh purchase decisions that may overlook updated technology: “Hard drive disk storage is
still considerably cheaper than flash, so in terms of sheer storage value, we have to go with HDD. But let’s try flash in strategic areas."

They apply numbers to support that reasoning. In terms of raw price, a gigabyte of spinning disk storage runs about seven or eight cents a gigabyte. Flash storage is five to six times higher—about 40 cents per gigabyte. And with ever-increasing appetite for more storage, how could you possibly make the case for converting to an all-flash approach? Who could afford it?

Such a one-dimensional comparison, however, doesn’t capture the whole calculation. It ignores the greater benefits of flash storage, such as the value of being able to deliver far better performance, greater resilience and faster return on investment.

Performance: There’s mounting emphasis on data-informed decisions among school leaders and staff and a desire for instant gratification among students. That translates to college and university users expecting speedy results from their queries. It obviously becomes an issue when a disk-centric or hybrid disk-and-flash stack can’t deliver the expected application performance.

Depending on the workload, all-flash arrays can handle data refreshes and queries up to 20 times faster than even the newest generation of spinning disks, which still rely on mechanical operations. An all-flash system delivers faster results, increased output from processing more transactions and greater user satisfaction.

Resilience: Making upgrades to hard disk drives or the software that manages them often requires bringing the storage system offline. Certain all-flash array solutions provide for resilience—the ability to continue functioning—when IT has to perform storage capacity expansion or updates to the controller. School operations are no longer an 8 a.m. to 8 p.m. proposition. Continuous uptime has a value both for students and faculty who can continue their work uninterrupted and the IT organization, which can maintain its service levels.

ROI: To fully calculate the economic impact of an all-flash array over traditional disk-based storage, you need to quantify the business benefits of better performance, such as the ability to make faster decisions in prospect marketing or student applications or to turn around research results more quickly. While it’s difficult to add the value of these individual improvements across campus, even a few key functions can help you make your case for choosing all-flash or legacy storage technologies.

All-flash solutions address the same performance level as spinning disks with fewer units, so the data center can reclaim a certain portion of its real estate dedicated to legacy disk racks. Using newer technology also has a bearing on power and cooling, which reduces energy requirements.

As you develop your storage business case and financial model, don’t settle for the simple pricing comparison of capacity HDD over all-flash solutions. Dig deeper to understand the financial impacts of boosting user productivity, regaining lost time and reducing the unintended consequences of sticking with legacy technology. Doing so will give your campus IT organization a better shot at making investments with the strongest growth prospects possible.
A comprehensive security plan for higher education is a combination of technology and process.

IN 2015, there were 11 publicly recorded instances of data breaches at universities or university-affiliated hospitals, according to data maintained by the Privacy Rights Clearinghouse. Those attacks included a break-in at Penn State that exposed 18,000 student records and five other data exposure events following the theft of laptops containing personal information. The largest breach, affecting some 4.5 million patients, struck the University of California Los Angeles Health System. As reporting in the Los Angeles Times noted, UCLA “hadn’t taken the basic step of encrypting ... patient data.”

In its annual “Internet Security Threat Report,” security company Symantec noted the biggest trend in cyber threats during 2014 was how new vulnerabilities made public were quickly picked up by attackers “stepping up to exploit it.” Reaction time—how quickly vendors created and rolled out patches—couldn’t keep up.

The report notes the three most exploited zero-day vulnerabilities of 2014 took 204 days, 22 days and 53 days, respectively, for security companies to release patches. (By compari-
son, researchers added, the average time for a patch release for the top vulnerabilities in 2013 took only four days.

Hackers have also figured out how to make their malware “virtual machine aware.” This means security researchers “who are dependent on virtual sandboxing to observe and detect malware” are no longer insulated from attacks.

In the same vein, social media and mobile devices—the bedrocks of student communication—are becoming increasingly popular attack platforms for the bad guys. Symantec found seven in 10 social media scams were manually shared, resulting in rapid spread. It also found 17 percent of all Android apps (nearly a million in total) “were actually malware in disguise.”

Not all attacks rely on rushing into the breach. Cybercriminals are showing great patience in achieving their goals. For example, one tactic is to identify “common software” used by their pending victims, hide malware within updates for those programs and then wait for their targets to download and install the software, thereby infecting themselves.

A Unified Defense
In response to the “persistence and patience” of cybercriminals, Symantec has advised organizations to defend themselves by adopting the same characteristics through a “unified security model.” As the researchers spell out, this “holistic approach” brings together three components: threat intelligence, risk management and “the very best technical solutions.”

Flash storage is turning out to be invaluable in that latter category. As Vaughn Stewart, Enterprise Architect at Pure Storage, explains, newer storage technologies, such as the Pure Storage all-flash arrays, embed security into the operating system. Nothing goes in or out of FlashArray without first being encrypted.

More importantly, an all-flash solution provides for the kind of capacious and high performance environment that helps security staff be more responsive. “You must amass this large collection of data access and behaviors and patterns. Those patterns have to be compared through real-time analytics,” says Stewart. “This means that your storage has to be large capacity, and it has to be extremely fast because your legacy ‘fingerprint’ or historical record of the normal behaviors has to be compared to the real-time anomalies [that] are the malevolent behaviors.”

Lessons Learned
Those institutions that have suffered high-profile breaches often provide the best advice to other schools for setting up their security profile to weather similar attacks:
- As Harvard informed its community following a break-in that exposed an unspecified number of records, protect your endpoints through increased user training, especially scenario-based training. Teach them to “click wisely,” the university advised.
- Following its latest break-in, Penn State security experts began implementing two-factor authentication on major university systems, stronger password management practices, and “enhancements to system and software administration.”
- Others recommend being “proactive” in educating campus leaders. Data breaches have reached the boardroom not only in business, but also higher education.
- And get moving on security staff development. While hiring new may be expensive, consider the long-term benefits of bringing willing IT professionals into the security fold with extensive training and the use of financial incentives.

“This new threat must be faced head-on, not just by Penn State but every large university, business and government the world over,” writes President Eric Barron in a letter to his campus community. “This is a new era in the digital age, one that will require even greater vigilance from everyone.”
FLASH STORAGE is moving from specialized instances to a more mainstream medium. More organizations are moving to adopt an all-flash environment, or even adding flash to existing environments for certain data workloads. The price/performance metric continues to attract new users.

The technology itself continues to evolve as well. In August 2015, Samsung stated it would release the PM1633a, a 15-terabyte solid state drive (SSD), sized to fit in the current generation of laptops and anticipated to be the “world’s largest flash drive.” Conventional hard drives top out at six to eight TBs. Although the product and pricing haven’t been announced yet, the introduction of this level of capacity sets a new course for the future of flash storage.

“We’re fairly bullish that in 2016, you’ll see flash advance from its roots in serving performance-centric workloads to addressing the high-growth market capacity-optimized storage,” says Vaughn Stewart, Enterprise Architect at Pure Storage, which has become a leader in the all-flash storage array market.

Stewart explains the historic view of all-flash storage implementations were a strategic response to specific system performance ailments. Compared to the cost of standard spinning disks, all-flash was too pricey for broad adoption. That’s been especially true in higher education environments that commonly see annual storage needs grow annually by 15 percent or more.

Hybrid storage environments that blend spinning disks and all-flash have become more popular on campus as stop-gap measures. However, those solutions often take “a lot of time to optimize,” says Stewart.

Although a number of features set Pure Storage apart from traditional storage vendors and all-flash start-ups, there are three areas worth highlighting that differentiate them:

**Data reduction:** This facet encompasses deduplication, data compression, deep reduction and pattern removal. As a Forrester report explains, data reduction helps all-flash systems achieve a level of equilibrium with spinning disks. This brings the “the usable per GB cost” of Pure’s FlashArray storage in line with or below the cost of a hard disk drive in “almost all use cases.”

While the actual reduction depends on workload, customers typically experience data shrinkage ranging between five times and 19 times over traditional HDDs. At the University of Texas at Dallas, the IT organization for the School of Engineering achieved an 8-to-1 data reduction in maintaining 13 master images used in its virtual desktop infrastructure. Significant cost savings are also frequently achieved as fewer server and software licenses are needed.

**Simple installation:** “Our system is iPhone-simple,” says Stewart. “Our systems can be racked and installed and up serving data in under an hour.”

“OUR SYSTEM IS IPHONE-SIMPLE. OUR SYSTEMS CAN BE RACKED AND INSTALLED AND UP SERVING DATA IN UNDER AN HOUR.”
—VAUGHN STEWART, ENTERPRISE ARCHITECT, PURE STORAGE
An administrator places the unit in a rack, plugs in the power and network, and after a few minutes they are provisioning storage complete with data protection policies.

The Forrester study of four customers found none of them required professional services or formal training to deploy their flash arrays. As U Texas IT manager John McConnell observes, “A student or an administrative assistant can add a user in just a few minutes. It doesn’t require an expensive, expert technical resource.” Even the project bids are simple. “It’s two items on the quote,” says Stewart. “It’s the array and the support.”

Support costs: A common approach to storage support is to build the maintenance fees into the initial bid for the first three years. Then organizations are often hit hard with a support bill for year four with built-in incremental increases in subsequent years. In other words, it’s a lease agreement predicated on the assumption that you’ll want a complete technology refresh by year five to avoid ever-escalating support costs. Either way, you’ll pay—either through increased maintenance fees for aging infrastructure or a pricey forklift upgrade.

Pure Storage changes the game with “Evergreen Storage,” where maintenance pricing on a per-gigabyte basis remains the same as it was on the day of purchase. It stays flat for the life of the system, which means customers stay modern and avoid the tremendous burden of storage replacement. Every three years, as long as the customer stays current on the maintenance plan, Pure Storage updates the array with the latest software updates and controller technology free of charge. Through the life of the agreement, any components that fail are also replaced free. That upgrade is done without disruption to applications or performance degradation.

“If you ask a storage administrator, ‘Would you prefer all-flash or a spinning disk array with a little bit of flash?’ they’ll say, ‘That’s a no brainer. We always want all-flash. We just could never afford it,’” says Stewart. However, a company survey found nearly seven in 10 Higher Ed customers (68 percent) who have owned Pure Storage for more than a year have purchased another array from Pure.

“Our customers who have tried just one application are blown away,” says Stewart. “From there it (the use of flash) spreads organically.” Without cost as a barrier, it may be time to try all-flash to see for yourself how it can impact not just the performance of an application, but the way you fundamentally think about storage.

Learn more about how Pure Storage is Accelerating Education at www.purestorage.com/education
Developing Your Staff for a Service World

While technical expertise definitely has its place in higher education, increasingly IT departments need to sharpen other kinds of skills to succeed.

THE UNIVERSITY of Toledo (OH) has consolidated several IT departments, and now it faces a new challenge: rationalizing the numerous job titles possessed by people from all of those various areas. “From one area we have 32 different job titles. From another we have 15. Then in another we have 18, and one with nine,” bemoaned Carol Lawrence, the assistant director for IT Project Administration in charge of the project. “We want to make them ‘centralized’ and also be meaningful in terms of where are we going for the future.”

The effort isn’t simply a matter of simplifying the org chart. It’ll also help IT leadership build “a roadmap of opportunities” for the employees so they can figure out how to maneuver in their careers. Eventually, Lawrence predicted, the university may offer a “rotational,” to allow staffers to “learn different areas within the departments.”

IT is an area where skills are continually being redefined as technology innovations and practices evolve. In fact, in Educause’s 2016 roster of top IT issues in higher ed, workforce hiring and retention came in at No. 4. (Last year, it was first on the list.) But some skills are turning out to be more important to the future of the institution than others.

Later this year, Educause will issue the results of a large study based on a survey filled out by some 1,800 people in the IT workforce. According to Susan Grajek, vice president for data, research and analytics, 16 skills were listed and respondents were asked to specify how important each was to their “work success” and how proficient they already were at the given skill. Three-quarters specified “IT as a service” as “very important or extremely important” for the success of their jobs. While the smallest gap between need and personal proficiency lay with “technical proficiency,” the top four skills designated as most important could all be classified on the soft side: 1) to communicate effectively; 2) to influence others; 3) to negotiate; and 4) to think strategically and plan.

The question for IT leaders is how to keep operations humming at the same time you bring your people up to speed on the kinds of skills particularly suited for a service world.

Practice and Mentoring

“One thing as-a-service is growing,” declared Lori Sundal, deputy CIO for IT Service Delivery at Georgia Institute of Technology. When her IT team goes in to fulfill a request these days, she said, “We [know] we could do this with a Web service.” So instead of staffers keeping their skills...
while benefiting the institution as well. If they don’t get the chance to use their knowledge, Sundal pointed out, “then it goes nowhere.”

At the same time, Sundal’s staff needs to get more comfortable in dealing directly with the “customers” they’re delivering services to. That puts the emphasis on soft skills. “As we move forward, customer relationship management, vendor relationship management, things like that, become even more important,” and so do the soft skills, such as “being able to communicate effectively with a diverse group and understanding things like emotional intelligence and your personality type compared to someone else’s,” said Sundal.

Those abilities aren’t so easy to obtain in a class, so Sundal and her peers do mentoring. She’ll step in for some just-in-time coaching when it appears her technical people “aren’t communicating effectively or in a very harsh way that’s going to cause a different kind of problem.”

Embracing a Change Mentality

George Claffey Jr. faces a different set of challenges as CIO at Charter Oak State College, an entirely online institution in Connecticut. “It’s a public college. We’re a union workforce,” he explained. While union rules mandate a 40-hour workweek for staff, an all-online school requires coverage 24/7. So the college has turned to a combination of on-call planning and third-party providers for support coverage right alongside the use of “outsourcing to

### 3 Ways to Fine-Tune an IT Team

**Focus on their happy place.** George Claffey Jr., CIO at Charter Oak State College (CT), and Lori Sundal, deputy CIO for IT Service Delivery at Georgia Institute of Technology, both acknowledge that higher ed can’t always meet the salaries dangled by the corporate world. So they make sure their people stay hooked in other ways. For Sundal that means includes keeping staff “happy,” “growing” them, and giving them “challenging opportunities to keep them interested.” Claffey said he finds the college atmosphere and an online school in particular a “fun and interesting place to work,” adding, “We’ve only been around since the 1970s, and we’ve consistently changed and evolved.”

**Tap the education your own school delivers.** When an “operations and communications director” position was added to IT at Charter Oak, the final candidate had a lot of communication experience, so he was enrolled in the college’s own credit-bearing certificate program for project management. “We’re eating our own dog food,” Claffey crowed. “We’re able to say this isn’t just good for everybody else; this is good for our people too. It has been a valuable product to him. And it’s also a valuable skill to us.”

**Keep your own skills sharp too.** Sundal expects to put a lot of personal attention on the area of accessibility over the next year. “It’s a hard nut to crack,” she noted. “I’m on several committees here, and we are making really good strides. But it’s a huge issue. You have to educate the campus. We have to have subject-matter experts (SMEs) who really understand it. We have to test our [services] via screen readers and other things of that nature. And the harder part is probably our procurement side of things, making sure that as we procure, it’s successful. There’s a long way to go overall.”
commodity providers in the cloud."

The mix has required his workforce to become “more nimble,” he said, particularly as the cycle of change is happening faster. “We used to be able to put a desktop on the faculty workstation that was by and far going to be there for five years. Maybe we updated it once and maybe we didn’t. But it was pretty static,” Claffey said. "I think that’s a good example of how the staff was too. They would learn a single operating system or a single version of code, and we expected that that was going to persist for a long time. We don’t have that today. We need to become a much more agile organization."

Plus, IT no longer sets the bar for standards — users do. And their expectations are fixed by places like Amazon and Apple, Claffey added. “The students are comparing us with their best experiences, not experiences of other colleges, which is a struggle for us, because we don’t have Amazon’s budget.”

In response, IT at Charter Oak has evolved, doing more than just providing help. “We’re almost providing concierge services where possible to help [improve] the student’s experience,” he said.

About three years ago his organization embraced ITIL, the service management practices that map IT work to business needs. The college brought in a trainer and held an off-site meeting for everybody in IT, which turned out to be “worth the money,” recalled Claffey. Not only was it a great team- and skill-building experience, he said, “but it also created a common vocabulary among the staff. We were all able to talk about service delivery and expectations in the unit, all having had that same experience.”

The shift occurred in the context of an earlier institutional initiative. In anticipation of becoming a “change organization,” Charter Oak’s institutional leadership embraced the study of John Kotter’s book, Our Iceberg Is Melting, which promises to “motivate people to face the future and take action.” As Claffey noted, adoption of a change mindset is great for the culture of the college and for his retention efforts. “People want to stick around, because their jobs are meaningful. There is some level of personal reward and accomplishment at the end of the day.”

Nor does it hurt that Claffey has been able to maintain a healthy training budget for IT. He said that his department tries to develop a career path for every staff member. The training is intended to help staffers achieve their goals while serving the needs of the college. For example, a director of enterprise systems wanted to get into information security about the same time the institution required a chief information security officer. Though it was a “lateral” move, it suited his growing interest. So he was sent to SANS for security training. That shift created an opening to promote another staff member who needed “new manager” training; she was sent to an Educause event for that.

As a service orientation infiltrates every hallway of the school, one challenge remains: helping people learn to get comfortable moving “front and center.” It’s easier for people like Claffey to do that because “we’ve always done it.” But now, those on the help desk or in the data center are also expected to provide client and service updates. “For years, we’ve promoted and rewarded people for being the smartest geek in the room — for lack of a better term. Now it’s not enough today to be the smartest person in the room. You’ve got to be able to explain that in laymen’s terms to business owners. And you have to understand their business. So that’s our struggle now — to create a higher ed business acumen across all levels of the organization, not just at the top level.”

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Creating a Collaboration Hub

When San Antonio’s Trinity University built a new Center for Sciences and Innovation, it included at its heart a 10,000-square-foot area that lends itself to interdisciplinary collaboration.

BACK IN 2007, when Trinity University (TX) science faculty were beginning to consider what they wanted out of a new facility, chemistry department chair and professor David Ribble had a very good idea of what was required. “We had a different vision about making things more collaborative, more interdisciplinary, more innovative,” Ribble said.

The building in which most of the science departments held their classes and labs had been built in the 1960s on the San Antonio campus — which was founded in 1869 — and a lot had changed since then about the way faculty and students view their roles.

“It’s now our responsibility to train citizens for the 21st century,” he said, “citizens who are not shy about interacting with different disciplines.”

It took some time as well as a lot of planning and discussion, but Ribble and his colleagues got what they wanted when the new Center for Sciences and Innovation opened in early 2015. The $127-million, five-story, 280,000-square-foot building is home to eight academic departments, the McNair Scholars Program, the Center for Innovation and Entrepreneurship — and “The Cube.”

The official name of “The Cube” is the Innovation Center, an approximately 10,000-square-foot glass-enclosed space that ostensibly is the site of the university’s engineering science and computer teaching lab. However, it is best known as the hub of the entire building, a place that chemistry professor Nancy Mills said offers students and faculty a rare opportunity.

“There is a serendipity that occurs when people interact with each other,” Mills said. “Those are what we call ‘productive collisions.’”

Ribble added, “It is the intellectual hub for the whole building. Given its central location, what it invites students and faculty to do is very important.”

The Innovation Center is a collaborative space where students and faculty can interact with technology in a unique learning environment. There are three significant zones in the glass-enclosed space that can be viewed from many different perspectives throughout the building.
A Teaching Area features two 60-inch 4K monitors surrounded by 40 armchair desks. The displays not only allow 4K content to be shown — such as finely detailed engineering schematics — but also improve the image quality of other types of content.

The Design Studio is a student lab area that supports the collaboration of students and faculty. There are 10 mobile workstations outfitted with permanent and removable whiteboards, flat-screen displays, power outlets, data ports, a worktable and a compartment to house each station’s electronic equipment.

While the studio is primarily used by engineering students during the weekday, it quickly fills up with students from all over the university during the evenings and weekends. “The technology is all there,” Ribble said. “You walk in and it begs you to sit down and collaborate.”

He was most taken by the way the workstations were created by engineering faculty and students in conjunction with the project architect, allowing students to sit across from each other with a computer off to the side. “As an educator, I’ve seen how powerful that can be,” Ribble said. “Too often, students are sitting next to each other looking at the computer and they’re not making personal contact. This increases the effectiveness of their collaborative endeavor.”

Finally, there is a Lounge that offers soft seating and acts as an informal gathering place. It features a large screen and projector that can display outputs from the Teaching Area and Design Studio. When the weather is nice, three large sliding glass doors open onto a patio that extends the lounge space even farther. The Lounge can comfortably accommodate up to 300 people, and has become the site of innumerable university-wide receptions, lectures and gatherings over the past year.

“We hoped this space would serve a social function,” Ribble said, “but we had no idea it would be so popular.”

On the periphery of the Innovation Center are the engineering department’s machine, wood and electronics shops and a computer lab. These further add to the interdisciplinary give and take that can occur in the space.

“It’s not just science students that are using it either,” Ribble said. “You can see writing on the glass and blackboards, and it’s everything from economics to Chinese to biology, which
is what a liberal arts institution should be about.”

While the shops and engineering computer lab are primarily in use during weekdays, the Innovation Center is always open to students and faculty. “In fact, the entire building runs 24/7, so we wanted it to be easy for students to use,” said Robert Miller, the university’s classroom design and project manager. “We always try to make sure there will be no issues for students. When we select equipment we aim for ease of use, reliability and remote access, so I can troubleshoot any problems from my home if I need to.”

Equipment in the Innovation Center was supplied by companies like AT&T (which also made a substantial financial contribution), Crestron, AMX, Steelcase, Spectrum and Tekvox.

Ribble said the building and the Innovation Center at its heart have accomplished three goals that university officials like himself had for it when they started the initial planning nearly nine years ago. They wanted it to be interdisciplinary, striking down departmental boundaries. They wanted it to be a showcase that would celebrate science (and, Ribble said, Trinity has seen a 20 percent increase in students interested in STEM — science, technology, engineering and math — subjects over the last few years).

Finally, they wanted it to be environmentally sustainable. The building has been LEED certified at the gold level.

The Innovation Center has not just been a showcase for the sciences either. Miller said he gets information requests from the vendors who participated in its construction and from other higher education institutions interested in doing something similar themselves. “Because of the innovations, they ask to bring other campuses to the facility,” he said. “We give them tours of the different rooms and the technology that is being used.”

Dennis Ahlburg, who was Trinity University president during the planning, design and construction of the Center for Sciences and Innovation, said, “This really was designed as a crucible for new ideas. It’s a place that brings people and their ideas together.”

When asked what advice he could give to other university officials contemplating the construction of a facility that would serve the education of college students in the 21st century, Ribble had three recommendations:

First, begin with a facility planning process that encompasses all the institution’s stakeholders and firmly establishes your objectives. In other words, come to some agreements early on about what you want to accomplish with the new space.

Second, take some time and select the most innovative architect you can, as he believes Trinity did with the Boston-based EYP architecture and design firm.

Finally, he said, “Hit the road. Take all of your planning committee out and visit other places that have done what you want to do.”

Michael Hart is a Los Angeles-based freelance writer and the former executive editor of THE Journal.
Experts identify the most substantial tech-related obstacles to education, ranging from the solvable to the downright wickedly difficult.

BY DAVID NAGEL

WEAK DIGITAL LITERACY skills among students and faculty are hampering the effective use of technology in schools. But according to a panel of experts, this problem, as prevalent and pernicious as it may be, is within our power to solve. Some of the other obstacles identified by the panel … not so much.

The panel, led by the New Media Consortium and the Educause Learning Initiative, identified six impediments that are hampering education and the adoption of technology in education in significant ways. The findings were published in a report released in February, the NMC Horizon Report: 2016 Higher Education Edition.
The issues were categorized in one of three groupings: barriers that are troublesome but to some degree solvable; obstacles that are more difficult and will require substantial effort to resolve; and impediments that are so difficult that they may not be within our power to solve ever. Each of the six identified trends has implications for policy, leadership and practice.

**Solvable Challenges**

**Digital literacy** is a worldwide problem that affects young and old alike. And despite wishful thinking to the contrary, it’s not one that is solving itself as technology propagates and becomes more commonplace. As the researchers noted, while the younger generations may be immersed in digital technology and consider it mundane, they are not necessarily any more adept at using it effectively.

“Students today would appear to be more digitally literate than previous generations because many have grown up immersed in technology-rich environments, but research has shown that this does not necessarily equate to confidence, especially in an educational context,” according to the researchers. “The Organization for Economic Co-operation and Development’s (OECD) most recent survey of adult skills found that millennials in the [United States] placed nearly last in digital literacy as compared to other developed nations. Illuminating this problem is the Rasmussen College study ‘Digital Literacy in 2015,’ which reports that one in four millennials want to improve their digital literacy, but 37 percent find the Internet ‘scary,’ more so than respondents aged 35 and over.”

Nevertheless, the experts labeled the problem as a solvable one largely because efforts that are already underway to improve digital literacy have begun to bear fruit, while others, such as the TechHire Initiative, look promising. Education institutions are providing their own solutions as well. “Solving this challenge calls for innovative approaches to delivering digital literacy training to students, and a number of projects are well underway,” according to the report.

The researchers cited a number of programs aimed at helping students with their digital skills — beyond learning to use the technology. For instance, “Virginia Commonwealth University’s ‘UniV 200: inquiry and the Craft of Argument’ is a blended learning course that takes students through a number of exercises, such as discovering the work of innovators in the digital realm and developing personal learning networks through the creation of Web sites and social media communities. At Ryerson University in Canada, coding is seen as an emerging and important literacy that will cultivate in students the skills needed to define and create the digital tools of the future. In their ‘Challenge Accepted’ workshops, students learn how to create a mobile app in only three hours.”

This is the third year in a row that digital literacy has made the Horizon Report’s list of barriers to the adoption of technology in education. Last year it was listed as a solvable challenge as well.

Also carrying over from the previous year’s report, blending formal and informal learning was cited as an important but solvable challenge for education.

The idea is that, right now, students’ informal learning experiences are not well integrated into formal learning, and this is a missed opportunity to foster experimentation and help develop creativity in students. “Most higher education institutions still exclusively speak the language of course credits, not incorporating prior informal experience as a placement factor,” according to the report. “While the blending of formal and informal learning is an intriguing notion, it is hampered by the lack of scalable ways to qualify learning that happens beyond the classroom.”

An example cited in the report is a student who’s spent years practicing graphic design outside of college, only to be relegated to an introductory course upon enrollment in an academic institution.

But, the researchers noted, things seem to be changing. UNESCO, the report noted, “is setting a precedent, connecting informal learning outcomes to the goal of building societies of lifelong learners in the book *Global Perspectives on Recognizing Non-formal and Informal Learning:***
Why Recognition Matters.

According to the report, “Part of solving this challenge means finding methods for recognizing informal learning at universities and colleges.”

Researchers cited efforts at Cork Institute of Technology in Ireland, which actively surveys students for prior experience and integrates that information into the learning plans it develops for its students. Institutions in the United States are also using social media “to connect outside learning practices to formal activities. Indiana University marketing students, for example, use Instagram to share compelling marketing ideas with each other through snapshots and hashtags. Students at Rhode Island College use Scoop.it to select relevant resources and add their own personal reflections, demonstrating how they can be social media producers rather than just consumers.” Micro-credentialing and badging have also developed in part as a response to the need to recognize skills that are derived outside of formal educational settings.

But, the researchers noted, both academic institutions and employers will need to view informal learning in a more positive light in order for the problem to be addressed.

Difficult Challenges

The researchers also identified two challenges that they categorized as “difficult.” That is, problems that we under-
ing models of education and personalizing learning. According to the researchers, “New educational models are bringing unprecedented competition to traditional models of higher education in which students typically receive on-campus instruction by faculty or teaching assistants per credit hour over four years. Institutions are increasingly looking for ways to provide high-quality offerings and more diverse learning opportunities at lower costs.”

While in the past MOOCs seemed to be the harbinger of doom for traditional education models, “competency-based education, coding boot camps and general unbundling of products and services are also disrupting existing credit hour systems and degree programs,” according to the report. “As these new pathways arise, there is a growing need for education leaders to frankly evaluate the models and determine how to best support collaboration, interaction, and assessment at scale. It is clear that simply capitalizing on emerging technology is not enough; the new models must use these tools and services to engage students on a deeper level and ensure academic quality.”

Personalized learning, meanwhile, is more of a mixed challenge. It’s undeniable that efforts are underway to differentiate instruction based on the unique needs of individual students, and certainly technologies have been developed to help solve the problem. But, the researchers noted: “Compounding the challenge is the notion that technology is not the whole solution — personalized learning efforts must incorporate effective pedagogy and include faculty in the development process.”

Wicked Challenges

The most difficult problems cited by this year’s expert panel — those considered difficult to define, let alone to solve — were both newcomers to the list.

The first, balancing our connected and unconnected lives, focuses on the need for institutions to develop within their students an understanding of how to balance the use of technological tools with their other “developmental needs” in order to “prevent students from getting lost in the abundant sea of digital tools.”

According to the researchers: “The proliferation of always-connected devices, particularly mobiles, has made conducting research possible anywhere. With technology usage, however, there is a fine line between convenience and addiction, especially when it comes to taking advantage of the social networking and communication features. A survey conducted by Baylor University [TX] found that college students spend between eight to 10 hours daily on their smartphones, with many agreeing that they are wasting their time or have become overly dependent. There is freedom in being able to communicate with peers and find information any time, but if these online activities are not understand but whose solutions remain elusive.

Both of the difficult challenges identified in this year’s report were carry-overs from the prior year’s report: competency-based education, coding boot camps and general unbundling of products and services are also disrupting existing credit hour systems and degree programs,” according to the report. “As these new pathways arise, there is a growing need for education leaders to frankly evaluate the models and determine how to best support collaboration, interaction, and assessment at scale. It is clear that simply capitalizing on emerging technology is not enough; the new models must use these tools and services to engage students on a deeper level and ensure academic quality.”

Personalized learning, meanwhile, is more of a mixed challenge. It’s undeniable that efforts are underway to differentiate instruction based on the unique needs of individual students, and certainly technologies have been developed to help solve the problem. But, the researchers noted: “Compounding the challenge is the notion that technology is not
balanced properly with self-reflection and analysis, technology can become a crutch — an excuse not to engage in the kind of critical thinking that leads to meaningful discovery and deep understanding.”

So far, the burden for finding the proper balance, if such a thing exists, has been on the student. That will need to change. But how?

There are no conclusive answers, though there have been efforts in this direction, including a call to action for policymakers that developed out of last year’s Global Education Industry Summit in Finland. That call to action stated that nations as a whole need to “develop national agendas that champion transformative technology use while avoiding institutions simply becoming ‘a marketplace for commercial self-interest of any corporation.’”

But perhaps the most vexing problem of all is the final wicked challenge, one that hits right at the heart of higher education: keeping education relevant.

The challenge, as the researchers noted, is that there’s a greater and greater disconnect between education and the impact of that education on students’ lives. “Today, a college degree no longer guarantees gainful employment. The Economic Policy Institute recently found that Americans under age 25 are more than twice as likely to be unemployed as other age groups,” according to the report. “This issue is not localized; rising youth unemployment rates and labor market research about the global skills gap leave many concerned that current higher education systems do not prepare learners for the workplace’s rapid modernization.”

While there has been a greater emphasis placed on technology- and engineering-related disciplines in recent years, and to some extent vocational training, it would be a mistake to sacrifice the humanities and social sciences in any move to graduate more students in fields that are perceived to have greater potential for employability.

“Some global leaders have acknowledged the skills gap, and are advancing reforms that encourage higher education institutions to remedy this issue. President of Japan Shinzo Abe recently announced a new economic growth strategy; this was followed by a decree from Japan’s Minister of Education that forced national universities to shutter social science and humanities departments, or risk losing funding from the federal government. This move has generated significant backlash from those who champion the humanities’ steadfast role in post-secondary learning, citing their value in forming a well-rounded worldview. Some experts point to reasoning used in Aristotle’s Nicomachean Ethics extolling the humanities as the middle ground that helps humans navigate society with practical wisdom to advance ‘the common good.’ In other words, they argue that scientific knowledge alone is not enough to address the multidimensional social problems people face today.”

Further, the researchers argued that leading academic institutions are beginning to merge the humanities with STEM and other disciplines: “While skills training is an important theme of this challenge, much attention has been paid to the idea of merging the humanities with scientific disciplines to inform broad perspectives. At Harvard University [MA], the Project on Purpose and Values in Education has created co-curricular programming that helps students reflect on big questions of meaning, value and purpose. Using best practices and resources from this project, Harvard faculty can integrate social and moral inquiries into technical subject matter, enabling learners to effectively advance the common good through any career path. As part of its Common Curriculum, Yale-NUS College [in Singapore] emphasizes the powerful dynamic between liberal arts and science for solving 21st-century problems. Through courses such as ‘Scientific Inquiry and Quantitative Reasoning’ alongside ‘Comparative Social Institutions and Literature and the Humanities,’ learners form an extensive knowledge base to drive critical thinking about global dilemmas.”

The complete report, NMC Horizon Report: 2016 Higher Education Edition, is available under a Creative Commons license and may be freely downloaded from NMC’s site. Additional details, including work not published in the final report, can be accessed on the Horizon Report wiki.
When you consider the opportunities and challenges surrounding a technology offering on campus, do you focus on the specifics of that technology, or on its impact? Here, CT examines the thinking behind makerspaces with Kyle Bowen, Penn State’s director for teaching and learning with technology.

CT: Are we beginning to see new ways of thinking about makerspaces in education? What should educators be considering as we go forward?

Kyle Bowen: Makerspaces have become an increasingly popular development at colleges and universities. This is an exciting movement for sure, because these spaces are providing students with access to technology and facilities that may not have always been available to them. The spaces introduce some challenges as well. Not everyone is comfortable with the popular notion of making. The idea of building a physical product can be intimidating. And combined with the technical skills needed to use the equipment, or to begin to construct your idea — all this can place the idea of making just out of reach. In addition, these spaces have historically been found inside of very specific colleges and departments (engineering and technology in particular) that make use of these kinds of tools — in effect placing an unintentional limitation on access to services.

The opportunity here is to develop, inside our students, these types of maker fluencies that can be developed inside these areas.

CT: Is makerspace fluency different from technical or digital literacy?

Bowen: Yes, with fluency, there is an important distinction. When you think about digital literacy and different types of literacies, the very idea of literacy focuses on what it is and how to attain it. In fluency, we are talking not only about what and how — it’s also when you apply this kind of thinking, and why you apply it.

Maker fluency is a combination of different types of activities — creativity, collaboration, solutions development. By Mary Grush

“Maker fluency is a combination of different types of activities — creativity, collaboration, solutions development.”

Bowen
research. These are ways students can develop 21st-century skills that enable them to solve problems now and in years to come.

CT: Would maker fluencies be helpful to all students? How might institutions approach this question?

Bowen: The idea for institutions is to build on the best parts, the most exciting things happening in their maker-spaces, and make them more accessible to students of all types, from any program. This will in turn provide opportunities for faculty to begin to introduce these types of activities as part of the learning process. Faculty can now assign invention as homework, and get students thinking about these skills and how they are of value.

The bottom line is that students will begin to apply maker fluencies in many different areas now — but they will also develop abilities they can draw on long term, to solve problems far into the future.

We have to realize that the technologies our students will be working with after graduation and beyond haven’t been invented yet. But the fluencies they develop now will serve them for a long time.

So that model has its applications in specific technical disciplines, for sure. And these spaces will continue to be a fixture for such disciplines, just as they were even before the term “maker-space” was coined. What’s changed now is the thinking about how to get more students involved. Because, even if you don’t have the technical skills, the benefit of engaging in this type of creative solution development, and doing that collaboratively, can have a lot of value regardless of your discipline.

Bowen: To this point, makerspaces have largely focused on providing access to facilities and equipment. What has been historically considered highly technical, specialized equipment may now be somewhat more generally available, but the challenge remains that many of these tools really are very technical in nature. To make effective use of them requires at the very least training, and often some technical skills as well.

CT: Where are we on the evolutionary growth path for makerspaces?

Bowen: To this point, makerspaces have largely focused on providing access to facilities and equipment. What has been historically considered highly technical, specialized equipment may now be somewhat more generally available, but the challenge remains that many of these tools really are very technical in nature. To make effective use of them requires at the very least training, and often some technical skills as well.

So that model has its applications in specific technical disciplines, for sure. And these spaces will continue to be a fixture for such disciplines, just as they were even before the term “maker-space” was coined. What’s changed now is the thinking about how to get more students involved. Because, even if you don’t have the technical skills, the benefit of engaging in this type of creative solution development, and doing that collaboratively, can have a lot of value regardless of your discipline.

Bowen: Yes, that’s true, and it will help with creating more diverse engagement going forward. In the past year or so, a lot of maker technologies — and certain maker tools — have matured to the point where they have reduced the barriers to entry. We can look, for example, at MakerBot and how it has simplified 3D printing. And new technologies like 3D scanners that can help students create their models. We can also look at technologies like those from little-Bits, a newer company that focuses on electronic building blocks from which you can create machines that connect to the Internet of Things, or you can apply sensors to a wide variety of materials. Finally, we can look again — more traditionally — at Legos, which have been the staple building toy for so many years. With the sum total of all these raw materials, if you will, and more to come, more people can finally begin to build their ideas.

CT: Where are makerspaces headed in the next two years?

Bowen: I think makerspaces will begin to diversify in terms of the types of services they offer. If you talk about makerspaces today, it largely conjures a vision in your mind of a collection of equipment, some of it very advanced, some of it not too advanced. But we’re going to see an evolution where there’s a diversity of ways people can engage in this type of making activity.

The long-term success of these types of programs is to focus on not just ac-
cess to tools and access to the facilities, but rather what the fluencies are that are being developed inside these kinds of spaces.

CT: Will we see engagement with a wider array of disciplines?

Bowen: Absolutely. Maker fluency is so important because it combines together a number of different ideas in ways that we’ve not seen before. The technology really enables this, and it does so inclusive of a wide variety of disciplines.

A lot of the makerspaces historically have been focused on technology and engineering, or STEM disciplines. But we can see that the maker fluencies that have emerged have application in the liberal arts, writing programs, medical education, teacher education. So, in ways not previously possible, all types of students can be drawn to engage in this.

CT: By “all types of students” are you including online learners?

Bowen: It’s important to point out once again that the makerspace isn’t just a facility. This has implications for online learning. Increasingly, makerspace technologies are network devices that can be accessed from anywhere. So we have an opportunity to explore another of the long-term benefits of the makerspace environment — its application to online learning.

CT: Going forward, do you think makerspaces in general will be broader, university-wide resources — maybe centrally located in the library or the learning commons? Who will own them, and who will support them?

Bowen: A key part of successfully growing these types of services is centralizing, or bringing together, openly available spaces where students can both get access to tools and get the help and support they need. The best way for institutions to accomplish this is through partnerships between technology organizations and the library. The library, after all, has a long history of providing collaborative spaces.

At the same time, I think there is a really great opportunity for IT to begin to help reduce barriers to entry; to begin to offer and support these technologies and to support the faculty and students using them. Supporting a “maker mindset” isn’t simply putting out yet another tool that faculty and students have to learn. For our faculty to create these new moments of learning, they need to know that students will be supported.

Supporting makerspace technologies may offer IT some new challenges, such as those presented by applications that connect new machines to the Internet. What happens when student inventions (not run-of-the-mill smartphones and laptops) are connected to the network? But for IT, that’s likely going to be part of providing makerspaces that are discipline-agnostic and inclusive.

CT: What are the most powerful examples you have of the way makerspaces change the learning experience for students?

Bowen: I’ll mention two: First, a student from any area who has an idea should be able to produce — regardless of their technical skills — a prototype of their original invention. We want them to be able to pursue that, and to be able to think creatively about new ideas that solve problems. When we offer makerspaces, we have this in mind.

Second, as we integrate maker activities into coursework, we will need to develop new forms of assessment. For example, the act and the process of creation itself could be the outcome. Rather than assessing the successful creation of a finished product or prototype, we could be offering the student the chance to fail, time and time again as they approach a difficult problem creatively … that type of activity in itself directly aids the learning process and builds a mindset that our students will carry forward after graduation. CT
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