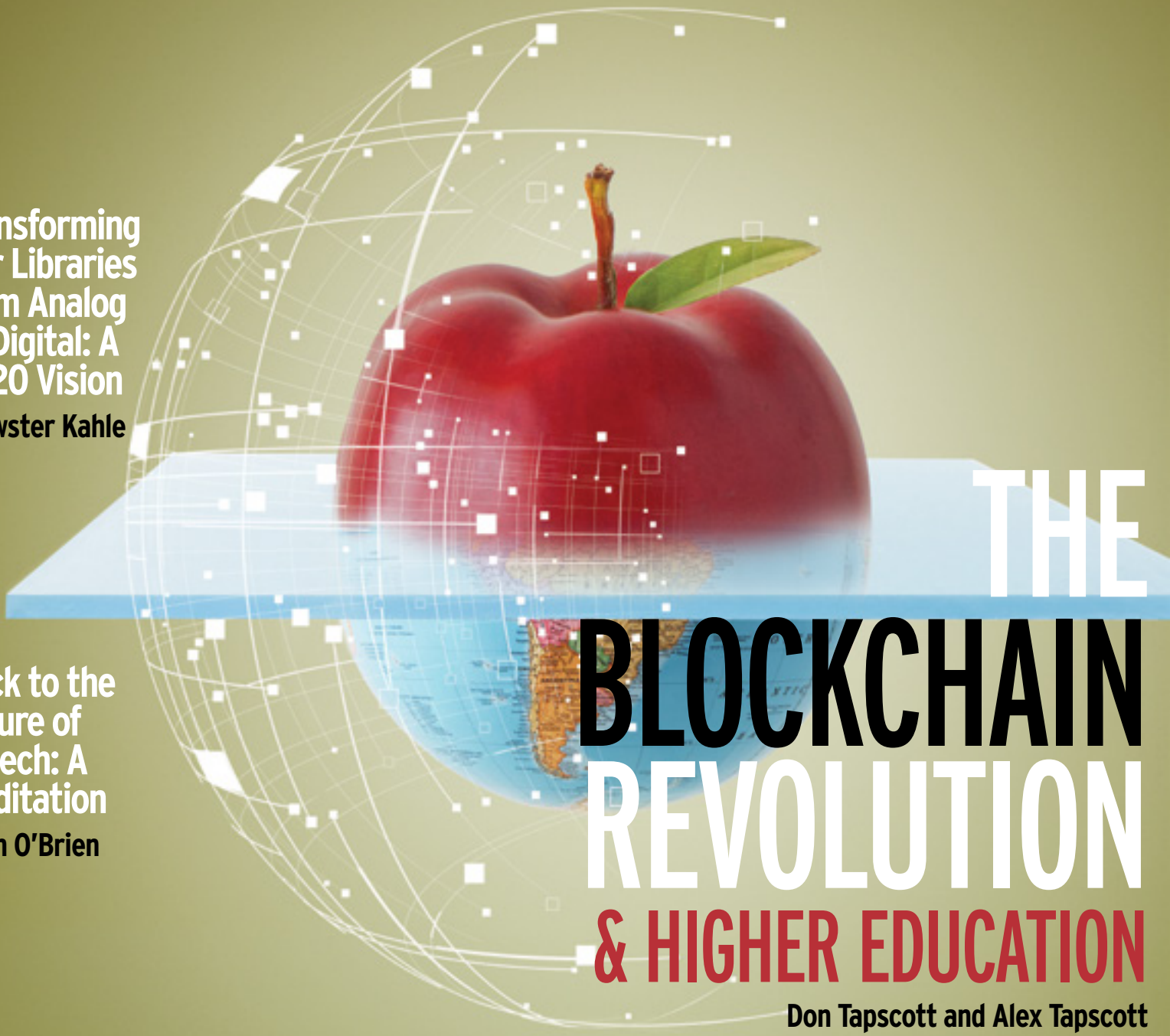
Why IT Matters to Higher Education

EDUCAUSE review

MARCH/APRIL 2017



Transforming Our Libraries from Analog to Digital: A 2020 Vision

Brewster Kahle

Back to the Future of Edtech: A Meditation

John O'Brien

THE BLOCKCHAIN REVOLUTION & HIGHER EDUCATION

Don Tapscott and Alex Tapscott

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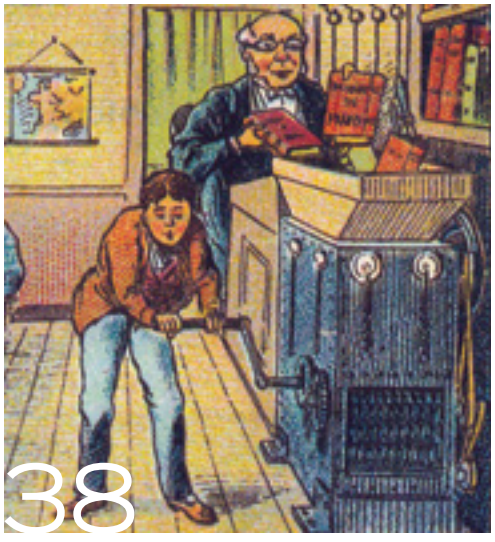
By 2020, we can build a collaborative digital library collection and circulation system in which thousands of libraries unlock their analog collections for a new generation of learners, enabling free, long-term, public access to knowledge.



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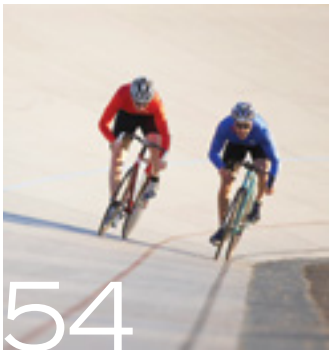

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FAST COMPANY 2017 50 MOST INNOVATIVE COMPANIES

By JOHN O'BRIEN

The Future of EDUCAUSE: Expanded Partnerships and Collaboration

Can we find our future in the past? The March/April 2017 issue of *EDUCAUSE Review* occupies the intersection between the past and the future. Don Tapscott and Alex Tapscott, the authors of *Blockchain Revolution,* consider the much discussed but less understood topic of blockchain technology, particularly its potential to deliver real value for higher education as it gives us the opportunity to build on the past and look to the future. Likewise Brewster Kahle, the founder of the Internet Archive, grounds his discussion in broad historical understanding as he proposes a plan to transform physical libraries into digital libraries and unlock analog collections, making them available to millions around the world. Finally, I offer a meditation that blurs seemingly simple terms like *past, present,* and *future,* concentrating on current insights to be gleaned from past imaginings of our edtech future.

EDUCAUSE itself sets off into the future focused on our three strategic priorities: (1) personalized member experience; (2) reimagined professional learning; and (3) expanded partnerships and collaboration. In this Homepage column, I'd like to suggest some ideas behind the third priority—expanded partnerships and collaboration—noting that internal EDUCAUSE working groups are doing the same and preparing to report to the EDUCAUSE Board in March.

Over the five-year period covered in our strategic plan, EDUCAUSE will work to promote stronger, more collaborative relationships between IT leaders and other senior campus leaders.

Over the five-year period covered in our strategic plan, EDUCAUSE will work to promote stronger, more collaborative relationships between IT leaders and other senior campus leaders. As technology solutions extend across campus and IT risks intensify, it's crucial to make connections and elevate the strategic role of information technology and also of IT leaders. With this in mind, EDUCAUSE will work at two levels. On the ground, we will expand access to resources that help our members connect the dots on campus and tell the IT story effectively. Beginning in July, we will be able to do that even better when our new membership model opens up ELI and ECAR resources to all members. We also will begin to offer even more practical, action-oriented resources like the toolkits that have proved so effective for our information security and iPASS (Integrated Planning and Advising for Student Success) initiatives, where success depends on reaching beyond IT circles.[1] I also imagine more concrete tools like EDUCAUSE infographics to help explain complex technologies and technology concepts to leaders with other areas of expertise. We'll know that we have succeeded when senior campus leaders, not just CIOs, have better frameworks for evaluating IT opportunities, understand how their institutions can improve efficiency and effectiveness through technology, and see the IT organization as a strategic partner, not a utility. Conversely, success here also means that IT leaders will have a better understanding of other stakeholders and the realities of their strategic domains.

Hand-in-hand with the important ground-level efforts on campus, we will also reenergize our efforts to make and expand connections with academic leaders, business officers, and others at the association level. Without a doubt, there are many current best practices on which we can build. For example, for the past three years we've brought IT leaders and chief finance and business officers together at our Enterprise IT Summit, cosponsored by EDUCAUSE and NACUBO, the

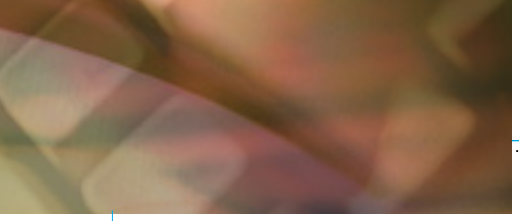
(continued on page 6)

INSTALLATION HIGHLIGHTS

Pictured is the Active Learning Classroom in the brand new wing of the Rawls College of Business at Texas Tech University in Lubbock, TX. CCI worked closely with the architect and on-site University staff in providing the exact Collaborative Table arrangement that fit the department's needs.

Rutgers University-New Brunswick introduced three new active learning classrooms in 2016 – two 90 seat classrooms in their new Academic Building on the College Avenue Campus and one 54 seat classroom in Tillett Hall on their Livingston Campus. All three classrooms have utilized our 9 seat Active Learning Cluster design which have been integrated with the University's latest technology allowing students to work together in groups.

An "Introductory Physics" classroom at Miami University – Oxford, Ohio utilizing the SCALE-UP model for an interactive environment. One of two new 99 seat classrooms.



(continued from page 4)

national association for business officers. And for over ten years, EDUCAUSE has partnered with the American Association of State Colleges and Universities (AASCU) and the University of Central Florida to deliver a summer leadership program that has helped hundreds of campus leaders innovate for student success. In the same vein, we've worked with the American Council on Education (ACE) for many years, closely collaborating on various policy matters. We will continue to develop, expand, and replicate these efforts.

We have already begun to meet with other national and international associations and organizations to share our plans and get ideas for future partnerships. For my part, I will be actively seeking opportunities to tell the story of information technology to non-IT audiences. In the next two months, for example, I'll be speaking (twice) to presidents and trustees at the annual conference of the Association of Governing Boards of Universities and Colleges, the League for Innovation in the Community College's national conference, and several other national and international conferences that bring together IT professionals and other campus leaders.

At a broader level, we will seek these opportunities because we know that our future depends on staying fresh and open to new ideas that reflect the rich diversity of our community.

On yet a third level, partnerships and collaborations can also arise from within our community, such as with our corporate members. In 2016 we created the Corporate Membership Advisory Committee to explore creative approaches to collaboration, convinced that traditional activities like corporate sponsorships are not the only way of working together for the benefit of our community. At the EDUCAUSE annual conference in October 2016, we enjoyed the first fruits of this effort at the Pitch IT! Challenge, where campus leaders pitched corporate partners with ideas for products they would like to see, in marked contrast to the traditional approach in which vendors build products that they hope higher education leaders will buy.

Certainly EDUCAUSE will explore partnerships and collaborations that advance the specific work we do, and at a broader level we will seek opportunities such as those I've mentioned because we know that our future depends on staying fresh and open to new ideas that reflect the rich diversity of our community. Embedded within our three strategic priorities is a strong commitment to diversity, equity, and inclusion (DEI), with considerable work planned for 2017. With the help of a grant from the Hewlett Foundation and our own funding, we are investing in our ability to promote DEI, engaging the association in a self-study of its own culture of DEI and helping the larger community do the same. One high-priority example is gender diversity, with the recent study from Accenture and Girls Who Code predicting that representation of women in computing will *decline* from 24 percent today (already unacceptable) to 22 percent by 2025.[2] When it comes to diversity of all kinds, equity, and inclusiveness, we will work hard in 2017 and beyond to make a positive difference.

EDUCAUSE is on the move. I'd love to hear your ideas, reactions, concerns, stories, and insights as we work to expand partnerships and collaboration within and beyond our community.

Notes

1. The Higher Education Information Security Council (HEISC) produces the *Information Security Guide: Effective Practices and Solutions for Higher Education*, a community-created resource of toolkits and other practical resources to assist campuses in implementing effective information security programs. The EDUCAUSE iPASS hub aggregates practical resources for those getting started with this highly effective approach to promoting student success.
2. Accenture and Girls Who Code, "Cracking the Gender Code" (website), accessed January 27, 2017.

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

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The Human Element: Faculty Collaboration in an Increasingly Digital World

Like most technologies, Web 2.0 learning tools can connect or divide us. The path we choose depends on how we understand and use the tools. Since ancient times, technological advances have stoked fears (among some) that our humanism will erode when new technologies grab hold of how we interact. No less a scholar than Socrates warned us that writing words down on parchment would kill our memories. Conversely, technological advances have also been seen as life-giving and nourishing, particularly by early indigenous populations who innovated to advance agriculture and irrigation. This fundamental separation—whether technology is bringing us together or pulling us apart—is alive in the 21st century, including within U.S. higher education. Students and faculty are the most impacted.

Here are the challenges that face our faculty today:

- Students who have access to smartphones and high-speed Internet may be distracted by a bombardment of quick and often shallow information.
- Students who do not have access could fall behind through no fault of their ability to learn.
- Faculty expectations and practices are changing at many institutions because Web 2.0 learning technologies are continuously evolving.

College and university leaders must invest in and use Web 2.0 technologies to introduce the human element in order to benefit both students *and* faculty.

With too little technology, we risk losing our edge. With too much technology, faculty can feel like Sisyphus with a boulder in one hand and a tablet in the other. But the technology in which colleges and universities invest, usually with an eye on the student experience, need not be limited to improving classroom learning. This gets at the crux of what is next for many faculty as well. Adult learners are adapting to an increasingly digital world. Generation Z and Millennial students were born into it. Digital content, open-source materials, and online and blended learning are opening doors to exciting and sometimes daunting spaces in higher education. But they also leave many wondering about the role of the human element and our needs for authentic interaction, a sense of belonging, and being cared for on a personal level.

In light of all of this, how can those of us who are leaders in higher education show our students and faculty we care about them as people? How do we make them feel they belong to a community of learners irrespective of the space in which they teach? How do we foster the human presence that makes all of this possible? How do we use our technology to connect everyone—not just students to educators? And in the context of digital fluency, how do we ensure that faculty are prepared for today's learners?

Most of Rasmussen College's courses, programs, and faculty are online. Many of our students are first-generation adult learners who belong to the "digital native" generation, though not all grew up with full digital access. Since 2013, Rasmussen College, which has a number of campuses across several states, has brought together our faculty for an annual symposium that explores major themes facing our classrooms. Themes have included the digital divide, prioritizing the human element in online classrooms, wonderment and creativity, and design thinking. These symposia were initially held in person but now use campus-based telepresence technology to allow faculty participants, generally numbering from 400 to 500 each year, to collaborate and learn synchronously despite the distance.

Our first symposium explored the digital divide. In my opening remarks, I urged all academic affairs professionals at the college to commit to ensuring that our students have access to the tools and infrastructure needed to flourish in a 21st-century knowledge economy—an era in which the most fortunate of us walk around with much of the planet's information in our pockets. It is our obligation to help students gain access to digital learning resources and to help them learn the skills to be digitally fluent. If our students don't have this access at home, we can and must provide these resources at our various campuses. Faculty embraced this goal with an enthusiasm beyond what I expected. Today, most Rasmussen College students have at least one online course within their academic schedules, and most of those courses utilize digital content and weekly synchronous web collaboration. Rasmussen College even adopted "Digital Fluency" as one of our institutional learning outcomes.[1]

Throughout the subsequent years, I learned that faculty embrace high-tech learning tools such as campus telepresence and webinar platforms not only to connect with students but also to connect with each other. An example is Carly Hearn, a writing and communications faculty member for Rasmussen College. At the 2015 symposium and using telepresence, she presented a session to faculty on the importance of having in-field and

By TRENDA BOYUM-BREEN

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general education coursework coexist within the curriculum. She said that technology has been effective in creating long-distance, meaningful relationships: "I can say I have friends and colleagues across the country—from Florida to Minnesota—that I truly care about. It started out with phone calls. Now we can see each other." This sentiment, which I heard repeatedly from other faculty, led me to realize that Rasmussen College's emphasis on "the human element" in a world of online learning must apply both to student learning and to faculty collaboration.

We know the benefits that a human presence in the classroom can have on student learning and long-term success. A poll from Gallup and Purdue University found that college graduates are nearly two times more likely to be engaged at work—and to be thriving in all areas of well-being after graduating—if they recalled having a college instructor who cared about them as a person.[2] This data suggests that caring counts when it comes to helping our students have meaningful lives and careers.

We also know the benefits that faculty collaboration can have on online course development, learning, and teaching.[3] The amount of research done specifically around online collaboration, however, is limited. It begs the question: As online learning and Web 2.0 tools are employed by more colleges and universities, and as our footprints move beyond brick-and-mortar campuses, can our technology also connect faculty to each other in ways that form rich relationships? And how can we expose our faculty to technology and support them in developing digital expertise?

Colleagues who have suffered through meetings with me know that I often start by asking about family, hobbies, or a recent vacation before we get to the work at hand. In turn, I build trust by sharing those parts of myself that are relatable. I try my best to be intentional about living out loud and sharing stories that reveal my authentic self. I do this because I care about my colleagues as individuals and I want to give them permission to enter into a deeper conversation with me and those around us. I am also aware that this level of inquiry and caring is much easier when we're standing right next to each other. But as Hearn taught us, technology can help us foster meaningful long-distance relationships across our systems—even across states and countries.

It is essential that our faculty remain connected and able to consistently engage in rich academic exploration *both with their students and with their faculty peers*. Technology must facilitate that connection, not hinder it. To that end, I offer a call to action: college and university leaders must invest in and use Web 2.0 technologies to benefit both students *and* faculty. Effective training must be part of this equation, so that faculty are not left alone to determine the value these tools may offer. These steps will allow our educators to collaborate with purpose, meaning, and inquiry. We are obligated beyond email, online forums, and other asynchronous platforms. Let us see faces, share anecdotes, joke and laugh, ask big questions aloud, listen to the answers, and embrace the human element. Even when we connect online. ■

Notes

1. See the Rasmussen College "Digital Fluency" web page, July 29, 2016.
2. Julie Ray and Stephanie Kafka, "Life in College Matters for Life after College," Gallup website, May 6, 2014.
3. See Ortrun Dorothea Zuber-Skerritt, "Action Learning and Action Research: Paradigm, Praxis and Programs," in Shankar Sankaran, Bob Dick, Ronn Passfield, and Pam Swepson, eds., *Effective Change Management Using Action Learning and Action Research: Concepts, Frameworks, Processes, Applications* (Lismore, Australia: Southern Cross University Press, 2001).

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THE BLOCKCHAIN REVOLUTION & Higher Education

Don Tapscott and Alex Tapscott

What will be the most important technology to change higher education? In our view, it's not big data, the social web, MOOCs, virtual reality, or even artificial intelligence. We see these as components of something new, all enabled and transformed by an emerging technology called the *blockchain*.

OK, it's not the most sonorous word ever, sounding more like a college football strategy than a transformative technology. Yet, sonorous or not, the blockchain represents nothing less than the second generation of the Internet, and it holds the potential to disrupt money, business, government, and yes, higher education.

The opportunities for innovators in higher education fall into four categories:

- *Identity and Student Records:* How we identify students; protect their privacy; measure, record, and credential their accomplishments; and keep these records secure
- *New Pedagogy:* How we customize teaching to each student and create new models of learning
- *Costs (Student Debt):* How we value and fund education and reward students for the quality of their work
- *The Meta-University:* How we design entirely new models of higher education so that former MIT President Chuck Vest's dream can become a reality[1]

The blockchain may help us change the relationships among colleges and universities and, in turn, their relationship to society.

Let us explain.

What Is the Blockchain Revolution?

The Internet today connects billions of people around the world, and certainly it's great for communicating and collaborating online. But because it's built for moving and storing information rather than *value*, it has done little to change how we do business. When professors send their students information such as an e-mail, lecture notes, a PowerPoint presentation, or an audio recording of a lecture, they're really sending a copy, not the original. It's OK (and indeed advantageous) for people to print a copy of their PowerPoint file, but it's not OK to print, say, money or diplomas. So with the Internet of information, we have to rely on powerful intermediaries to exchange things of value. Governments, banks, digital platforms (e.g., Amazon, eBay, and AirBnB), and colleges and universities do the work of establishing our identity, vouching for our trustworthiness, and helping us to acquire and transfer assets and settle the transactions.

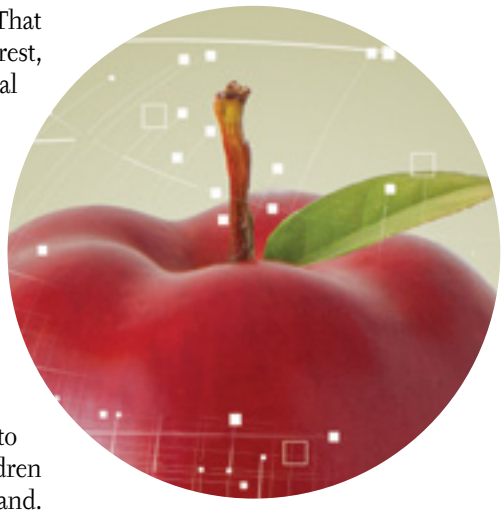
Overall, they do a pretty good job—but there are limitations. They use centralized servers, which can be hacked. They take a piece of the value for performing this service—say, 10 percent to send some money internationally. They capture our data, not just preventing us from using it for our own benefit but often undermining our privacy. These intermediaries are sometimes unreliable and often slow. They exclude two billion people who don't have enough money to justify a bank account, let alone an education. Most problematic, they are capturing the benefits of the digital age asymmetrically.

What if there was an Internet of value—a global, distributed, highly secure platform, ledger, or database where we could store and exchange things of value and where we could trust each other without powerful intermediaries? That is the blockchain. Collective self-interest, hard-coded into this new native digital medium for value, would ensure the safety, security, and reliability of our exchanges online. Trust is programmed into the technology, which is why we call blockchain the Trust Protocol.

Why should you care? Maybe you're a music professor who wants artists to make a living off their art. Perhaps you're an immigrant who is sick of paying big fees to send money home so that your children can go to college in your ancestral land. Or maybe you're a parent fed up with the lack of transparency and accountability of the politicians and political appointees responsible for higher education in your state. Or perhaps you're a social media user who thinks all the data you generate might be worth something—to you—and that your privacy matters. Even as we write, innovators are building blockchain-based applications that serve these ends. And these apps are just the beginning.

It turns out that every business, institution, government, and individual can benefit in profound ways. How about the corporation, a pillar of modern capitalism? With the rise of a global peer-to-peer platform for identity, trust, reputation, and transactions, we will be able to reengineer deep structures of the firm, for innovation and shared value creation. We're talking about building 21st-century companies that look more like networks than the vertically integrated hierarchies of the Industrial Age. The whole financial services industry is already being reinvented by the blockchain, and others will soon follow. How well does today's college or university prepare students for such a future?

How about the Internet of Things? In the not-too-distant future, billions of smart things in the physical world will be sensing, responding, communicating, sharing important data, and generating, buying, and selling their own electricity,



doing everything from protecting our environment to managing our health. It turns out that this Internet of Everything will need a *Ledger of Everything*.

One of the biggest opportunities of the blockchain is to free us from the grip of a troubling prosperity paradox. The economy is growing, but fewer people are benefiting. Rather than trying to solve the problem of growing social inequality through redistribution alone, we can change how wealth—and opportunity—is *pre*distributed in the first place, as people everywhere, from farmers to musicians, can use this technology to share more fully in the wealth they create.

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Blockchain, Identity, and Student Records

"Today you need an organization with endowed rights to provide you with an identity," said Carlos Moreira of WISeKey.[2] This process of identification usually begins with a birth certificate issued by a state-licensed medical professional. From that day forward, the baby begins to accumulate personal data, which will include academic achievements in analog form.

The first challenge is to maintain the privacy and security of data stored digitally by those academically accredited institutions. In 2013, the Education Advisory Board (EAB) published a list of 157 strategies for collecting data about students and alumni for colleges and universities to exploit in fundraising efforts, and institutions have become good at doing so.[3] When it comes to protecting these data, however, colleges and universities are no less vulnerable than other large organizations. The University of California–Berkeley, Ohio State University, the University of Wisconsin–Milwaukee, and Kirkwood Community College were among those hacked in recent years. Yale University accidentally published confidential information online, and Indiana University hosted such data on an unprotected site. The University of Utah Hospitals and Clinics, Stanford University, and the University of Miami stored data on laptops or data tapes that were later stolen.[4]

The blockchain can be programmed to record virtually everything of value and importance to humankind, starting with birth certificates and moving on to educational transcripts, social security cards, student loans, and anything else that can be expressed in code. The blockchain uses public key infrastructure (PKI) for establishing a secure platform. PKI is an advanced form of asymmetric cryptography, where users get two keys that don't perform the same function: one is for encryption and the other for decryption. Hence, they are asymmetric. The Bitcoin blockchain is now the largest civilian deployment of PKI in the world, second overall to the U.S. Department of Defense common access system.[5] Sony Global Education has adapted this technology into what it is calling an open data exchange protocol, through which two parties anywhere in the world can securely share official academic records.[6] But without the exact two keys, a hacker cannot access the data.

A second challenge to address is validity. At a time when information is abundant, fleeting, and mutable, being able to verify a job prospect's claims is becoming increasingly important to employers. According to CareerBuilder, 57 percent of job applicants have embellished their skill set, and 33 percent have lied about their academic degree.[7] Not surprising, employers are wanting to see official college transcripts. However, when it comes to processing requests, universities often charge transaction fees. At MIT, for example, "the base cost for a transcript is $8.00" with a $2.00 handling charge for each transcript ordered online.[8] Sony's solution could make the transfer of such information quick and comparatively cost-free. Imagine how such a system could benefit, say, refugees who were seeking to continue their education or find a job in a new country.

As long as society values existing credentials, and students will pay to get those credentials at recognized institutions of higher education, then the college/university will remain a gatekeeper to opportunity.

A third issue is time. In the United States, only 25 percent of students attend college full-time at residential campuses. The rest are juggling work and family. These part-time students take twice as long to graduate, and only 25 percent of them actually earn a degree.[9] Initiatives such as OpenBadges (https://openbadges.org/), Blockchain Certificates (http://www.blockcerts.org/), and Learning Is Earning 2026 (http://www.learningisearning2026.org/) are exploring ways to reward students with credentials for everything they learn, no matter the setting. If a parent teaches his or her child how to change the oil in a car, that counts (and the parent gets teaching credit). If a student learns a new skill at work, or has to collaborate to finish a task, or is managing others, that goes on the learning transcript too. The MIT Media Lab started hashing digital certificates onto the blockchain to permanently denote membership and to reward community members for their valuable contributions to the lab's work.[10] Students are not getting just a grade; they are getting a credential, which they can put to use immediately on the job market.

Blockchain and the New Pedagogy

As long as society—or at least today's employers, including governments—values existing credentials, and students will pay to get those credentials at recognized institutions of higher education rather than pursue alternatives, then the college/university will remain a gatekeeper to opportunity.

But the credential and even the prestige of a higher education institution are rooted in its effectiveness as a learning institution. If colleges and universities become seen as places where learning is inferior to other models or, worse, as places where learning is restricted and stifled, then the role of the campus experience and the credential itself will be undermined. Attending a college or university is too costly to be simply an extended summer camp.

Campuses that embrace the new models become more effective learning environments and more desirable places. Computer-based learning, for instance, can free up intellectual capital—on the part of both professors and students—to spend their on-campus time thinking, inquiring, and challenging each other, rather than just absorbing information.

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*Gamer, Noah. "The most prominent cyber threats faced by high-target industries." Trend Micro blog, Jan. 25, 2016.

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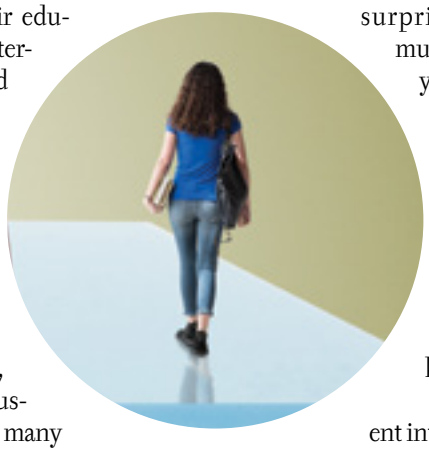
If there is one thing that's due for innovation in higher education, it's the model of pedagogy. To start with, big universities are still offering the broadcast model of learning, in which the teacher is the broadcaster and the student is the supposedly willing recipient of the one-way message. It goes like this: "I'm a professor, and I have knowledge. Get ready; here it comes. Your goal is to take this data into your short-term memory so that you can recall it to me when I test you."

The definition of a lecture has become the process in which the notes of the teacher go to the notes of the student without going through the brains of either. This is no longer appropriate for the digital age and for a new generation of students who represent the future of learning. Young people want to converse when they learn. They like to share. Immersed in digital technology, they are keen to try new things, often at high speed. They want their education to be fun and interesting. So they should enjoy the delight of discovering things for themselves.



It's true that colleges and universities are trying to update this broadcast model—through essays, hands-on labs, and even seminar discussions. And of course, many professors are working hard to move beyond this model. However, it remains dominant overall. The professors who remain relevant will have to abandon the traditional lecture and start listening and conversing with the students. To begin, students could achieve the mastery of knowledge (anything where there is a right or wrong answer) by working with interactive, self-paced computer learning programs outside the classroom, freeing students and faculty alike to spend class time on the things that matter: discussion, debate, and collaboration around projects.

We also need to be clear on the purpose of higher education. It's not about skills, and to a certain extent, it's not even about knowledge. What counts these days is the capacity to learn throughout life; to research, analyze, synthesize, contextualize, and critically evaluate information; to apply research in solving problems; and to collaborate and communicate.

So how can blockchains help? Consider the case, noted above, of Vitalik Buterin, the founder of the Ethereum blockchain. Like many teenagers, Buterin "spent ridiculous amounts of time on the Internet," reading about different ideas that were heterodox, out of the mainstream.[11] Ask him which economists he likes, and he rattles off Tyler Cowen, Alex Tabarrok, Robin Hanson, and Bryan Caplan. He can speak on the works of the game theorist Thomas Schelling and the behavioral economists Daniel Kahneman and Dan Ariely. "It's actually surprisingly useful how much you can learn for yourself by debating ideas like politics with other people on forums. It's a surprising educational experience all by itself," he said. The topic of bitcoin, he noted, kept coming up.

"I had all these different interests, and somehow bitcoin seemed like a perfect convergence. It has this math. It has its computer science. It has its cryptography. It has its economics. It has its political and social philosophy. It was this community that I was immediately drawn into," he said. "I found it really empowering." He went through the online forums, looked for ways to own some bitcoin, and discovered a guy who was starting up a bitcoin blog. "It was called *Bitcoin Weekly,* and he was offering people five bitcoins to write articles for him. That was around four dollars at the time," Buterin said. "I wrote a few articles. I earned twenty bitcoins. I spent half of them on a T-shirt. Going through that whole process, it felt almost like working with the fundamental building blocks of society." How many students have that experience in college?

By the end of that year, Buterin was spending ten to twenty hours a week writing for another publication, *Bitcoin Magazine*. "When I was about eight months into university, I realized that it had taken over my entire life, and I might as well let it take over my entire life. Waterloo was a really good university and I really liked the program. My dropping out was definitely not a case of the university sucking. It was more a matter of, 'That was fun, and this is more fun.' It was a once-in-a-lifetime opportunity, and I just basically couldn't let it go." He was only seventeen years old.

Buterin is a natural-born leader, in that he pulls people along with his ideas and his vision. Shouldn't the university experience cultivate these assets rather than get in the way of them?

In 2011, the technology entrepreneur and investor Peter Thiel launched his two-year fellowship program for "young people who want to build new things" (http://thielfellowship.org/about/). Thiel's target audience consists of students who "skip or [drop] out of college to receive a $100,000 grant and support from the Thiel Foundation's network of founders, investors, and scientists." The approach is similar to Buterin's: students learn by working on something they care about, such as clean water. Thus far, Thiel Fellows have started more than 60 companies with a combined value of $1.1 billion. Blockchains provide a platform for such collaboration, not just tracking people's individual contributions but also rewarding them for results.

A good model for classroom collaboration is Consensus Systems (ConsenSys), one of the first Ethereum software-development companies. It is breaking new ground in management science along the lines of *holacracy*, a collaborative rather than hierarchical process for defining and aligning the work to be done. Among those holacratic

tenets are "dynamic roles rather than traditional job descriptions; distributed, not delegated authority; transparent rules rather than office politics; and rapid reiterations rather than big reorganizations," all of which describe how blockchain technologies work.[12] How ConsenSys is structured, how it creates value, and how it manages itself differs not only from the typical classroom but also from the typical online course.

For the most part, members of ConsenSys choose two to five projects to work on. No top-down assignments. There is no boss. Everyone owns a piece of every project directly or indirectly: the Ethereum platform issues tokens that members can exchange for Ether and then convert into any other currency. The goal is to achieve a balance between independence and interdependence. For the classroom, the watchwords are *agility*, *openness*, and *consensus*: identify what needs to be learned, distribute the load among the students eager and able to do it, agree on their roles, responsibilities, and rewards, and then codify these rights in smart contracts. Teachers and students alike would need training to participate in such a system.

How Blockchains Establish Trust

Digital assets—everything from money, stocks, bonds, and intellectual property to music, art, loyalty points, and student records—are not all stored in a central place: they're distributed across a global ledger, using the highest level of cryptography. When a transaction is conducted, it's posted globally, across millions of computers. Around the world is a group of people called miners who have massive computing power at their fingertips—10 to 100 times bigger than all of Google worldwide. Every 10 minutes, kind of like the heartbeat of a network, these miners assemble all the transactions from the previous 10 minutes into a block. Then the miners compete to solve a tough problem; whoever solves the problem gets to validate the block and receives some digital currency as a reward. In the case of the Bitcoin blockchain, the winner gets Bitcoin.

Then that block is linked to the previous block and to the block before that to create a chain of blocks. Every block is time-stamped, kind of like with a digital waxed seal. So if you wanted to hack a block and, say, send the same Bitcoin to several people, you'd have to hack that block, plus all the preceding blocks, through the entire history of that Bitcoin on the blockchain—not just on one computer but across millions of computers, simultaneously, all using the highest levels of encryption, in broad daylight. Tough to do. This is infinitely more secure than the computer systems that we use today.

The Bitcoin blockchain is just one of many. For example, the Ethereum blockchain was developed by a twenty-two-year-old Canadian named Vitalik Buterin. Ethereum has some extraordinary capabilities and tools. For example, it enables programmers to build smart contracts, agreements translated into lines of computer code that handle the enforcement, management, performance, and payments of contracts between people. On the Ethereum blockchain, there are projects to create a replacement for the stock market and a new model of democracy, where politicians are accountable to citizens.

Blockchain and Costs (Student Debt)

Many educators have a problem with the idea of education as big business, and yet companies like Pearson and McGraw-Hill make their fortunes by providing the classroom content, additional teacher training, classroom and school administration systems, and the testing content and platforms—the results of which lead to credentials, not just of high school diplomas and college entrance but of individual licensures and professional certifications. These companies have considerable budgets for lobbying federal and state legislators.

Let's look at the numbers. From 1995 to 2015, the average tuition and fees at private colleges and universities increased 179 percent. Tuition and fees for out-of-state students at public universities jumped 226 percent, and in-state tuition and fees ballooned by 296 percent.[13] Approximately 44 million Americans owe a grand total of $1.3 trillion in student loans. A member of the Class of 2016 racked up, on average, $37,172 in debt.[14] It's no wonder that cost of a college education was such a hot issue in the 2016 U.S. presidential election.

Melanie Swan is looking to the blockchain to tackle student debt head-on. She is the founder of the Institute for Blockchain Studies. She has been working on MOOC accreditation and "pay for success" models on the blockchain. The blockchain provides three elements toward this goal: (1) a trustable proof-of-truth mechanism to confirm that the students who signed up for Coursera classes actually completed them, took the tests, and mastered the material; (2) a payment mechanism; and (3) smart contracts that could constitute learning plans.

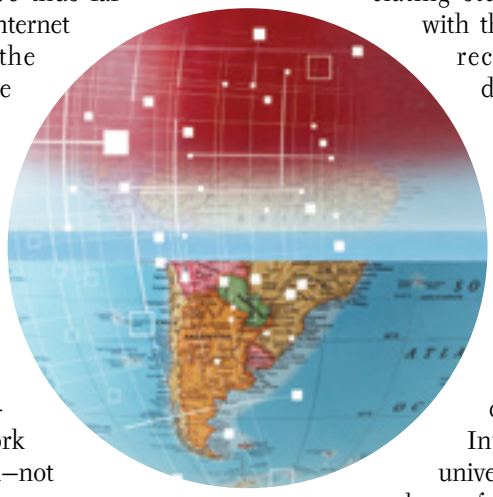
Consider smart contracts for coding skills. "Why don't we target financial aid toward personal development?" Swan said.[15] It works like the microfunding organization Kiva, but Kiva for coding classes rather than for entrepreneurial startups; everything would be super transparent, and students would be accountable for their progress. Donors—such as companies that need specific skills—could sponsor individual students, put money toward learning goals, and pay out according to achievement. Let's say you wanted to support a female student who lives in Nigeria and is going through Google's Training for Android developers (https://developer.android.com/training/). Every week this student would need to provide proof of completion of a development module. Perhaps this is all automated through an online test where the blockchain confirms the student's identity and records progress[16] before disbursing the next week's funding—into what we could call the student's

"smart wallet for higher education"—so that the student could continue paying for college courses without interference. This could all be accomplished without a not-for-profit or government agency with administrative costs and the power to change funding. "Money toward a girl's education couldn't be diverted to her brother's schooling," Swan said.

The visionaries behind the Learning Is Earning initiative, such as Jane McGonigal, in partnership with the Institute for the Future (http://www.iftf.org) and the ACT Foundation (http://actfdn.org/), envision "teach it forward" schemes in which students can pay down their student loans by teaching other students what they just learned or by applying this new knowledge immediately in the job market.[17] They needn't wait for a degree to begin earning money. Employers—or other students or professors—will be able to query the blockchain for people with the particular combination of skills and knowledge needed immediately on the job or in the classroom. In other words, the blockchain will help employers match projects with the proven capabilities of students available for project work. Students will be able to link these earnings with a particular lecture or skill so that they can calculate the precise value of each element of their training and development. Likewise, human resources personnel will be able to calculate the return on their training and development investments. Employers may even be willing to pay for a student's entire education in exchange for a cut of the student's future earnings. Academic publishers may be willing to pay for some of this tracking data to improve their learning modules for all types of learners, since they won't have access to it otherwise on the blockchain.[18]

The Blockchain and the Meta-University

The phrase *ivory tower* usually carries pejorative connotations. From the 19th century, it has been used to designate a world or atmosphere in which intellectuals engage in pursuits that are disconnected from the practical concerns of everyday life. For cynics, it connotes a willful separation from the everyday world; esoteric, overspecialized, or even useless research; and academic elitism, if not outright condescension. If we set aside some of these more negative associations, the ivory tower metaphor still captures one of the key flaws in today's system of higher learning: in a world of unprecedented connectivity, especially among today's youth, colleges and universities continue to operate as largely autonomous islands of scholarship and learning and have thus far failed to use the Internet to break down the walls that divide institutions, professors, parents, and students.



The blockchain will enable the 21st-century institution of higher education to disaggregate into a network and an ecosystem—not a tower. Indeed, innovators have an enormous opportunity to create an unparalleled educational experience for students globally by assembling the world's best learning materials online and enabling students to customize their learning path with support from a network of instructors and educational facilitators, some of whom may be local and some halfway around the globe. To make this work for students, colleges and universities will require deep structural changes, and educators will need to embrace the partnerships. In 2006, MIT President Emeritus Vest offered a tantalizing vision of what he called the *meta-university*. In the open-access movement, he saw "a transcendent, accessible, empowering, dynamic, communally constructed framework of open materials and platforms on which much of higher education worldwide can be constructed or enhanced."[19] The web would provide the communication infrastructure, and a global open-access library of course materials would provide much of the knowledge and information infrastructure. Dr. Vest argued that a noble and global endeavour of this scale would speed the propagation of high-quality education and give teachers and students everywhere the ability to access and share teaching materials, scholarly publications, and scientific works in progress and to participate in real-time science experiments.

However, without a means of associating students' identities with their achievements, recording and credentialing these achievements over time, rewarding constructive and collaborative behavior in the community, and otherwise holding participants accountable for deliverables, this Internet-only meta-university would still fall short of traditional education. An average of only 15 percent of students who sign up for MOOCs complete them; free MOOCs are still considered supplemental to tuition-based online courses from traditional colleges and universities.[20]

The blockchain provides a rich, secure, and transparent platform on which to create such a *global network for higher learning*.[21] We envision three stages. The first is content exchange. Professors share ideas and upload their teaching materials to the Internet for others to use freely. The second is content co-innovation, where teachers collaborate across institutional and disciplinary boundaries to co-create new teaching materials using wikis and other tools. By stage three, the college or university has become a node in the global network of faculty, students, and institutions learning collaboratively. It still maintains its

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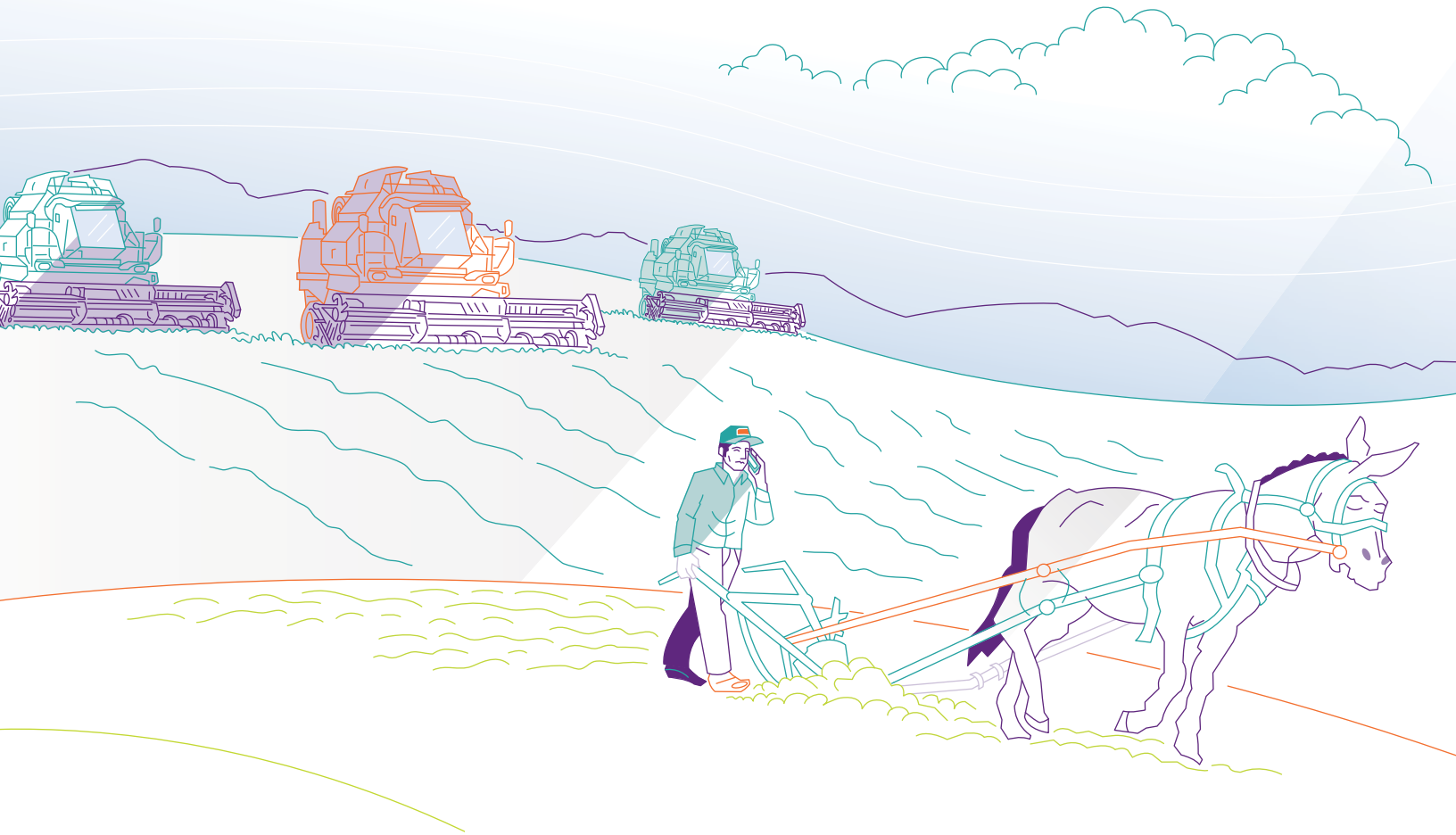

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identity, campus, and brand. The global network for higher learning is not a pipe dream. Leading scholars know that higher education institutions and their faculties cannot continue to operate as islands, constantly reinventing the lecture.

Stage 1: Content Exchange

The lowest level of collaborative knowledge production is simple content exchange: colleges and universities post their educational materials online, putting into the public domain what would have traditionally been considered a proprietary asset and part of the institution's competitive advantage in the global market for students. MIT pioneered the concept, and today more than 200 institutions of higher learning have followed suit as part of MIT's OpenCourseWare initiative (https://ocw.mit.edu/). OpenCourseWare solves the problem of isolation and provides a wealth of materials that others can use and even build on, regardless of their institutional affiliation.

The digital world is challenging not only the lecture-driven classroom but the very notion of a walled-in institution that excludes large numbers of people.

We're talking about not only textbooks and digital books but also lecture notes, assignments, exams, videos, podcasts, and so on. Professors and students will need better tools for gauging the quality and suitability of various assets, and students will want some evidence of effort to carry forward. Using capabilities like smart contracts, blockchains provide a means of tracking and rewarding each party's contributions. Users can do more than "like," "upvote," or share a piece of content; they can send its creator some tokens of value that might be used, say, to support research assistance or grant writing. Members of the worldwide academic community will have incentive to contribute their intellectual property, know-how, and insights not just to improve higher education but also to enhance their own reputations and even to receive material or financial benefit. Newcomers will be able to see not only the most used content relevant to their studies but also the most valued contributors. For-profit academic journal and textbook publishers can participate in, rather than intermediate, value creation.

Stage 2: Content Co-Innovation

The next level in collaborative knowledge creation goes beyond discussing and sharing ideas to the actual *co-creation* of content. Just as Wikipedia's distributed editors collaborate to create, update, and expand the online encyclopedia's entries, so too could professors co-innovate new teaching material, publish this newly synthesized content, and share in the recognition and rewards.

A case in point is Wikiversity (https://en.wikiversity.org/), a project of the Wikimedia Foundation. Rather than offer a set menu of courses and materials, Wikiversity participants set out what they want to learn, and the Wikiversity community collaborates, in multiple languages, to develop learning activities and projects to accommodate those goals. Imagine what a platform like Wikiversity could do with a token system to reward collaborative behavior! That's what the blockchain supports. It enables the community to identify valuable projects, assemble teams of collaborators, and fund each phase of development, rewarding collaborators according to their contributions.

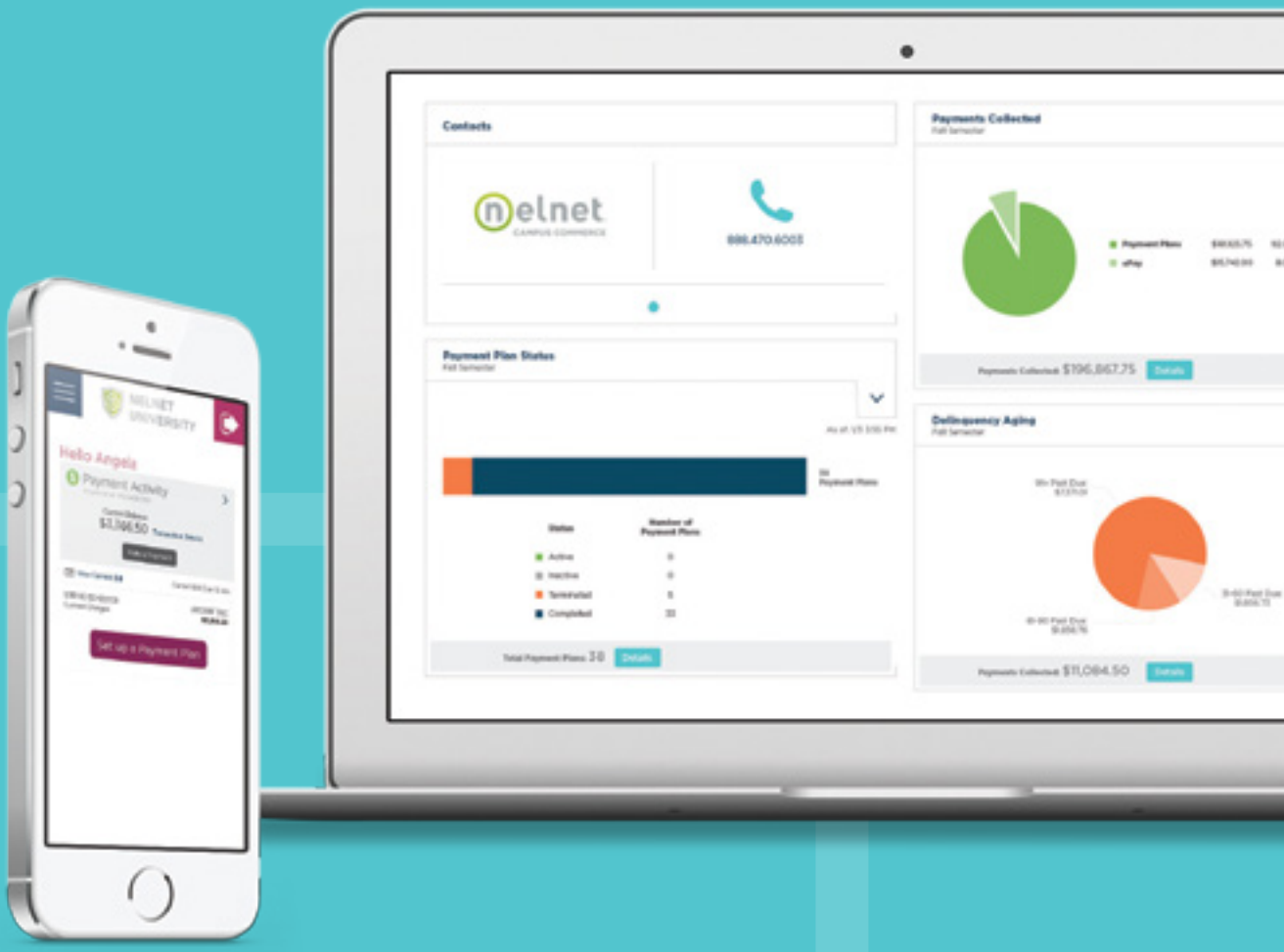
In this scenario, psychology professors would work together to design the "perfect course" that pools the collective knowledge of the world's leading thinkers in the field. Of course, participants would not agree totally on course contents, since there are various perspectives, schools of thought, and teaching techniques. But as in Wikipedia, the professors could work globally to create core, generally agreed-upon modules, and then subnetworks of like-minded teachers could develop ancillary elements. For the ultimate course, the teachers would need more than course materials—they would need course software allowing students to interact with the content, supporting small-group discussions, enabling testing and scoring, and issuing badges for completion.

If thousands of people can develop Linux (https://www.linuxfoundation.org/), the most sophisticated computer operating system in the world, they can certainly develop the tools for a psychology course. Indeed, many well-known open-source software projects are already under way in the academic community. One of the most popular is Sakai (https://sakaiproject.org/). Built by educators for educators, Sakai facilitates collaboration in and across courses, research, projects, administrative processes, and multidisciplinary and multi-institution efforts. Creation of the software itself is a product of content co-innovation. In turn, the product helps users co-innovate content that educators can teach to students. We need more projects like this.

Used properly, blockchain platforms could support such collaboration directly with students too. Rather than simply receiving the professor's knowledge, the students could co-create knowledge with light supervision—one of the most effective methods of learning—and get credit for their co-creation.

Stage 3: Global Network

The upshot could be a disaggregation of institutions of higher learning. The digital world, which has trained young minds to inquire and collaborate, is challenging not only the lecture-driven classroom but the very notion of a walled-in institution that excludes large numbers of people. Why not allow a brilliant ninth-grader to take first-year college math, without abandoning the social life of his or her high school? Why use the concept of grades and grade matriculation at all? Why not encourage a foreign



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student majoring in math to take a high school English course? Why is the college or university the unit of measurement when it comes to branding a degree? In fact, in a networked world, why should students have to assign their "enrollment" to a given institution, akin to declaring loyalty to some feudal fiefdom?

In this vision of a global network for higher learning, a student receives a custom learning experience from a dozen institutions, while the blockchain serves to track the student's path and progress. The student enrolls in his or her primary college and is assigned a *knowledge facilitator*, who works with the student to customize a learning experience, the journey, and outcomes. The student might enroll in the primary college in Oregon and register to take a behavioral psychology course from Stanford University and a medieval history course from Cambridge. For these students, the collective syllabi of the world form their menu for higher education. Yet the opportunity goes beyond simply mixing and matching courses. Next-generation faculty will create a context whereby students from around the world can participate in online discussions, forums, and wikis to discover, learn, and produce knowledge as a community of learners who are engaged directly in addressing some of the world's most pressing problems. The blockchain harmonizes and aggregates the records of various institutions for each skill learned and each module completed, steadily building an individual student's list of achievements.

Of course, such open platforms could provide a means to address the needs of all learners, not just traditional college-age students. For today's knowledge workers, remaining truly competitive in fast-moving fields of research and innovation means constantly retraining and retooling to begin or continue their working lives in a modern, dynamic, and technology-focused environment. The cost of building new continuing education programs from scratch could be prohibitively high, but innovative models of collaborative education could bring greater efficiency, creativity, and credentialing to lifelong learning initiatives.[22] Indeed, why not allow companies and governments to participate in this global network for higher learning? Platform developers could use fees collected from commercial users to subsidize ongoing development.

Incentives to Change

If all this innovation is a good idea, what are the incentives to change? Why should professors adopt a new model of pedagogy? Tenure continues to prop up the lecture model. The U.S. publishing industry provides much of the classroom curriculum, the administrative and engagement platforms, and the testing programs for credentialing at all levels of academic achievement. So if you're an academic or an administrator, you might say: "Let the publishers rethink the student experience. Why should I bother? I have enough on my plate."

Indeed, there are few incentives to change—except that the new model of higher education is in the best interest of learners. Faculty and administrators alike should consider what has happened to other cultural institutions that have resisted change. Encyclopedias, newspapers, record labels, and colleges/universities have a lot in common. They are all in the business of producing content. They all recruit, manage, and compensate capable producers. They all offer proprietary products, and they take legal action against those who infringe their intellectual property. Because they create unique value, their customers pay them, and they have revenue. All of these businesses are possible because of scarcity—in quality news, information, knowledge, learning, art.

Today, the businesses of encyclopedias, newspapers, and record labels are in various stages of collapse. Because of the Internet, they've lost their monopolies on the creation and curation of quality

content. The digital age brought abundance, mass participation, new delivery channels, and new business models. The Internet erased their allegedly unassailable attributes faster than you can transfer bitcoin from one phone to another. In each sector, only two or three global behemoths remain.

Colleges and universities have not yet lost their monopoly on academic credentialing and educational brands. But again we have a case of an irresistible force (i.e., the reinvention of higher learning) meeting an immovable object (i.e., the old paradigm). As soon as one of the blockchain-based innovators demonstrates that its approach to learning will pay off more quickly, that employers value its credentials as much if not more, and that it can deliver real value to the great many students who cannot afford college tuition or whose cognitive or social abilities don't "fit" traditional pedagogy, then rest assured: students will demand more for their money than what they are receiving from traditional institutions of higher education.

Why not be leaders for a new paradigm? The blockchain provides a rich, secure, and transparent platform on which to create a global network for higher learning. We believe that higher education works best when it works for all types of teaching and learning, and we believe that this new platform is an engine of inclusion. Let's use the emerging Internet of value and the blockchain revolution to recapture our identities and endow them with our detailed and real-time records of learning. Perhaps then we can finally reinvent the past model of pedagogy and transform the architecture of higher education for the future generation of lifelong learners. ■

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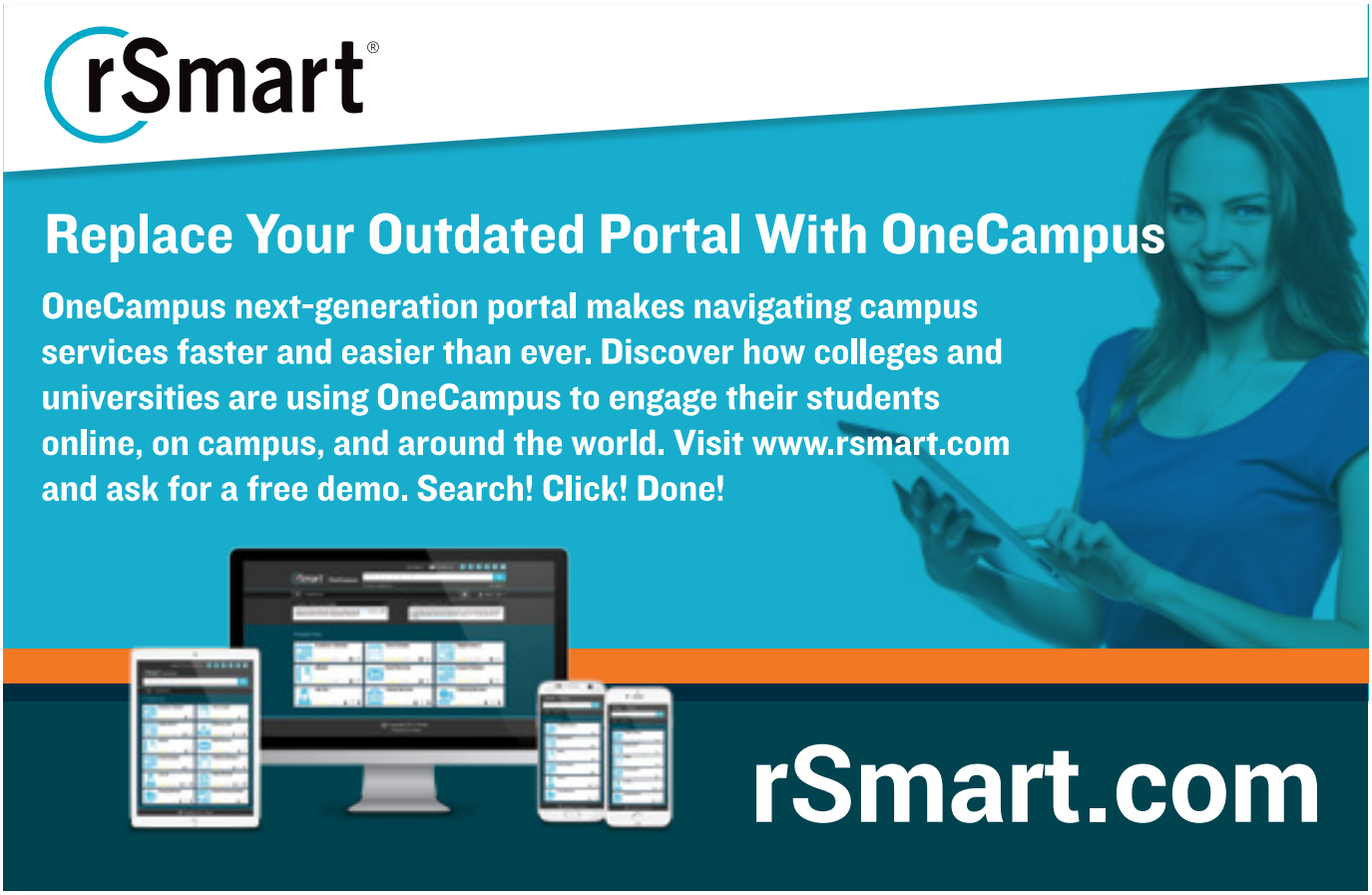
Don Tapscott and **Alex Tapscott** are the authors of *Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business and the World* (2016). Don is the author of fifteen widely read books about technology in business and society (including *Growing Up Digital* and *Wikinomics*) and is ranked as the #4 living business thinker by Thinkers50. His co-author, Alex Tapscott, is the CEO and founder of Northwest Passage Ventures, an advisory firm building industry-leading blockchain businesses.



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Today, people get their information online—often filtered through for-profit platforms. If a book isn't online, it's as if it doesn't exist. Yet much of modern knowledge still exists only on the printed page, stored in libraries. Libraries haven't met this digital demand, stymied by costs, e-book restrictions, policy risks, and missing infrastructure. We now have the technology and legal frameworks to transform our library system by 2020. The Internet Archive, working with library partners, proposes bringing millions of books online, through purchase or digitization, starting with the books most widely held and used in libraries and classrooms. Our vision includes at-scale circulation of these e-books, enabling libraries owning the physical works to substitute them with lendable digital copies. By 2020, we can build a collaborative digital library collection and circulation system in which thousands of libraries unlock their analog collections for a new generation of learners, enabling free, long-term, public access to knowledge.

Finding the Future in the Past

A 2020 Vision

Brewster Kahle

ILLUSTRATION BY DUNG HOANG, © 2017

The Problem

We all want to see the modern-day Library of Alexandria, a digital library where the published works of humankind—all the books, music, video, webpages, and software—are available to anyone curious enough to want to access them. I believe now is the time to build it.

The technology and costs to achieve this vision are now understood, and in fact, various projects are proving that it can be done. Three major entities have digitized modern materials at scale: Google, Amazon, and the Internet Archive, probably in that order of magnitude. Google's goal was to digitize texts to aid user search and its own artificial intelligence projects. Amazon's book-digitization program helps customers browse books before purchasing them; Amazon is quiet about the number of books it has scanned and any future plans for them. The Internet Archive has digitized more than 2.5 million public domain (pre-1923) books and made them fully downloadable and 500,000+ modern (post-1923) books and made them available to the blind and dyslexic and through its lending system on its Open Library site.

Yet bringing universal access to all books has not been achieved. Why? There are the commonly understood challenges: money, technology, and legal clarity. Our community has been fractured by disagreement about the path forward, with ongoing resistance to some approaches that strike many as monopolistic. Indeed, the library community seems to be holding out for a healthy system that engages authors, publishers, libraries, and most importantly, the readers and future readers.

I suggest that by working together, we can efficiently achieve our goal. This will require the library community working with philanthropists, booksellers, and publishers to unleash the full value of our existing and future collections by offering them digitally.

For the books we cannot buy in electronic form, I am proposing a collaborative effort to select and digitize the most widely held and used books of the 20th and 21st centuries, and to build a robust system to circulate the resulting e-books to millions and eventually billions of people.

Mike Lesk, considered by many to be the father of digital libraries, once said that he was worried about the books of the 20th century and noted that we haven't figured out "institutional responsibility" in our digital world.[1] He believed that the materials up to the 19th century would be digitized and available and that the 21st-century materials, since they were born-digital, were going to be circulated effectively. But the 20th-century materials, he thought, would be caught in machinations of copyright law—most remaining out-of-print, and all seemingly locked up by late-20th-century laws that appeared to make digitization risky.

As we shift from the analog to the digital era, Lesk's comment about "institutional responsibility" is also apt. Today, public, university, and national library leaders are not clear how best to perform their preservation and access roles, at a time when subscribing to remote databases is increasingly common and when publishers are trying to adapt to a world

By working together, we can efficiently achieve our goal. This will require the library community working with philanthropists, booksellers, and publishers to unleash the full value of our existing and future collections by offering them digitally.

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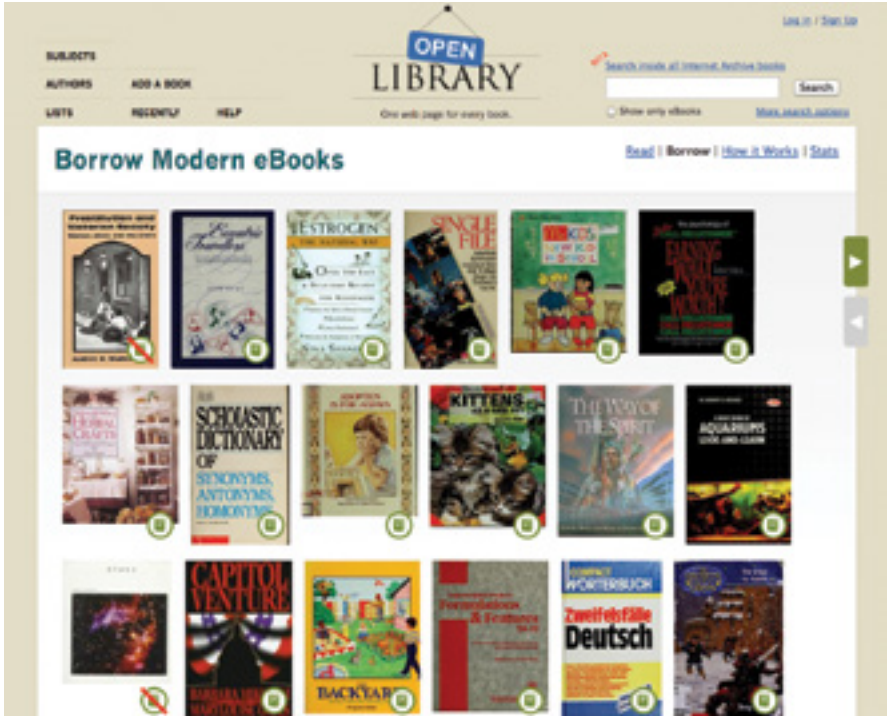
in which distribution is increasingly consolidated among a few powerhouses. If we are to have healthy publishing and library ecosystems, we need many winners and not just a few dominant players. But how do we achieve that?

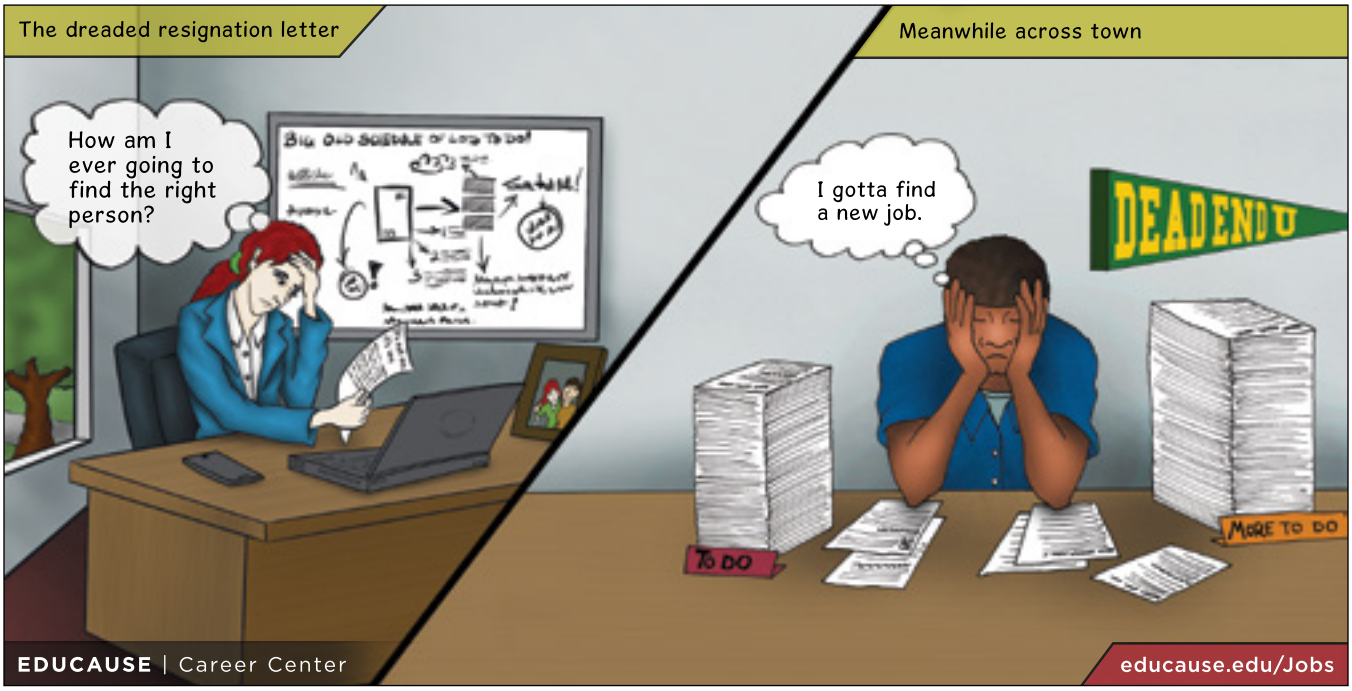
A step forward would be for libraries to buy e-books when they can, but also to transform efficiently the books currently on our physical shelves to sit on our digital shelves as well. Patrons could then easily borrow either the physical books or the electronic versions.

Open Library: Building on a Six-Year Pilot

Since 2010, the Internet Archive's Open Library has been piloting collaborative collection and lending of 20th-century books contributed by dozens of libraries (see figure 1).[2] For six years, we have been buying e-books or digitizing physical books to lend. We now lend more than 500,000 post-1923 digital volumes to one reader at a time via the Open Library website (https://openlibrary.org/borrow). This digital circulation mechanism employs the same protection technologies that publishers use for their in-print e-books distributed by commercial operations such as OverDrive (https://www.overdrive.com/) and Google Books (https://books.google.com/). Watching Open Library being used by millions over the years, we have found this approach to work. The time is ripe to go much further!

FIGURE 1. THE INTERNET ARCHIVE'S OPEN LIBRARY

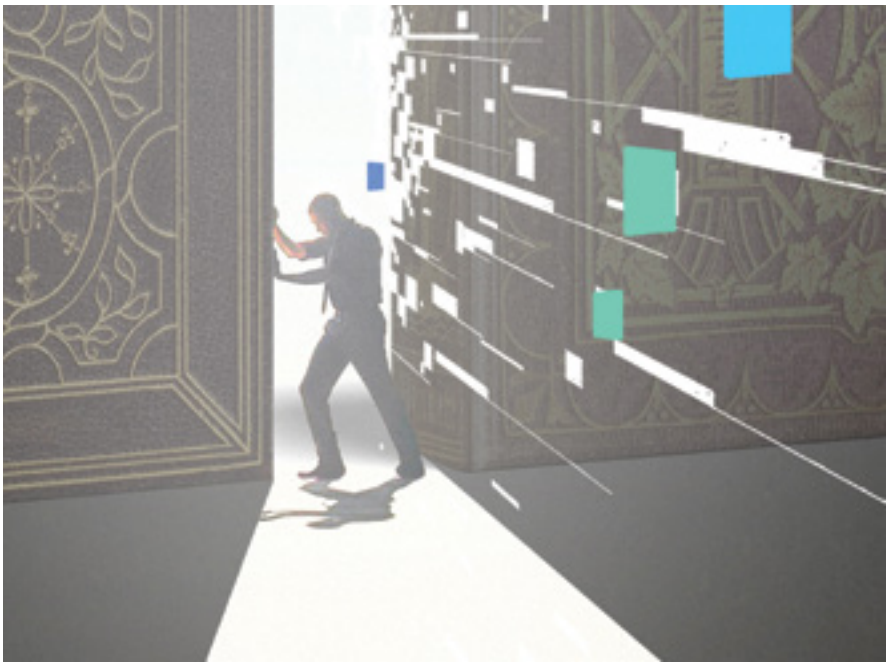




Using the Open Library approach as a foundation, we can expand to bring all interested libraries digital by 2020. By building upon the collection of 2.5 million public domain e-books that so many libraries have collaboratively digitized with the Internet Archive, we can bring the full breadth of books, both past and present, to millions of readers on portable devices, at websites, and through online library catalogs. With its extensive collections and strong public service mission, the library community can be central to this endeavor.

For instance, in each library's online card catalog, when a digital version of a book exists, we can include a web link on the record for the physical book, giving readers the ability to browse the book on screen or to borrow it from the convenience of their homes. In this way, we can smoothly enhance a library's collection, from analog to digital, at scale, by coordinating through the library catalog cloud-based vendors. We would also collectively work with publishers to purchase as many books as possible for library lending.

To build this future, we will need the participation of multiple sectors to bring thousands of libraries digital. That is one of the essential differences from the 2004 Google Book Search project, an attempt by Google and several large research libraries to bring 20th-century books online in a centralized way. That path yielded, in 2008, the Google Books settlement proposing a central controlling authority, which the courts halted in 2011 as monopolistic.[3]



A System with Many Winners

I believe this time we can pursue a *decentralized* approach, one that leads to many publishers and many libraries interacting through the market rather than having a single controlling entity. While libraries today often license e-books with restrictive terms, libraries are better served if they purchase e-books with the same rights to lend and preserve that they are entitled to when they purchase physical books today. Hopefully, going forward, all books would be available to libraries in this way—providing revenue to ensure healthy author and publisher sectors that would garner their support. But what about books that are not available in this form—including most of the existing library collections and some books published today? For these texts, libraries can work together to digitize the materials efficiently while minimizing duplication and can lend the digital texts with the same limitations placed on physical books.

In this way, patrons could read past and present books on the screens of their choice; librarians would perform their traditional roles of purchasing, organizing, presenting, and preserving the great works of humankind; publishers would sell e-books at market-based rates; and authors could choose how to distribute their works, including through publishers for payment. This may sound old-fashioned and not particularly "disruptive," but it bears the advantage that each institution plays a role structurally similar to the role it has played historically.

While libraries today often license e-books with restrictive terms, libraries are better served if they purchase e-books with the same rights to lend and preserve that they are entitled to when they purchase physical books today.

Different Eras of Books: Different Solutions

To bring our libraries digital, let's first discuss ways that groups are digitizing books at scale and then address how they can be made maximally available. The historical core of a great library, often pre-1923 books, resides in the public domain and thus does not have rights issues to hamper distribution.

Libraries with their rich special collections must still catalog and digitize their books, and we continue to work with hundreds of libraries to bring their special collections digital. But the large swath of public domain works has largely been digitized twice in the last ten years: once by the libraries working with Google and once by the libraries collaborating with the Internet Archive. Google's project has been much more thorough in its scope, scanning an estimated 25 million books thus far, but unfortunately, access to these works is limited. Institutional subscribers can gain limited access to the Google books through HathiTrust (https://www.hathitrust.org/), and the public can download some public domain books, one at a time, through the Google Books website. The Internet Archive's digitized 2.5 million older books, on the other hand, are available in bulk and for free public access. Indeed, content specialists from genealogy to biodiversity researchers actively download public domain materials from the Internet Archive, fueling innovation, dissemination, and broad public good. While we still need to complete the digitization of special collections and government documents, the pre-1923 corpus of published books is largely online and available, albeit often with restrictions.

The 20th-century books, the era that worried Lesk, are also the books librarians fret about due to rights issues. In most of the developed world, an organization can digitize books for the blind and dyslexic, and through the Marrakesh Treaty (2013), signatory countries can share these books with other signatories at scale in a way that is explicitly legal.[4] In practice, this means Canada can now digitize and lend a book from any era for the reading disabled and can share those digital copies with libraries in Australia or more than two dozen other countries. Furthermore, the U.S. court's ruling in *Authors Guild v. Google* found the basic act of mass digitization of books, even by commercial entities, to be legal under the "fair use" doctrine in the United States. So the right to digitize has been settled in many countries. A remaining legal question is what access is allowed; this proposal will allow different libraries to make their own decisions.

I believe that building a major library at the scale of the Princeton University Library, the Yale University Library, or the Boston Public Library would require institutions to offer access to a curated digital collection of 10 million books, most of which are post-1923. Collaborators can prioritize subsets of books, such as the 1.2 million books most widely held by libraries according to OCLC or the almost 1 million books that appear on one or more syllabi as determined by the Open Syllabus Project.[5] A team of collaborators could volunteer to ensure full coverage in the major subject areas while building on the core collection. But for the purposes of argument, let's stipulate that 10 million books is the number we would need to support a broadly useful public digital library system.

Collaborating to Build a Digital Collection

Building a collaborative digital collection of 10 million books will require our libraries and our partners to efficiently perform three functions:

- Coordinate collection development to avoid duplicating effort
- Offer local and cloud access
- Provide distributed preservation

In very broad strokes, to build the collections, we need curators or curatorial approaches for selecting the most useful books, then a process to determine which books we already have digitized. We need institutions or vendors able to source the missing physical books to be digitized. The participating organizations would need to have the funding to staff these functions, based either on their internal budgets or on funds raised from philanthropic sources. Maybe we could start with some already funded projects, since they might help shape the rest of the system.

Curating a Collaborative Collection

Prioritizing the books is still an open question. One approach might be to break the collection into a widely-used core of books for K-16 learners and into important topical collections. The Internet Archive could focus on obtaining and scanning the core collection of perhaps 1–2 million volumes, and then partner libraries with strong specialties could develop and scan the subject-based collections. An engineering school might take on engineering books, and a law school could focus on law books.

We must continue to work with Google Books, HathiTrust, and Amazon to explore areas of alignment. No one in the library world wants to waste precious resources by digitizing a text more than once. It would be a public benefit if these large-scale digitizers would be willing to contribute to this collaborative effort.

We will also need to research which books are emerging from copyright protection and create a comprehensive list of all digitized works. These will be important areas of research to support.

Various Levels of Access

Once we have established the core collections, each library can determine its own approach to providing access to modern works. Some might want to start by giving full access to the blind and dyslexic, as the University of Toronto is doing through the Ontario Council of University Libraries (OCUL) and the Accessible Content E-Portal (http://guides.scholarsportal.info/aceportal). Others, such as the University of California, might want to create a preservation copy. Some, such as HathiTrust, might prepare datasets for nonconsumptive researcher access. And many others, including the Internet Archive, may choose to lend their copies while keeping the physical copy on the shelf. This flexibility in access models could be one of the great strengths of this overall approach to bringing 20th-century books online—different libraries in different countries can play varying roles as their environment permits.

Libraries can take a giant step forward in the digital era by lending purchased and digitized e-books. The Internet Archive digital e-book lending program mirrors traditional library practices: one reader at a time can borrow a book, and others must wait for that one to be returned manually; alternatively, after two weeks the book is automatically returned and is offered to any waiting patrons. The technical protection mechanisms used to ensure access to only one reader at a time are the same technologies used by publishers to protect their in-print e-books. In this way, the Open Library site is respectful of rights issues and can leverage some of the learning and tools used by the publishers. The California library consortium Califa (http://califa.org/) has set up its own lending server, and it makes purchased and digitized books available through its own infrastructure to California residents. We understand the Department of Education in China also loans books it owns to one reader at a time at a major Chinese university. We all learn and benefit when different organizations in different countries test a range of approaches to access, balancing convenience and rights issues.

How would we circulate the digital e-books? Some libraries are integrating links into their library catalogs, so information about the digital versions and physical copies are side by side in the same record. Libraries can always link to the copy in the Internet Archive's Open Library, but if this is a modern book, there may be only one copy available for the whole world. Libraries can also store their own digital copies and administer their own lending system, as Califa has done. Another alternative is that the Internet Archive could create a circulation system that would administer the lending for libraries. In effect, then, each library can choose from a variety of methods to lend digital versions of the physical books in its collection. This would keep the local libraries in control but leverage the convenience of a cloud-based system that others maintain and update.

Turning on the e-book links in a catalog might be very easy now that many libraries have their catalogs on cloud services from major catalog vendors. Persuading those providers to collaborate

Each library can choose from a variety of methods to lend digital versions of the physical books in its collection. This would keep the local libraries in control but leverage the convenience of a cloud-based system that others maintain and update.

If we are striving to build the modern-day Library of Alexandria, we should avoid the fate of the first Library of Alexandria. Our community should preserve multiple copies of the books that are bought and digitized.

with this community could help deliver e-books to millions of patrons with a flip of a digital switch.

Distributed Preservation

If we are striving to build the modern-day Library of Alexandria, we should avoid the fate of the first Library of Alexandria: burning. If the library had made another copy of each work and put them in India or China, we would have the complete works of Aristotle and the lost plays of Euripides. Our community should preserve multiple copies of the books that are bought and digitized. While many libraries may be content with access to the collection on a cloud-based server, we can empower and encourage a number of libraries to store local digital copies of their books.

Fortunately, digitized books are compact enough to be affordable for libraries to store. Digital books, even with high-resolution images and all the derivative formats, are often 500 megabytes in size, so 1 million books would be 500 terabytes, which is increasingly affordable.

Distributed preservation of both the purchased e-books and the digitized books can help ensure the longevity of the precious materials in our libraries.

The Internet Archive's Funding and Technology

The Internet Archive has secured new funding to develop "super scanning centers" for the mass digitization of millions of books per year, at a significant cost savings. With the first funded super scanning center in Asia that we are now certifying for production, we anticipate being able to scan books for about one-third of the normal in-library rates achieved by the Internet Archive's twenty-eight Regional Scanning Centers. Through the Asian super scanning center, the Internet Archive can offer partners a cost savings of 50–60 percent for those willing to scan large quantities of books and have them out of circulation for several months. We are now talking with a large university research library about a plan to digitize 500,000 modern books using an Internet Archive super scanning center. This project offers the library new options in collection management, allowing it to provide digital access to books that are moving to an offsite repository. Librarians may find mass digitization at reduced cost to be a powerful tool for collection management.

In the past year, the Internet Archive has developed an in-library book-scanning system that integrates duplication detection, catalog lookup, digitization,

FIGURE 2. THE INTERNET ARCHIVE'S TABLE TOP SCRIBE, A PORTABLE, LOW-COST SCANNER

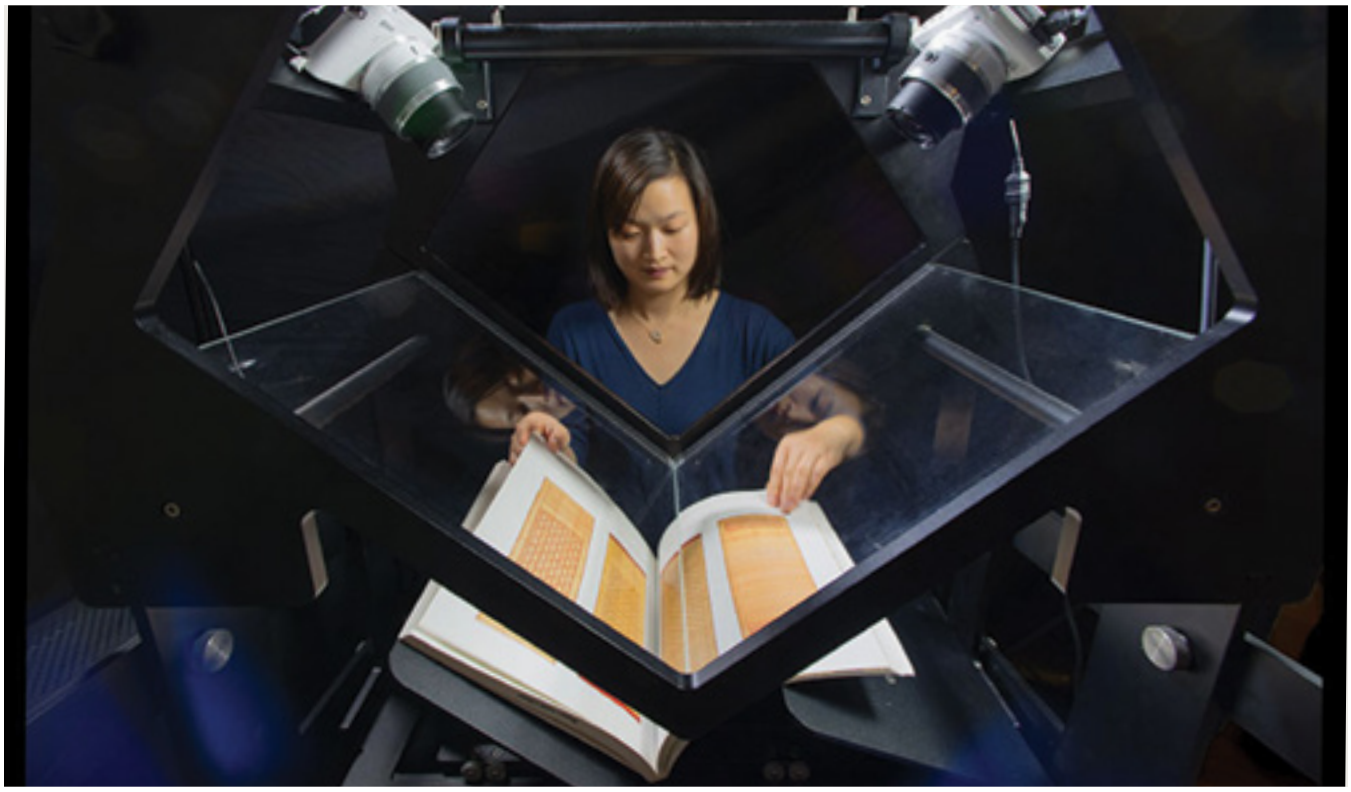


Photo Credit: David Rinehart

and integrated delivery. This can be useful for organizations that want to move through their collections, discover what has not been digitized either by themselves or by others, and digitize just these texts—while gaining access to the Internet Archive's digitized versions of all of their books, digitized from a large variety of source libraries.

Also, we now have a funding commitment to digitize millions of books and other materials that are donated to the Internet Archive. Through this initiative, the Internet Archive will seek to acquire and then digitize a core collection of books based on the recommendations of a curatorial team, while considering lists such as those compiled by OCLC and the Open Syllabus Project. This funding gives other organizations the option to donate appropriate physical books to the Internet Archive and receive a digital copy in return, at no cost to their institution.

In these ways, libraries can choose the most appropriate means of scanning their holdings. We now offer options ranging from the Table Top Scribe (see figure 2), where institutions purchase the hardware and supply their own staffing, to our regional centers in institutions such as the Boston Public Library, the University of Toronto, the Princeton Theological Seminary, and the Library of Congress. We offer lower costs for mass digitization at our Asian super scanning center and free digitization for appropriate materials donated to the Internet Archive. Our goal in offering this plethora of scanning options is to encourage all libraries to participate in the collaborative collection building in a paradigm that works for them.

Costs of Digitization

At the Internet Archive, the cost of digitization varies between $10 and $30 per book, depending on where the scanning occurs—offshore or in a library. Additional costs include acquisition, storage, and lifetime digital file management, which may come to be the predominant cost in the future.

Current in-print books are often available in e-book form, but there are few publishers willing to allow libraries to buy e-books with similar rights to the physical books they purchase. There is hope that if we coordinate our buying power, the book publishers will embrace selling e-books to libraries, much as the music publishers have come to embrace, or were forced to embrace, the selling of MP3s to services that provide broad access.[6] When available, the purchase price for these e-books tends to be approximately the same as the cost of the physical book.

Financial Stability

So far there has been little discussion of money changing hands or of any financial model to support maintaining and growing this system. If the libraries share the burden of the digitization and share the results, there would then be an incentive for some to "freeload" and wait until other libraries digitize the books and provide the services. If we want to

counter this, those libraries that did not contribute digitization or backend services could be charged for access to digitized books. And we could charge a one-time transfer fee to libraries that want to store their own local copies. But we should think carefully about financial models and avoid incentives leading to dominant systems that will limit innovation.

Conclusion

Each of our organizations has a role to play in building this collaborative digital library collection and circulation system. The Internet Archive is ready to contribute scanning technology, backend infrastructure, and philanthropic funding to digitize a core set of books that will serve K-16 learners. We are calling for partners who will help curate and source the best collections beyond what we can do, for vendors who will help circulate digital copies, and for leaders who are bold enough to push into new territory.

Because today's learners seek knowledge online, we must enable all library patrons to borrow e-books via their portable devices, by searching the web or by browsing online library catalogs. By working together, thousands of libraries can unlock analog collections for a new generation of learners, enabling digital access to millions of books now beyond their reach. The central goal—for future learners to have access to all books without physical constraints—could be realized for millions of people worldwide by the year 2020. ■

Notes

An earlier version of this article was published as the white paper "Transforming Our Libraries into Digital Libraries: A Digital Book for Every Physical Book in Our Libraries," Library Leaders Forum, Internet Archive, San Francisco, October 2016.

1. Mike Lesk, personal conversation with the author.
2. Geoffrey A. Fowler, "Libraries Have a Novel Idea," *Wall Street Journal*, June 29, 2010.
3. James Grimmelmann, "The Orphan Wars," *EDUCAUSE Review* 47, no. 1 (January/February 2012).
4. "Marrakesh Treaty to Facilitate Access to Published Works," World Intellectual Property Organization (WIPO), accessed February 4, 2017.
5. "OCLC Provides Downloadable Linked Data File for the 1 Million Most Widely Held Works in WorldCat," OCLC, news release, August 14, 2012; Open Syllabus lists 933,635 texts as of February 2017: http://explorer.opensyllabusproject.org/.
6. Steve Jobs, "Thoughts on Music," Apple (via Internet Archive Wayback Machine), February 6, 2007.

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Brewster Kahle (brewster@archive.org) is Founder and Digital Librarian of the Internet Archive (https://archive.org/).

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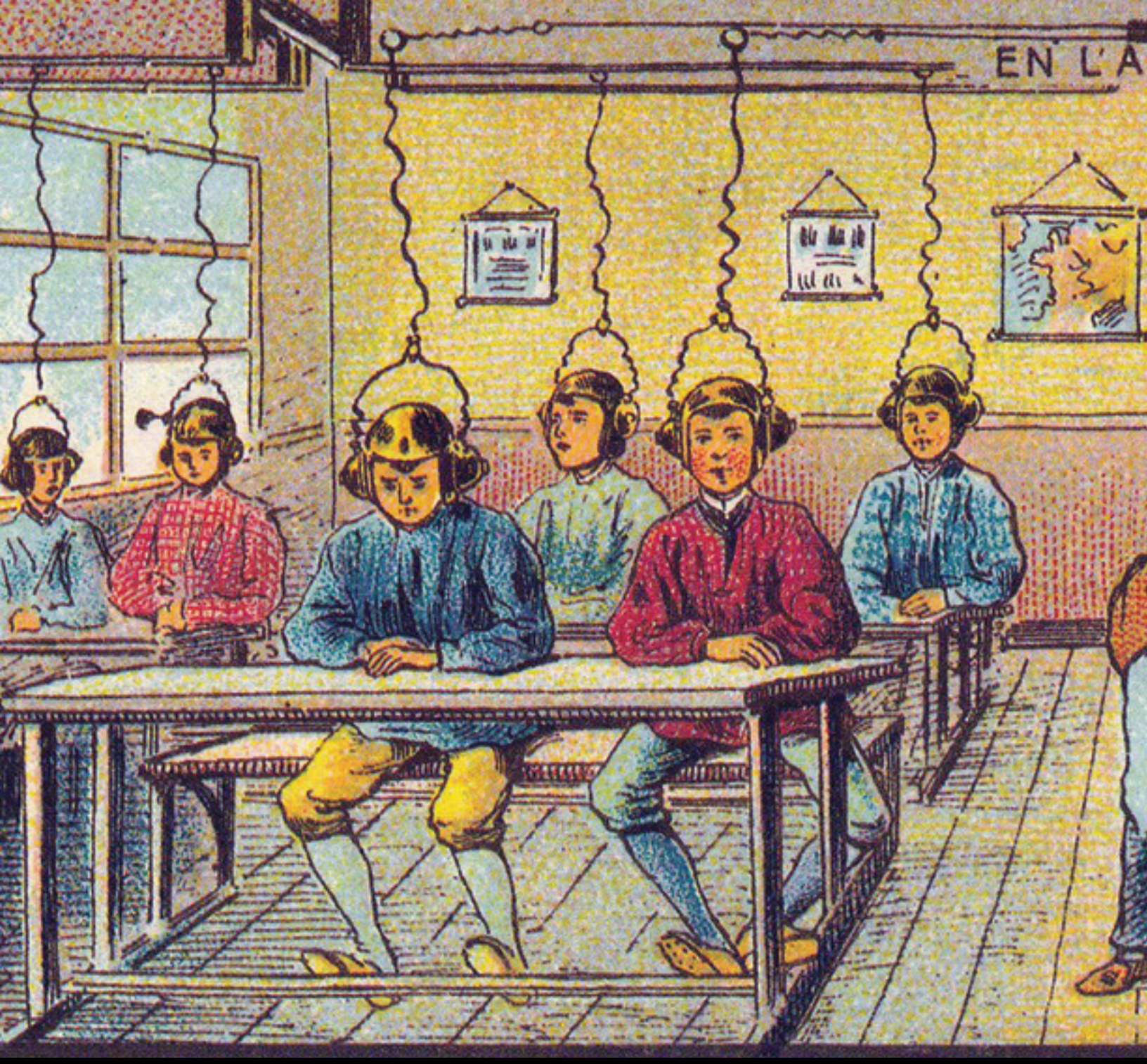
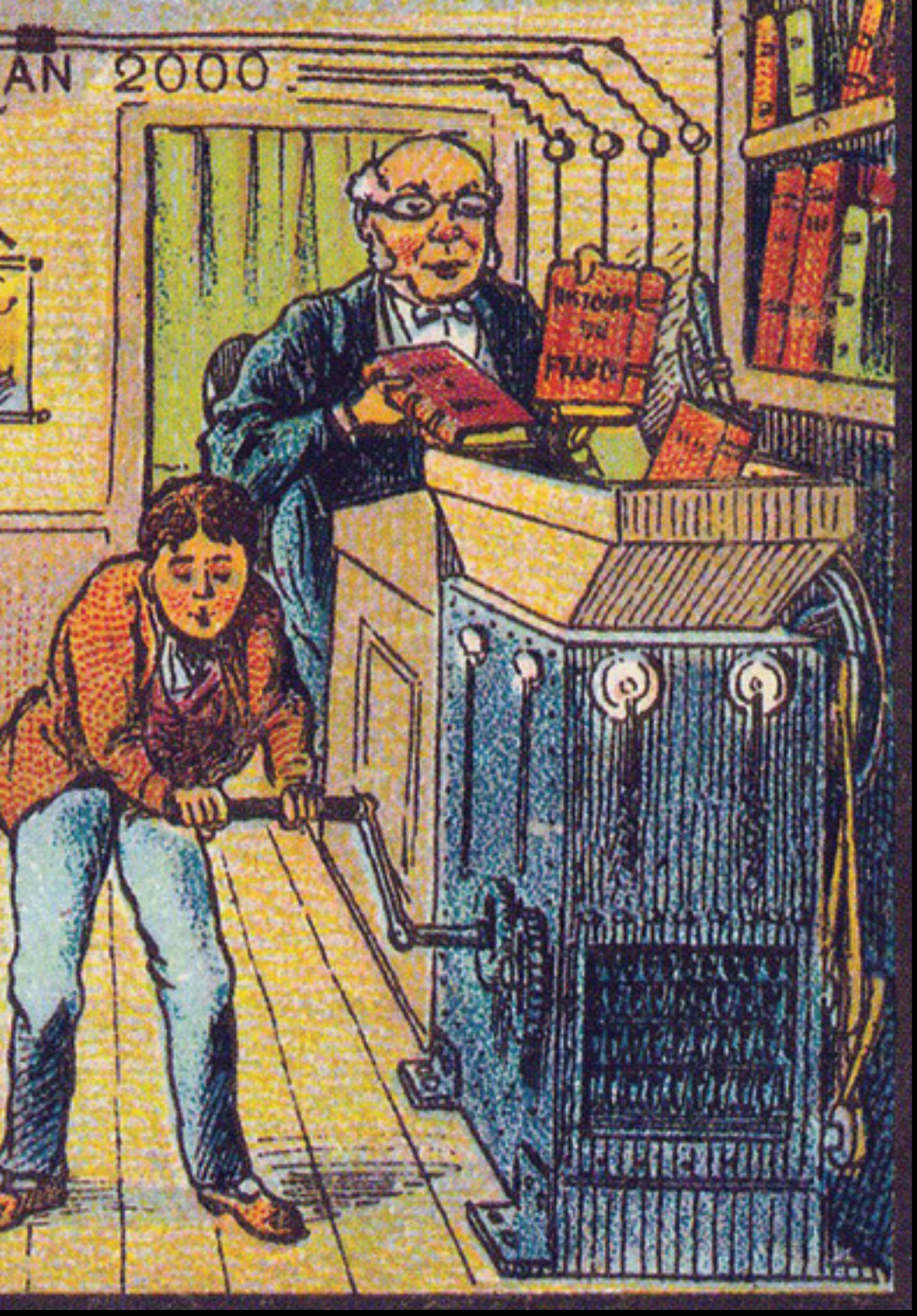


Back to the Future

Finding the Future in the Past

A

ILLUSTRATION BY JEAN-MARC CÔTÉ, 1899



My relationship with technology has been a lifelong love affair, one that probably started when I took apart appliances in the basement or when my brother and I invented our own radio shows on a cassette recorder in the early 1970s. Being a digital immigrant is usually understood to be a deficit, a lack of fluency borne of growing up in the dark time before computers became ubiquitous. And yet. Never knowing a time without computers or the Internet also means missing out on the powerful wave of excitement and optimism as we experienced the dawning of the computer age. The sense of wonder we felt as we looked to the future was powerful and palpable. Instead of taking for granted a world that was "always on," we painstakingly learned DOS commands, deciphered the mysteries of motherboard DIP switches, and lived these early years with our operating system on one 5¼-inch floppy disk drive and the entire archive of our digital lives on the other.

# of Edtech: Meditation

John O'Brien

Even though science fiction writers had provided several decades' worth of cautionary tales of robot overlords and dystopian possibilities, it was their optimism that most captured our imagination. Among other things, we imagined that technology would solve world hunger, and thanks to the Jetsons, we were pretty sure that wristwatch video phones, jetpacks, and robot servants were in our future. While we played Pong on our state-of-the-art Atari consoles, we marveled at trips to the moon, Skylab, and the exciting new space shuttle program.

Growing up as an immigrant to this world of technology-enabled possibility filled me with a sense of endless wonder that may come less easily to natives. The tectonic technology changes of the 1960s and 1970s have left me always looking forward, glancing back—excited about the march toward the future but deeply aware of the historical journey that has brought us this far.

This crossroads where the past and future meet can be jarringly beautiful, as the digitally colorized photos of Sanna Dullaway vividly dramatize.[1] Using the lens of the past to understand the future gives us the hope that we need not repeat our mistakes. It illuminates the past and opens our eyes to a deeper understanding of the present. Lewis Hine's photos of child labor from a century ago are powerful in their own right, but Dullaway amplifies their power for the 21st century. When we look at Hine's century-old images, our impression is colored by current belief in our own advancement. But somehow a splash of literal color reminds us that the 21st century may not be that advanced and that we have our own collection of shameful images of child labor happening right now. Understanding the past is important, and thinking about the future is fundamentally human, but more fascinating still is the combination, the history of the future: the road pointing back to where you were, the road pointing ahead to where you're going, and the moment at the crossroads contemplating both.

Remarkable Paleofuture Artifacts

There is an emerging field of academic inquiry related to this line of thinking. Self-proclaimed "time capsule nerd" Matt Novak calls it paleofuture, while "ed-tech's Cassandra" Audrey Watters calls it the *history of the future*.[2] Instead of focusing exclusively on representations of the past (the work of historians) or on those of the future (the work of futurists), paleofuturists concentrate on representations of the future in the past. Since the 19th century, technology permeates so many images of the future that in many ways, paleofuture often amounts to representations of a tech-rich future in a relatively tech-poor past.

Paleofuture artifacts are amazing in many respects. For nostalgic reasons, I'm fond of predictions from the 1950s and 1960s about life in the 21st century, such as Philco-Ford Corporation's remarkable 1967 film *Home of the Future: Year 1999 A.D.* (world fairs repeatedly turned to Home of the Future exhibits). Other films from this time reveal as much about the decades they were conceived in as the one they imagine. *The Monsanto House of the Future*, for example, loudly sings the praises of "man-made fibers"

FIGURE 1. THE NEW-FANGLED BARBER

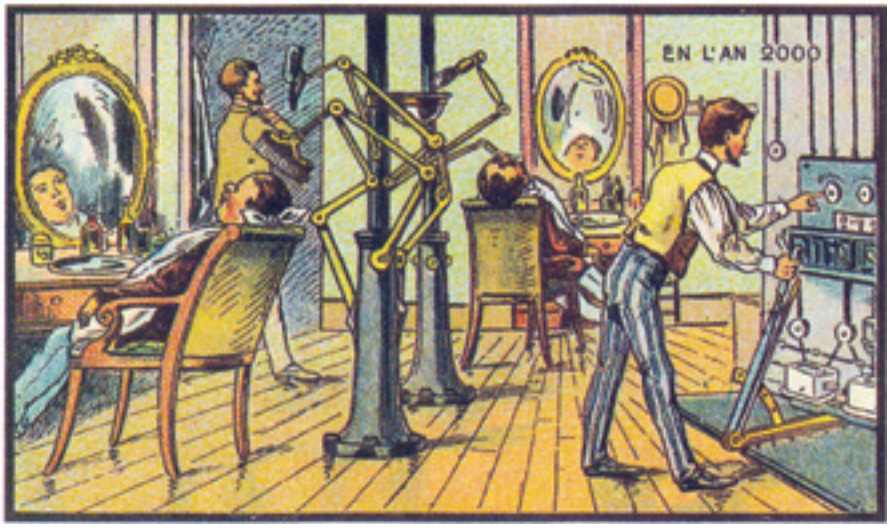


Illustration by Jean-Marc Côté, 1899

FIGURE 2. A VERY BUSY FARMER

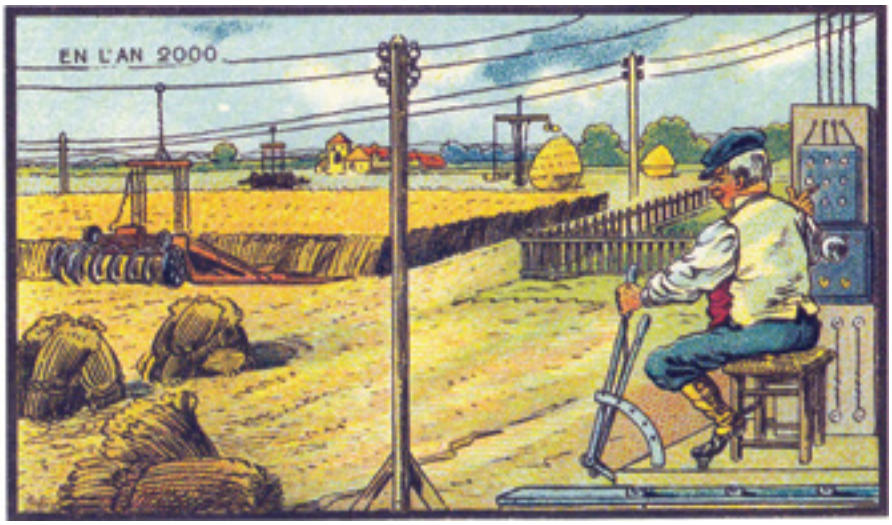


Illustration by Jean-Marc Côté, 1899

FIGURE 3. AT SCHOOL

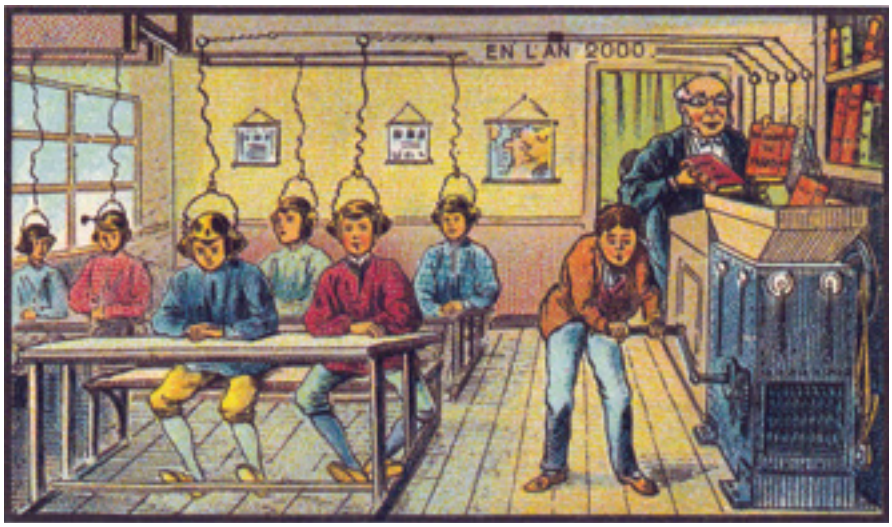


Illustration by Jean-Marc Côté, 1899

FIGURE 4. STUDENTS TODAY

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and plastics, at one point rhetorically asking "Is everything of plastic?" and breathlessly answering: "Almost! . . . a dream of the future brought to reality by Monsanto."[3]

However, much older paleofuture artifacts are uniquely captivating. One of the best-known history-of-the-future collections is a series of *fin de siècle* cards created for cigar boxes by the illustrator Jean-Marc Côté to depict advances imagined to be ubiquitous "in the year 2000" (En L'An 2000).[4] In 1986, Isaac Asimov discovered and published them with his commentary in the book *Futuredays: A Nineteenth-Century Vision of the Year 2000*. The images typically feature a technology-rich future, with technology "improving" everything, from barbering to farming (see figure 1 and figure 2).

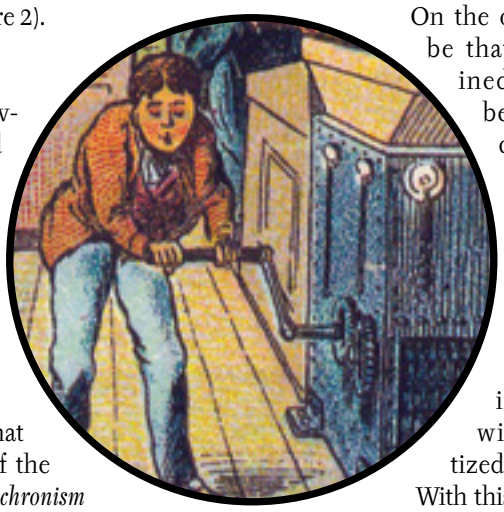
Educational Technology Artifacts

It's clear that the century that conceived of the Industrial Revolution imagined a future world in which technology would ease the burden of work. But what about the "burden" of education? My fascination with the paleofuture of educational technology began when I first saw the well-known 1899 Jean-Marc Côté illustration *At School* (see figure 3).

If you focus on the students in their desks and set aside the boy with the hand crank, the image from over a hundred years ago is in many ways an uncannily accurate depiction of students today (see figure 4).

The hand crank, however, is a wonderful example of what I think of as a *reverse anachronism*. When representations of the past include things that came only later, we waive the *anachronism* flag, such as when Shakespeare has Cassius declare "the clock has stricken three" centuries before mechanical clocks were even invented. A reverse anachronism involves futuristic representations that fail to fully escape their own non-futuristic thinking, like the *En L'An 2000* card showing a futuristic train composed of what appears to be old-fashioned bricks and mortar. There are additional ways in which the *At School* illustration demonstrates this concept. For example, the students still use traditional desks (for what?) that are lined up in rows (why?), and the students, still wearing the clothes of the 19th century, remain no more visibly diverse than in the artist's time.

Let's return to the fascinating (for me, at least) hand crank, which is about to chew up a copy of a book on the history of France. A century ago, it would have been nearly impossible to imagine a process of digitization, and so gears would be the closest metaphor available for engineering magic following the explosive growth in the use of gears during the Industrial Revolution. According to this interpretation, the crank reveals the artist's rudimentary understanding of the process that would convert paper books into audible format. In the illustration, the wires end near the students' ears with some kind of listening device (headphones or "electrophones" were known as early as 1895).



On the other hand, it may be that the artist imagined something well beyond the idea of converting paper to audio. Maybe this is an example not of a reverse anachronism but of something far more futuristic. Perhaps the artist imagined that the wires carried digitized ideas, not sound. With this interpretation, the

cranking mechanism goes from a precious understanding of digitization to a prescient picture of technology that—still not available in 2017—was predicted by Athelstan F. Spilhaus, dean of the University of Minnesota's Institute of Technology, in the December 1965 strip *Our New Age* (see figure 5).

This technology may yet be coming. Memories have been mechanically planted in mice, and in recent developments in neuroprosthetics (brain implants), researchers at UC Berkeley are working to create thousands of wireless brain interfaces called "neural dust." EMOTIV's "brain wearable" products allow wearers to complete rudimentary tasks by thinking them. Although 2016 may have been an ambitious prediction by Spilhaus, "One Laptop Per Child" founder Nicholas Negroponte predicted a couple of years ago that in thirty years, knowledge will be chemically created so that someone could take a pill to learn English or to comprehend the entire works of Shakespeare. So the hand crank may not be as laughable as it seems, and we may be far closer to learning Matrix-style than we think.[5]

FIGURE 5. MAN'S INTELLIGENCE IN 2016

Our New Age (cartoon strip), December 26, 1965

Why Study the History of the Future?

Ask a historian "why study history?" and you will get any number of answers, including the perennial axiom: "to avoid repeating past mistakes." Peter N. Stearns has summarized the importance of studying history by noting that history helps us understand people and societies, contributes to moral understanding, provides identity, lays the foundation for good citizenship, and provides crucial skills and habits of mind to students. It is a compelling case for a compelling field of academic study.[6]

Understanding the past also helps us recalibrate our thinking about the future, and studying failed and nailed predictions gives us a framework to better understand both. While Stearns says that "the past causes the present, and so the future," Peter Bishop phrases the interconnectedness as an equation that contains the constituent parts of paleofuture studies: what was + what is + what if.[7]

In the narrower universe of educational technology, Audrey Watters likewise insists: "We always tell stories of our past in order to situate ourselves in the present and guide ourselves into the future. But that means these stories about education and education technology—past, present, future—really matter." Writing about the annual *Horizon* reports, she argues for the importance of studying the history of the future: "I'm less interested in the accuracy of the predictions about the future of education technology that the Horizon Report has made over the last decade than I am in what those predictions now might tell us about the *history* of ed-tech. I'm interested in the history of our *imagination* about education's future and the role technology—and influential ed-tech storytelling—is assigned in shaping that."[8]

I would add, first of all, that understanding the history of our hopes and dreams gives us a deeper and more comprehensive understanding of our current time, as we see "now" as part of a trajectory that began long before (and continues into the future). I'm convinced that we have as much to learn from the visions that have been realized as from those that have not come to pass. And perhaps there is even more to learn from the misses. Why *don't* we have robot teachers? Why *aren't* so many more students these days math and science geniuses like Elroy Jetson? What do these disconnections mean? What can we learn from them? Past predictions that did not come true can be as instructive as predictions that unfolded exactly as anticipated.

If there is one takeaway I would hope we can learn from the study of the history of the future, it is a sense of humility and caution. We are too quick to forget our own insignificance relative to the vast scope of human history. We are not the first generation to feel we are striding forward with unprecedented technology advances. A sense of perspective on that score would be a good thing. Lacking this

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One imagined glimpse of the future captures the 19th century's hopes and dreams about technology, critiques that very optimism, and accurately predicts technology-enabled social problems. What seems to be sheer tech-utopianism simultaneously contains a seed of doubt and caution.

sense of proportionality, we easily inflate our own specialness and assume that technology really will solve all our problems (and create no new ones!), contrary to the prescience of some paleo-future visionaries.

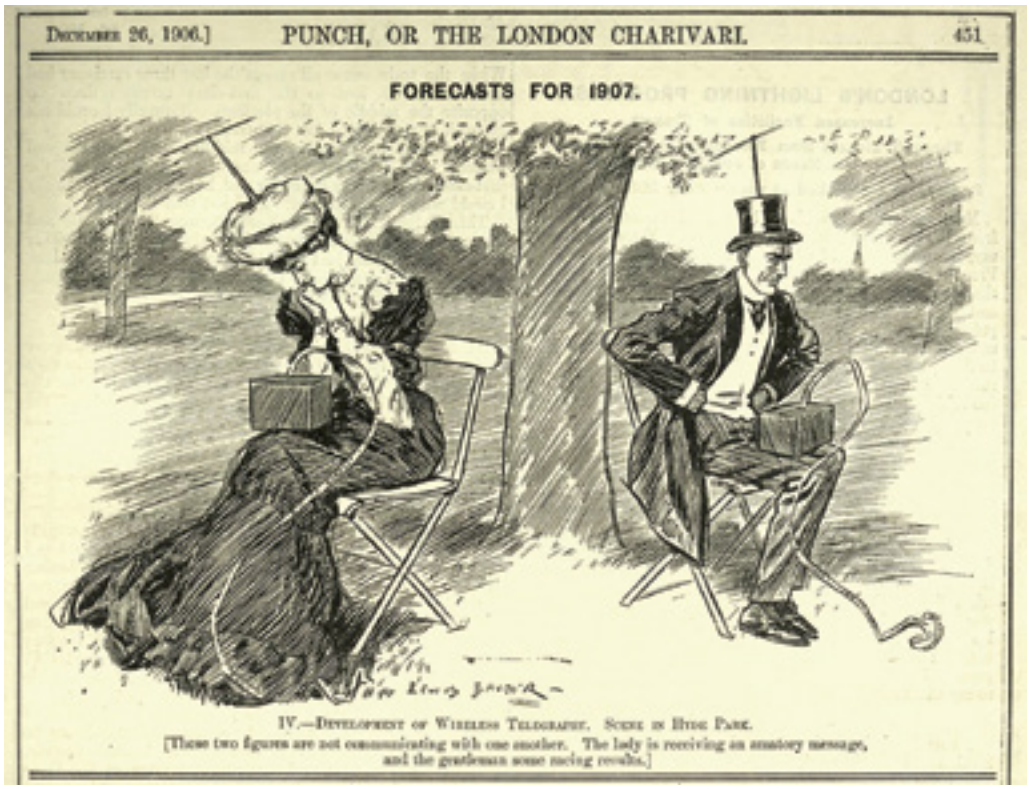
Take, for example, the *Punch* magazine cartoon "Forecasts for 1907," which predicts mobile communication technology with remarkable precision (see figure 6). Even more extraordinary, it anticipates the now fully realized downside of today's cellphone connectivity, what MIT's Sherry Turkle calls the "alone together" phenomenon in her book of the same name.[9] The text beneath the cartoon points out that the man and woman "are not communicating with one another." Rather, "the lady is receiving an amatory message, and the gentleman some racing results."

In one imagined glimpse of the future, this paleo-future artifact captures the 19th century's hopes and dreams about technology, critiques that very optimism and accurately predicts technology-enabled social problems from sexting to online gambling. What seems to be sheer tech-utopianism simultaneously contains a seed of doubt and caution.

A Skeptical Turn: "The Future Isn't What It Used to Be"

When it comes to the history of the future of educational technology, various scholars have made a compelling case for skepticism about what they consider technological utopianism. According to Kentaro Toyama, for example, technology has more of a tendency to intensify humanity's fault lines than to correct them. In his book *Geek Heresy*, Toyama uses the Daedalus story as a high-tech parable to make this point. Daedalus invents advanced technology to enable humans to fly, but when he shares it with his son, he warns the youngster not to fly too close to the sun. Children being children, Icarus ignores his father's warning and "soars exuberantly." As a result of his life-or-death user error, he plummets to his death. The moral of the story, aside from hubris and listen-to-your-parents, is that "brilliant technology is not enough to save us from ourselves." Later in the book, Toyama observes about educational technology: "If you provide an all-purpose technology that can be used for learning and entertainment, children choose entertainment. Technology by itself

FIGURE 6. FORECASTS FOR 1907



Source: Punch magazine, December 26, 1906

FIGURE 7. CHAUFFAGE AU RADIUM

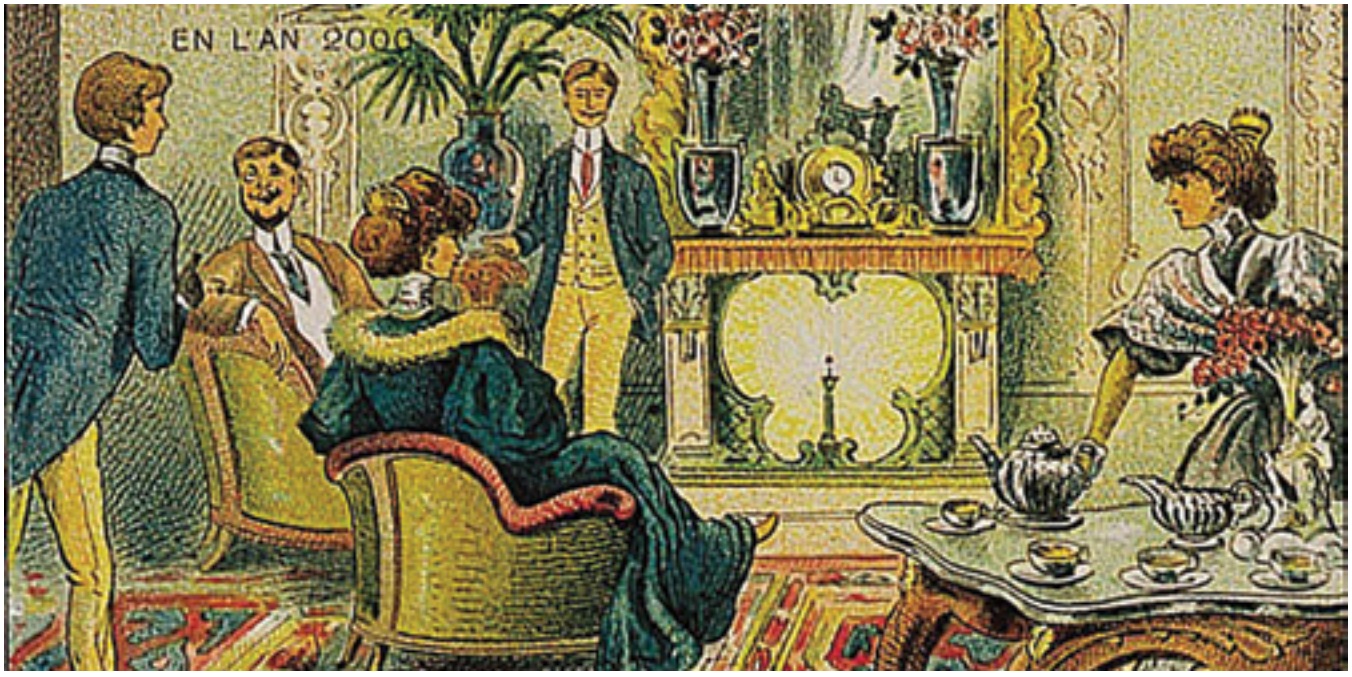


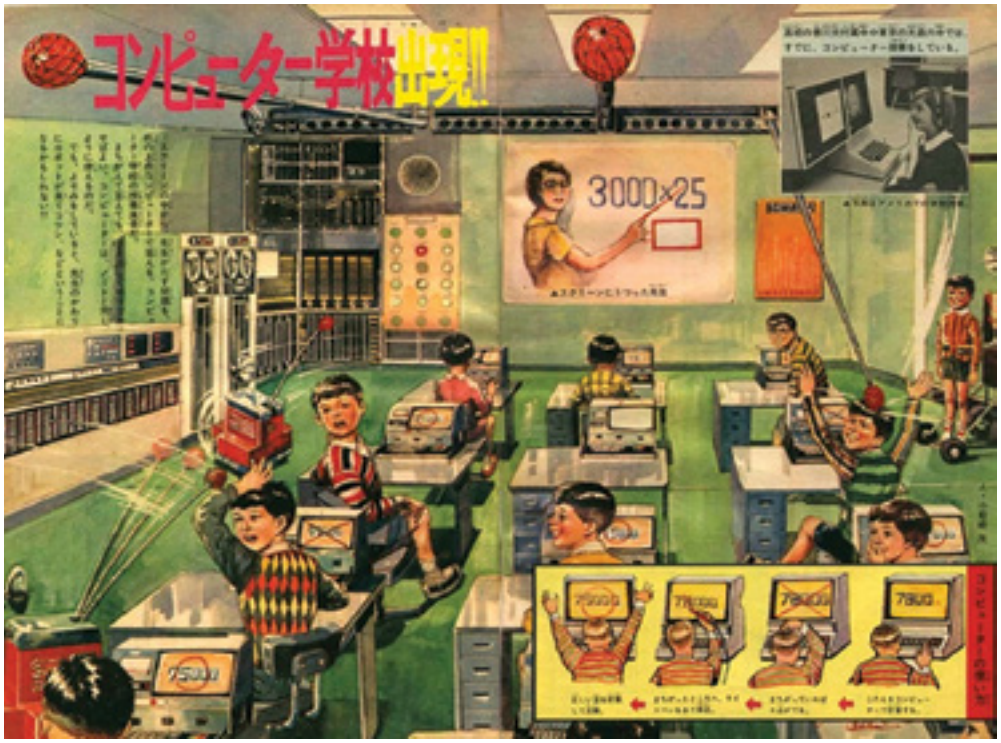
Illustration by Jean-Marc Côté, 1899

doesn't undo that inclination—it amplifies it."[10]

Sometimes the skepticism can be seen only from the 20/20 hindsight of the future. Who, for example, could argue that there is anything dark about the rosy vision of the future seen in figure 7, from the Jean-Marc Côté collection? We have leisurely salon conversation among friends basking in the radiance of what looks to be a lovely fireplace—except when we note, with 21st-century horror, that those gathered are illuminated by the glow of a single piece of deadly radium.

Other times the skepticism seems to be an intentional part of the artifact itself. A Japanese paleofuture artifact from 1969 (see figure 8) shows a classroom of the future, again with paperless desks lined up in a row. However, a closer look reveals that this classroom is less tech-utopia and more *Lord of the Flies*, with students who get the answer correct smiling or barely suppressing their glee as less-correct students are bludgeoned by vigilant "robot proctor."[11]

FIGURE 8. 1969 VIEW OF THE JAPANESE CLASSROOM OF THE FUTURE



Source: Shōnen Sunday (1969)

While the darker side of this image of the future is hard to miss, there are more subtle seeds of doubt even in some of the most breathless utopian visions of the

future. A 1958 drawing by Arthur Radebaugh (see figure 9) imagines a teacherless classroom of the future (again with desks in a row) in which automated teaching would be accomplished by "special machines" that were "'geared' for each individual student so he can advance as rapidly as his abilities warranted." The student's work would be "kept by machine" but "would be periodically reviewed by skilled teachers, and personal help would be available when necessary." With cosmetic updates in the language and image, this 1958 artifact summarizes key ideas frequently articulated in the discussion of personalized learning today. Yet those looking for a skeptical turn might point to the distracted student, waving to his unicopter-flying friend outside the window.

This image is similar to the distracted student in another Radebaugh prediction; in this case, a student learning from home does not find his technology or his "TV instructor" as engrossing as baseball with his friends (see figure 10).

Radebaugh is not the only source of paleofuture mixed messages regarding educational technology. For example, the 1967 film *Home of the Future: Year 1999 A.D.* (mentioned earlier) enthusiastically explains how technology improves the lives of each member of the Shore family, including third-grader James Shore. We see him learning from home with the help of 1960s-imagined adaptive learning technology, "teaching machines which allow him to progress as rapidly as his awakening mind can absorb the audio-visual lesson." When his awakening mind falls short of the expected competency, his robot proctor, lacking pedagogical patience, lets him know ("you flunk") and points him to another video lecture. James dutifully listens to the push-button lecture on Galileo for a while, gets bored, and then looks around mischievously before switching to a cartoon he enjoys, it turns out, far more.[12]

FIGURE 9. PUSH-BUTTON EDUCATION

Illustration by Arthur Radebaugh. ©1958 *Chicago Tribune*. Reprinted by permission.

FIGURE 10. LEARNING FROM HOME

Illustration by Arthur Radebaugh. ©1958 *Chicago Tribune*. Reprinted by permission.

Another favorite of mine is a 1982 drawing conceived for Atari by Robert Stein as part of his work on the idea of an "Intelligent Encyclopedia." In this super-engaged third-grade classroom of the future, one group of students is simulating a Mars landing, and the other group is designing a spacecraft. A single student in the foreground is doing neither, focused instead on drawing a less-than-flattering picture of his teacher (see figure 11).

Returning to Côté's 1899 illustration *At School*, Watters sees it as the ultimate expression of "our worst suspicions" about the future of education: "mechanized

FIGURE 11. A FUTURE THIRD-GRADE CLASSROOM

Illustration by Glenn Keane. ©1982 Robert Stein. Reprinted by permission.

and automated." She urges caution, and instead of focusing on the significance of the magic digitization crank, she looks to the role of the teacher in this brave new classroom. Far from a "sage on stage," this teacher is reduced to the equivalent of factory work, feeding the digital book-chipper. Watters argues that this paleo-future artifact confirms her worst fears about the future of education, "that it's destined to become mechanized, automated and that it's designed based on a belief that knowledge—educational content—is something to be delivered. Students' heads are something to be filled."[13]

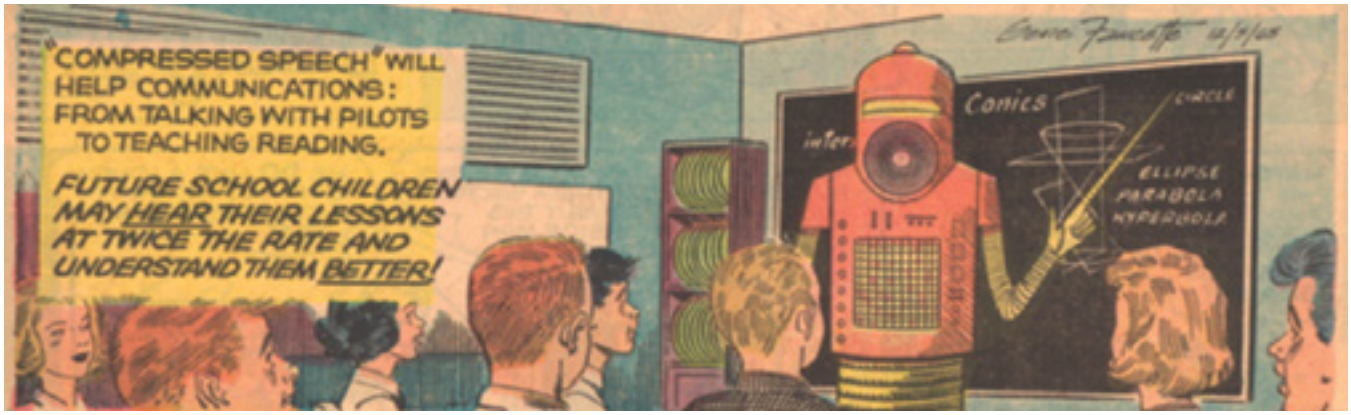
In fact, Watters's observation of the entire Côté set of illustrations is that they consistently depict technology automating manual labor (e.g., farmers, barbers), so when she considers the image of the classroom of the future, she wonders whether the profession of teaching (and the vocation of learning) is being represented as just another form of menial labor. The question is decidedly timely today as we contemplate personalized learning and as we imagine the role of faculty in such a future. Is this turn-of-the-century illustration the ultimate "unbundling"? Is the faculty role to be nothing more than feeding the digital book-chipper?

Watters links this illustration with the historical obsession with automation, which is linked in turn with the idea of efficiency that can be traced back to 1913 and Thomas Edison, who believed that books would "soon" be obsolete, replaced by the technology that was topping the "peak of inflated expectations" at that time: motion pictures. A decade later Edison would proclaim that schoolbooks of the age achieved "about two percent efficiency" while motion pictures should make "one hundred percent efficiency" possible. Watters response is immediate: "100% efficiency. Efficiency. What does that even mean? Because unexamined, this prediction, this goal for education, has become an undercurrent of so many predictions about the future of teaching and learning as enhanced by technology. Efficiency."[14]

These dual concerns about efficiency and automation (the teacher-less classroom) come together in many illustrations, including a comic strip from 1965, where the classroom of the future not only features a robot-teacher but comes with a prediction that students of the future will adapt to understand robot language, which is twice as fast (see figure 12). Efficiency.

Since 1913, there have been many more examples of high expectations about the efficiency or effectiveness of technology applied to learning. My favorite is one

FIGURE 12. THE ROBOT-TEACHER



Our New Age (cartoon strip), December 5, 1965

from 1958, which suggests a 38 percent increase in measurable outcomes from one piece of technology (see figure 13). Robot tutors in the sky? No, a Royal Portable typewriter.

I've been suggesting that a healthy dose of skepticism about our technology future is warranted, and I've pointed to seeds of skepticism that are embedded in even the sunniest paleofuture artifacts. Nonetheless, I'm not particularly interested in abandoning optimism. Cautionary impulses aside, I believe that many of the most recklessly optimistic imaginings of our future can be inspiring. I am genuinely excited about this particular time in the history of educational technology.

An Optimistic Turn

Skepticism is, I believe, a sign of thriving health, and given the long-standing tradition of overselling and inflated expectations for educational technology, it serves as a critical check-and-balance. I suggested earlier that one of the values of studying paleofuture artifacts may be to help us recalibrate our contemporary assessments. Perhaps the study of the history of the future cautions us to avoid the hype that so frequently animates technology-fueled visions of the future. It's impossible to scan the dozens of "in the year 2000" illustrations and miss the unrelenting rosiness of it all, and it's equally impossible to avoid wondering if we are guilty of the same enthusiasms now.

> It's true that the border between audacity and hype may be in the eyes of a beholder, but as frustrating as unquestioned hype can be, it's impossible to ignore the tremendous promise of education technology tools.

And yet there is something decidedly infectious about the ebullient optimism evident in predictions of the future. In "Arthur Radebaugh's Shiny Happy Future," Novak calls the conviction that technology will create "a leisurely utopian world" of jetpacks, flying cars, and robot butlers a sort of "Technological Manifest Destiny." Arthur C. Clarke's 1974 predictions about desktop computing were spectacularly accurate, and even earlier, in 1960, he said with confidence: "The only thing we can be sure of about the future is that it will be absolutely fantastic."[15] Who wants to be the curmudgeon to deflate the hope that humanity is striding from one success to the next, always improving—often exponentially—even beyond our imagination?

My own optimistic inclinations are what led me, two decades ago, to teach myself Authorware so I could develop software that would improve my teaching. And yes, it was about efficiency, but it was about my own efficiency as a teacher trying to manage limited time to help my students most, not wigitized efficiency imposed on me. I spent an entire "summer off" creating software to allow me to give my Composition 1101 students more detailed feedback on their composition drafts than I ever could have accomplished by scrawling comments like "unclear" or "awkward" in the margins. Perhaps because my experience with technology was so early in my career and so positive, my practical, positive sensibility has persisted.

Moving from the individual to the institutional level, IT leaders like James Hilton have been a consistent voice for technology transformation and optimism about what higher education can accomplish. When Hilton, dean of libraries and vice provost for digital education and innovation at the University of Michigan, received the 2015 EDUCAUSE Lead-

FIGURE 13. THE ROYAL PORTABLE TYPEWRITER

©1958 Royal Typewriter. Reprinted by permission.

ership Award, his visionary leadership was singled out as core to his contribution to the community. His featured presentation at our annual conference and his *EDUCAUSE Review* interview made the case for "reclaiming audacity" in the face of powerful constraints and a context of dynamic and sometimes menacing change. He pointed to space travel as one inspiring point of audacity, no doubt intentionally recalling the moonshot optimism of the early 1960s.[16]

Hilton sees Elon Musk as one innovator pointing the way to audacious progress, and Hilton is quick to point out that Musk has staked out ambitious plans in several domains known for struggling with low budgets and high regulation (transportation, energy, and space travel). For Hilton, what should be reclaimed is not just the optimism that new technologies naturally bring forward but also the compelling idealism about access to higher education. Looking to the past for inspiration, he recalls a postwar period when the biologist Norman Borlaug and others were "academic heroes." Hilton recalls a powerful vision at this time based on the notion that "schools should be incredibly expensive for government and absolutely free of charge for its citizens, just like national defense."[17]

Hilton's enthusiasm can be found in many paleofuture artifacts. For example, the December 1901 issue of *Ladies' Home Journal* published predictions from John Elfreth Watkins Jr. for the year 2000. Watkins exhibits a similarly irrepressible optimism:

> A university education will be free to every man and woman. . . . Poor students will be given free board, free clothing and free books if ambitious and actually unable to meet their school and college expenses. Medical inspectors regularly visiting the public schools will furnish poor children free eyeglasses, free dentistry and free medical attention of every kind. . . . In vacation time, poor children will be taken on trips to various parts of the world.[18]

In this example and elsewhere, optimism often singles out higher education when showing the way toward a brighter future, even in an Arthur Radebaugh picture from 1959 imagining the technology-rich home library of the future (see figure 14). Though this illustration seems to have nothing to do with higher education, the library technology makes it possible to read books that are projected onto, of all things, the ceiling. In this case, the text on the ceiling says: "College training can be had by anybody who truly wants it and can qualify academically. Money need not be a problem if a spirit of sacrifice is accepted. Other obstacles too can be overcome by real determination." Given the depressing quality of many contemporary characterizations of the value of higher education, this level of unabashed enthusiasm and confidence in the value of a college education is energizing.

What Hilton encourages these days is audacity in our willingness to work together and think big about technology. It's true that the border between audacity and hype may be in the eyes of a beholder, but as frustrating as unquestioned hype can be, it's

FIGURE 14. THE ELECTRONIC HOME LIBRARY

Illustration by Arthur Radebaugh. ©1959 *Chicago Tribune*. Reprinted by permission.

impossible to ignore the tremendous promise of education technology tools when it comes to advancing critical areas like student success. In fact, the 2017 EDUCAUSE Top 10 IT Issues list underscores the critical traction that technology offers in this high-priority area. Integrated planning and advising tools, adaptive learning, and other elements of personalization may fall short of the hype they tend to generate, but at the same time they offer unprecedented promise when it comes to moving hard-to-move needles like graduation and retention rates.[19]

A Meditation

I don't intend this collection of reflections and ideas to be either a withering critique or a rousing call to action. I mean instead simply to offer a meditation during turbulent times of dynamic change. Pressed on the subject, I would admit that, in the end, I want to have it both ways. I want to acknowledge and encourage a healthy skepticism when our edtech reach exceeds our grasp and when our excitement about the future gets out of control. But I also want us to think big—and dream even bigger.

Ultimately, as I position myself at the crossroads between the past and the future, reflecting on how the future has been imagined in the past, I can't help but hope for some kind of middle way. I imagine that it is possible that artificial intelligence developments in the years ahead might well improve learning without turning the keys to the kingdom over to Tay, the Microsoft chatbot who went from "humans are super cool" to holocaust-denying racist in a day.[20] I imagine it is possible that personalized and adaptive learning could well preserve that which is sacred in the faculty-student relationship, freeing faculty of transactional matters to focus on what matters most. After all, what I cherish most about the colleges and universities I have attended are the human connections.

I have always believed that we learn the most by asking questions. Understanding our current world by exploring how it was imagined in the past is a thoroughly insightful endeavor because we find ourselves thinking about questions we typically would never ask. Paleofuture artifacts yield up volumes of information about the age that created them and also about the age that interprets them—offering insights that span decades, generations, and even centuries, deepening our understanding of the past, present, and future. ■

A longer version of this article will be available online in April. The online version contains many more examples, images, videos, and links to sources discussed.

Notes

1. See Dullaway's website: http://sannadullaway.com/.
2. Matt Novak, "The 10 Coolest Time Capsules Opened in 2015," *Paleofuture*, December 21, 2015; Audrey Watters, "The History of the Future of Education," *Hack Education*, February 19, 2015. See also Watters's website: http://audreywatters.com/.
3. Philco-Ford Corporation, *The Home Of The Future: Year 1999 A.D.* (1967); Monsanto Chemical Company, Plastics Division, *The Monsanto House of the Future* (1957).
4. "A 19th-Century Vision of the Year 2000," *Public Domain Review*, accessed February 4, 2017.
5. Paul T. Corrigan, "What Did the Future of Learning Look Like 100 Years Ago?" *Teaching and Learning in Higher Ed*, September 12, 2003; Anya Kamenetz, "Knowledge Pills, Robo-Graders, Brain Implants and Other Dystopian Edtech," *Digital/Edu*, March 20, 2014; "Watch Fortune's Alan Murray Demo a Mind Control Device" (video), Fortune, July 12, 2016; Nicholas Negroponte, "A 30-Year History of the Future" (video), July 8, 2014; Steven Kotler, "Matrix Learning," *Discover*, February 18, 2013. Note that in 1960, Arthur C. Clarke also predicted: "We may develop a machine for recording information directly onto the brain as today we can record a symphony on tape. So we may one day be able to become instant experts learning Chinese overnight, for example." See Clarke, "1960: A Vision of the Future" (video).
6. Peter N. Stearns, "Why Study History?" (1998), American Historical Association, accessed February 4, 2017.
7. Peter Bishop, "Can We Teach the Future?" (video), accessed February 4, 2017.
8. Watters, "The History of the Future of Education"; Audrey Watters, "The Horizon Report: A History of Ed-Tech Predictions," *Hack Education*, February 17, 2015.
9. Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less from Each Other* (New York: Basic Books, 2011).
10. Kentaro Toyama, *Geek Heresy: Rescuing Social Change from the Cult of Technology* (New York: Public Affairs, 2015), 31. Illustrating his words, when the Los Angeles Unified School District bought iPads for students in 2013, students hacked them for entertainment purposes in less than a week. (Sam Sanders, "Students Find Ways to Hack School-Issued iPads within a Week," *All Tech Considered*, NPR blog, September 27, 2013.)
11. This futuristic picture is itself an homage to the distant past. A Western historian looking at this image might instantly recognize that the staves used on these children recall 17th-century "tithing men" in Puritan New England who enforced order with a "church stick" that had a knob at one end for children and a feather on the other end for adults.
12. Another interesting and comprehensive view is "L.A. 2013: Techno-Comforts and Urban Stresses—Fast-Forward to One Day in the Life of a Future Family," published on April 3, 1988. See "L.A. 2013," *Los Angeles Times Magazine*, March 8, 2013.
13. Watters, "The History of the Future of Education."
14. Ibid.
15. Clarke, "1960: A Vision of the Future" (video).
16. "Embracing Differentiation and Reclaiming Audacity: An Interview with James Hilton," *EDUCAUSE Review* 50, no. 6 (November/December 2015).
17. Ibid.
18. Hannah Keyser, "Fact Check: 26 *Ladies' Home Journal* Predictions for 2001 (from 1901)," *Mental Floss*, September 17, 2014.
19. Susan Grajek and the 2016–2017 EDUCAUSE IT Issues Panel, "Top 10 IT Issues, 2017: Foundations for Student Success," *EDUCAUSE Review* 52, no. 1 (January/February 2017).
20. John West, "Microsoft's Disastrous Tay Experiment Shows the Hidden Dangers of AI," *Quartz*, April 2, 2016.

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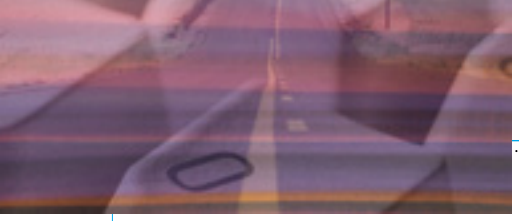

Mission Driven, Common Challenges

After working for Cuyahoga Community College in Ohio for over six years, in February 2016 I moved to a new position (and state) to take on a new challenge, at Southern New Hampshire University. Surprisingly, the move from the community college environment to the College of Online and Continuing Education at a private, liberal arts university revealed far more similarities than differences in how to support students as effective online learners.

A Common Mission of Access

One of the primary things that drew me to both institutions—and overall the beauty and the challenge of both environments—is that access to higher education is part of their mission. Students who otherwise might not be able to go to college and obtain a degree have an opportunity because of institutions like these. The mission of Southern New Hampshire University (SNHU) is to transform the lives of our students by "relentlessly challenging the status quo" and creating "high quality, affordable and innovative pathways to meet the unique needs of each and every student."[1] The mission statement of Cuyahoga Community College (Tri-C) similarly focuses on its purpose to "provide high quality, accessible and affordable educational opportunities and services."[2]

This mission—though institutionally unique—presents common challenges for how to design online learning to effectively support students who are largely nontraditional students balancing many priorities, often including family and work.

Fighting with Legacy Systems

In both environments, a common challenge is wrestling with legacy technology systems. Often, business processes grew alongside the systems to mitigate the technology challenges. Engagement with content, with fellow students, and with faculty is often limited by the constraints of technical systems. The management of content—from files to videos to interactive materials—can be difficult. Content is hosted in multiple places, and the technology systems necessary to effectively manage content (and measure the effectiveness of such materials) are not yet operationalized at most institutions.

Both the community college and the private university need content management. Hosting files is one step, but ensuring that content has appropriate management—with version control, responsiveness for mobile delivery, and tracking for student usage—goes a step beyond. Most colleges host instructional content in a variety of locations, which provides little in terms of actionable information for how to improve student learning. Data collection in such environments is a challenge. What is needed is a true Learning Object Repository or robust Content Management System, where information on student interactions with which versions of what content can be tracked and used to revise the learning design for students.

Transitioning legacy systems to more modern environments can be as much about how to utilize the system as it is about the system functionality itself. Limitations that existed in legacy systems years ago necessitated many layers of workarounds to help mitigate the challenges, and as technology develops, many of those workarounds persist. Disassembling the existing business process to take advantage of newer functionality can be disruptive but is often necessary.

Moving to Interoperability First

Both institutional environments—the community college and the private university—face the challenge of transitioning to a Next Generation Digital Learning Environment where interoperability is front and center.[3] At Cuyahoga Community College, online and hybrid course design and development was driven by individual faculty members, and as a result, what is integrated into the system is both limited and limiting. When there are publishers' materials that are preferred for instructional value, those materials have longer staying power in the system than is necessarily advisable. Copying courses can result in multiple versions of the same dense content that may not be integrated—or that perhaps should not be integrated.

Integrating building blocks into Blackboard, or utilizing LTI (Learning Tools Interoperability), requires functional testing and then implementation in approved upgrade windows in both environments. Empowering institutions to ask for—and then effectively integrate—standards-based resources and experiences requires a different type of partnership with both content-based and technology-based vendors. The IMS Global Learning Consortium (https://www.imsglobal.org/) is rapidly making progress with open standards, and it is up to the institutions that serve students to require adherence to standards.

Even among colleges and universities with large online enrollments, Southern New Hampshire University is unique in the way in which it partners with publishers. This relationship is enabled by the master course model, wherein faculty and Subject Matter Experts (SMEs) work with instructional designers, academic leaders, and content architects to centrally

Connections Editor: **Bret Ingerman**

By SASHA THACKABERRY

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develop courses that are then consistently utilized by faculty. When learning resources are selected in a holistic manner, the institution has the opportunity to work more closely with publishers over time.

By contrast, in the community college environment that I experienced, adoption of learning resources would occur at the departmental or campus level. When individual publisher reps work with a single faculty member or a department, oftentimes the coordination for integrating resources in order to get good data on student performance with those materials is lacking or not even considered. Discovering the effectiveness of learning resources for large numbers of students becomes even more challenging in this disaggregated environment.

Effective Online Student Support

Online support structures vary between environments as well. Whereas both types of institutions utilize online tutoring and both have writing support for students, how that support is deployed differs. SNHU has an innovative advising model. Data is regularly drawn from the LMS: if students miss an assignment or fall behind in class, their advisor and faculty intervene early and often. Few campus-based community colleges are well-positioned to scale intervention support for online students in this way.

Some colleges and universities—even those dedicated to open access—expect that students will reach out when they need help; institutional leaders assume that students understand internal college or university structures. Though this is beginning to change with intrusive advising and outreach to students at many community colleges, sometimes the ability of students to utilize support services depends on students finding and coordinating that support themselves. Sometimes, students even self-advise on courses and program selection—a mediocre idea at best.

Core Ecosystem Functionality Needs

Another commonality between the community college and private university environments is that there are some standard needs for learning and support. Though institutions vary in their place on the spectrum between legacy systems and new innovative systems, all have gaps in functionality and tools. Beyond the LMS, core learning technology need areas include the following:

- Learning Object Repository or Content Management System
- Video streaming
- Mobile-first ability for institutionally or faculty-designed resources and interactions
- Synchronous interaction (video, chat)
- Contemporary asynchronous interaction (video, discussion boards, audio and video feedback)
- Systemic communication tools (texting, apps, alerts)
- Effective data dashboards and data warehouses with effective data flow
- Automatic notifications for students, faculty, and advisors
- Curriculum management system
- Adaptive learning (engine, publisher system, or other)
- Competency-based education (tools, systems)
- Tutoring, writing, and other support systems
- Student-to-student social engagement and support outside of courses
- Placement tools, remediation, and just-in-time resources
- Proctoring for assessments, and multifactored authentication for academic integrity
- Library and research resources integrated into the LMS

A Common Challenge

To support the new majority of students—often older, working, and with families—community colleges and private universities face a common challenge: the need to find ways to evolve their learning technology systems. Students expect a more consumer-grade experience with technology, and colleges and universities will need to meet those expectations. More learners have access to higher education than ever before, but that access is meaningful only when all tools available to them are deployed to support their success. Learning technologies are the tools that can provide our students with that best chance at success. And student success is the business we are in—together. ■

Notes

1. "About Us," Southern New Hampshire University website, accessed February 16, 2017.
2. "Mission, Vision, and Values," Cuyahoga Community College website, accessed February 16, 2017.
3. See Malcolm Brown, Joanne Dehoney, and Nancy Millichap, "What's Next for the LMS?" *EDUCAUSE Review* 50, no. 4 (July/August 2015).

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Out of the Black Box

Each quarter, we ask our new undergraduate and graduate students how they form their basis of knowledge, a question that inevitably leads to conversations referencing the information technology that informs their daily educational lives. While their interaction with their own learning environments both on and off campus, and with scholarly knowledge itself, is now almost always in digital form, it is also almost wholly embedded within an IT context that operates largely invisibly to most of our students—that is, through *black-boxed technologies*. Not only are students embedded in the array of systems and networks, databases, and digital tools provided to them by the vast IT infrastructure of our university, but they frequently traverse those local networks to venture out into other information worlds, often through the gateways of Google Search, and into the realm of large-scale commercial information providers. Their digital travels are via invisible, seamless, high-speed, and ubiquitous connectivity over a multitude of devices.

Search engines and algorithmically driven platforms are a staple of the present, and future information seeking without them seems unimaginable. As students move through a variety of digital information sources, they generally do not notice the changing contexts and nature of the information providers, and they do not see the infrastructure and labor involved in the creation and maintenance of those sources. The results obtained from quick keyword searches on Google, Bing, or other search portals are typically unquestioned in terms of their validity, value, and persistence. Indeed, many students report that they could never write a paper without Google or the Internet and cannot imagine the not-so-distant past when we did just that: working with paper-based information sources through the intermediary of campus research librarians. Ask any group of undergraduate students what it would be like if all of their information services became unavailable at the close of the library at midnight. The anguished gasps of horror would permeate far beyond the confines of the campus.

The IT services that higher education institutions and libraries now provide have been liberating for students and researchers alike, allowing academic inquiry to be undertaken without geographic, physical, or time constraints. Yet so many of these information technologies that we have rapidly embraced over the past thirty years in higher education have contributed to another kind of constrained sphere of knowledge, in very specific ways that have gone largely unchallenged by those of us entrusted with creating and maintaining our students' informational environment. Black-boxed technologies that amass and commercialize data on students, often without their knowledge, and that often serve as privatized aggregators of their intellectual work (e.g., Turnitin) are uncritically embraced as learning technologies that will foster intellectual honesty and accountability. While on one hand, the need to detect plagiarism may be a widely accepted rationale, it is also true that these technologies surveil students and put the onus on technologies to police students—rather than our fostering trust and accountability through a framework of ethics and expertise developed in a teacher-student relationship.

> Working together strategically, academics and IT professionals need to step out of the black box and consider the many dimensions of IT platforms and our digital environment.

Another unintended consequence of our hyper-investment in digital technologies is the unimaginable amount of energy and environmental impact that the ubiquitous, always-on nature of data storage and transfer has necessitated. Far from the immaterial and ethereal "cloud" as often described, these mass storage and data networks require great amounts of power, space, and other environmental resources and vast infrastructure.[1] Our comfort with these technologies, as if there is no human or environmental impact, remains intact when we are unaware—when we divorce research from implementation.

Indeed, the majority of our students have never stopped to think through the many social and economic dimensions of knowledge creation and dissemination and the role played by information technology. This begs the question: Will the future of knowledge reside with powerful information systems, unknowable algorithms, and privatized islands of data? If so, at what cost? Further, what role do we, as information technologists and educators, play in identifying and discussing these nuances with our students, staff, faculty, and campus administrators?

It's time to think critically about how technology creates the information environment of higher education. In the past, our goal has been to find a seamless, flawless IT implementation that delivers the best return on investment, but as we look to the future, deepening engagements among campus centralized IT organizations and technology researchers, whose work is interrogating the relationship between information

E-Content Editor: **Lisa Janicke Hinchliffe**


By SAFIYA U. NOBLE and SARAH T. ROBERTS

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systems and their broader social consequences, will lead to more intentional and thoughtful applications of technology to information problems. The framing of IT services through the former models of "return" may push the ethical decision making—and the time needed to think through all of the attendant affordances and consequences of these investments—to the bottom of a priority list. Indeed, information workers are often tacitly or even directly discouraged from engaging in the intellectual work of thinking through the ethical and environmental dimensions of the platforms they implement. Rather than obscuring the role and impact of technology, and the IT workers who implement it, we need to foreground the choices and consequences of our hyper-digital campus environments.

Policy-making around information technology has broad consequences. For example, in our research, we have identified the importance of human engagement in digital technology systems. Noble's interrogation of the commercial values that undergird Internet search technologies—along with the uncurated and problematic results when students and researchers navigate the open web via Google, Bing, or some other search engine—is revealing the social consequences of biased platforms. Equally, Roberts's research has shown that human decision-making is often obscured while at the same time it serves as an integral part of the digital information and social media production processes, as evinced in practices like commercial content moderation. Far from being a global platform of unfettered free expression and democratic engagement, the Internet is more akin to a series of privatized islands where rules and norms may differ drastically from site to site and platform to platform. These norms are further dictated by jurisdiction and geographic location in the physical world, where major platforms often must negotiate the terms under which its users will be allowed to participate. Invariably, such deals change the user experience, user access to information, and policy—which then must be enforced, typically and most effectively by human beings, who bring their own values, norms and cultural predispositions to the table.

Another example hits closer to home. In a rush to economize resources and provide a suite of learning technologies and services, many campuses have adopted Google's Gmail, offloading the labor and investment in campus-based secure servers, training, and service for students, staff, and faculty. Granted, the previous iterations of IT management have been labor- and resource-intensive, but these have also come with certain affordances. The use of Google's services opens up the entire campus community to a level of data mining and surveillance that goes beyond our public mandates for transparency. With each decision like this, either we can put our knowledge and information into strengthening a private commercial company, or we can strengthen the public sphere of information and our institutions' infrastructures.

We know there is little time to think about the many dimensions of IT platforms and our digital environment. But we see incredible possibilities if academics and IT professionals work together, strategically. The future of knowledge should not be relinquished to precarious, black-boxed technologies. Let's step out of the box. ■

Note

1. Mél Hogan and Nicole Starosielski are two of a growing number of scholars who have put these issues at the fore of their research. Safiya U. Noble has written about the way that the environmental and human damage is out of view, sequestered to the Global South, where everything from mineral extraction to e-waste is made invisible. See Noble, "A Future for Intersectional Black Feminist Technology Studies," *S&F Online*, no. 13.3-14.1 (2016).

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Teaching Students to Marshal Evidence and Evaluate Claims

A month before the 2016 U.S. presidential election, President Barack Obama spoke at the White House Frontiers Conference and said: "We're going to have to rebuild, within this Wild Wild West of information flow, some sort of curating function that people agree to."[1] In the 1960s and 1970s, Walter Cronkite's nightly newscast sign-off ("That's the way it is") reached tens of millions of viewers and defined a broad consensus. How can we rebuild such a consensus? Here's one way higher education can help: teach critical thinking modes that bring scholarly best practices to the modern web.

To evaluate literary, scientific, or historical evidence, scholars and researchers must first marshal that evidence. Footnotes identify sources. Links to web pages and PDFs grant access to those sources. And now online annotations can identify and link to *claims* in those web pages and PDFs. Web annotation marries an ancient tradition—underlining passages in books, writing glosses in their margins—to modern publishing that's online and social.[2] My company, Hypothes.is (https://hypothes.is), is among those enterprises that are developing web annotation software used to highlight online evidence, attach notes to the highlights, and discuss the cited passages in groups or on the open web. Unlike comments at the bottom of online news stories, or in Twitter replies, or in Facebook posts, such annotations appear in overlays that are separate from—but precisely connected to—the evidence to which they refer.

The creator of one such overlay is Climate Feedback (http://climatefeedback.org/), a group of scientists who vet mainstream reporting on climate change. When a Climate Feedback scientist evaluates a climate-related claim in the *Wall Street Journal*, for example, readers using annotation-aware browsers see that expert gloss directly on the *WSJ* web page. Sites may or may not choose to invite this kind of intimate analysis. But the web's open architecture guarantees that one way or another, it's possible to create and share authoritative overlays. Annotation tools and services are converging on open standards that will enable them to work with one another,[3] just as different kinds of web browser and email clients are able to work with different kinds of web and email servers. This movement toward open and interoperable web annotation sets the stage for a democratization of the scholarly arts of close reading, line-by-line analysis, and accurate citation.

Here are some of the ways teachers use web annotation:

- To prepopulate an online text with questions for students to answer
- To mark and explain rhetorical strategies
- To teach students to check facts, trace provenance, and evaluate sources[4]

In 2017 the need to teach fact-checking and source analysis looms larger than ever. Among the responses to that need, Mike Caulfield, 2017 editor of this New Horizons series of columns in *EDUCAUSE Review*, has launched the Digital Polarization Initiative (http://digipo.io). It's a template for a cross-institutional course in which students learn how to evaluate claims in news stories. Here's a sample claim: "Minnesota Affordable Care Act insurance premiums increased by up to 66% last year." A student begins by citing the claim itself, using an annotation tool to select the statement as it appears in the story and to create an annotation that *anchors* to the claim. The annotation is represented by a link that points not just to the page but, more precisely, to the highlighted statement within the page. This *direct link*[5] captures context, and because each annotation can grow a discussion thread, it enables students to work together in that context.

From there, the investigation moves upstream to discover and cite the sources on which the story relies and laterally to gather the background information needed to evaluate the claim and its sources. A single investigation may require students to find, organize, and present evidence found online in dozens of HTML or PDF documents. For each document, the student may need to cite several statements, ideally using annotations to point to them directly. Once all this evidence has been gathered and organized, the student draws on it to write an analysis, which may conclude that the claim is true, false, or indeterminate.

The Digital Polarization Initiative aims to inculcate both traditional and modern literacies. Footnotes and bibliographies belong to a tradition that we must preserve and adapt for the web. Evaluating the sources noted and listed, though, requires some genuinely new skills. To help students master them, we at Hypothes.is have created the DigiPo toolkit.[6] It's a Chrome extension that embodies best practices for fact-checkers and works closely with the DigiPo wiki widgets that display annotation-based evidence.

To evaluate the reputation of an unfamiliar website, for example, students are taught to use an advanced search that excludes that site's own pages from search results. The toolkit keeps that Google query handy, just a right-click away. Another right-click option sends a selected statement to a set of fact-checking web-

New Horizons Editor: **Michael Caulfield**

By JON UDELL

sites. Because not all sources are available online, yet another right-click option sends a book title to the Online Computer Library Center's WorldCat service, which may report that a copy is available in the student's local library. Fact-checking is hard work! When there's a lot of evidence to process, these affordances help streamline the process.

These helpers also build an awareness of capabilities that can make students more competent web citizens and thus better critical thinkers. "Many assume that because young people are fluent in social media they are equally savvy about what they find there," the Stanford History Education Group wrote in a recent report. "Our work shows the opposite."[7] So we need to teach students how to debunk fake news, know when they are reading sponsored content, and separate national newspapers of record from fringe publications.

More broadly, we need to lay a foundation for evidence-based reasoning in social, professional, and civic realms. Students must know how to marshal and manage growing bodies of evidence distributed around the web. To that end, the DigiPo toolkit also provides right-click options that embody best practices for web information management.

Here's an underappreciated best practice: if you tag a set of documents consistently, you create a collection that can be cited with a URL that queries for the tag. In the Digital Polarization Initiative projects, every investigation happens on its own wiki page. When annotations are tagged with the name of the wiki page, they appear in several collections included in the page. One collection gathers all of the evidence that supports the investigation. Another arranges a subset of the evidence on a timeline so that investigators (and readers) can reason about the history of the topic. Students could assign those tags manually, but that's awkward and error-prone. So right-click options to tag a source page (or a selected claim) offer a list of current investigations. Selecting from the list is an easy way to add evidence to collections. It also teaches controlled naming, a form of digital literacy that, like the advanced Google queries mentioned earlier, won't always be so helpfully supported with training wheels.

Other best practices are emerging as web annotation matures:

- Cite evidence using links that resolve to quotes in context
- Work with others in annotation layers that gather and enhance dispersed web resources
- Use annotation tools that are open, standard, and interoperable

What the Digital Polarization Initiative aims to teach, above all, is a set of strategies for evaluating claims: go upstream, read laterally, check sources, marshal evidence. If higher education can build consensus around those strategies and the digital literacies that support them, it will help us establish "some sort of curating function that people can agree to." ■

Notes

1. "White House Frontiers Conference" (video), Pittsburgh, PA, October 13, 2016; "Remarks by the President in Opening Remarks and Panel Discussion at White House Frontiers Conference" (transcript), Office of the Press Secretary, The White House, October 13, 2016.
2. For more on web annotation, see the W3C Web Annotation Working Group web page.
3. See "Web Annotation Data Model," W3C Proposed Recommendation, January 17, 2017.
4. Jeremy Dean, "Back to School with Annotation: 10 Ways to Annotate with Students," Hypothes.is blog, August 25, 2015.
5. Bob Salera, "Huge Obamacare Premium Increases in Minnesota: Where are Rick Nolan and Angie Craig?" NRCC blog, September 1, 2016 (Hypothes.is annotated version).
6. Jon Udell, "A Hypothesis-Powered Toolkit for Fact Checkers," Hypothes.is blog, January 17, 2017.
7. Stanford History Education Group, "Evaluating Information: The Cornerstone of Civic Online Reasoning," November 22, 2016, p. 7 (Hypothes.is annotated version).

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Is It Déjà Vu All Over Again?

In 2002, the EDUCAUSE Center for Applied Research (ECAR) published "The Promise and Performance of Enterprise Systems for Higher Education," by Robert Kvavik, Richard Katz, and others. In it the authors estimated that more than $5 billion had been spent on administrative and ERP (enterprise resource planning) systems.[1] One can only imagine what has been spent since then—and what is being spent this year and what will be spent in the coming years. Whatever the amount, it is likely to be very substantial.

When the Kvavik and Katz data gets resurrected at a discussion around the water cooler or at conferences these days, the reactions range from "so what, that's the cost of doing business" to "hmmm, I didn't know that, I wonder what we spent" to "you have got to be kidding me, that can't be right." What seems the most striking is that we don't know if the money spent was too much, too little, or just right. We have a hard time showing, in a verifiable way, that the benefits exceeded the cost of implementing the new systems. Regardless of the reaction, we seem poised to do it all over again.

> Higher education must avoid the déjà vu of repeating the system implementation mistakes from years past.

Even more troubling than the amount spent, Kvavik and Katz reported that many of the projects that contributed to the $5 billion price tag failed in that they came in over budget, took longer than planned, or did not deliver the expected value. Why? Kvavik and Katz explain:

> External forces such as quality of software or consulting were found to be less influential than internal forces. When asked, these institutions revealed that the major obstacles to completion were mostly internal to the institution. They include data issues, cultural resistance to change, and lack of understanding of software capabilities. The realization that the greatest implementation challenges are the result of internal institutional issues—not external forces—contradicts a popular message prevalent in the industry for the past few years. It's interesting to discover that the institutions themselves—their cultures, their people, and their historical decisions—are the primary hurdle to clear for a successful implementation, not the technology, the consultants, or the vendors.[2]

In other words, the project aspects over which we had absolute control were the most frequent causes of failure. No wonder, then, that in a recent discussion Vicki Tambellini, a widely regarded expert in the higher education software market, noted that a number of institutions seem to be deliberately waiting to replace or upgrade these systems. As she has tried to understand why, she has learned that most of them anticipate making significant investments in administrative systems in the coming three to five years and are waiting to see what shakes out in the software (tool) marketplace. Specifically, many are watching the emergence of cloud-based software vendors, otherwise known as Software as a Service (SaaS).[3] What is troubling, however, is that most appear to be preparing to make another "silver bullet" bet, thinking all they need to worry about is picking the right software tool to be successful. In other words, they are concerned with external forces, which Kvavik and Katz found to be "less influential." There appears to be little happening in terms of dealing with internal forces—the "major obstacles" to which Kvavik and Katz refer.

Given that many of us had the "good fortune" of being involved in the first round of investing in large enterprise systems, it seems wise to reflect on what we learned (or should have learned) and what we plan to do differently going forward as a result of our reflecting on past system implementations. My reflections have resulted in reminding myself of the following well-tested rules for successful system implementations:

- *System = well-aligned process, data, people, and tools.* Too often when we see the word *system,* our partners think *software tool* and we as CIOs seem to just shrug our shoulders and go along, not wanting to rock the boat. Remember what Kvavik and Katz noted: that the major obstacles to the successful completion of implementing an enterprise system were mostly internal to the institution. In other words, the obstacles are *process, data,* and *people*. Resetting the definition of *system* in higher education has become a bit of a mission for me. As I have tried to make my point to my colleagues, I have printed (on a 3D printer) tetrahedrons with *process* printed on one side, *data* on another side, *people* on another, and *tool* on the fourth side.[4] Handing these out allows me to talk about the need to align these four components of a system. It seems to help people get the message, and it creates the opportunity for me to make the next point.

Viewpoints Editor: **Klara Jelinkova**

By ERIC DENNA

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- *Process and data first, then people, then tools.* Industry has learned that we focus first on process and data, then we clarify people's roles in the new process, and then we design/configure the tool for people to use in implementing the process and data. Too often organizations think that they can simply install a new tool and then the process, data, and people issues will resolve themselves. For decades we have known that process and data need to come first, yet we keep breaking picks on this principle etched in stone.
- *Automate, don't just augment.* If there is one thing I have seen too often in higher education it is that we use technology to simply augment people's administrative work instead of rethinking the process, data, and people's roles and striving to automate work whenever possible. When we augment instead of automate, we often add cost to the current process and actually make the process harder to change. We should be ambitious partners with administrative leadership to bend the cost curve of administration and not just apply technology for technology's sake.

Some may wonder whether it is the domain of the CIO to be fiddling with process and people issues in system design and implementation. Aren't we technologists? Let me conclude with a thought about this issue.

For me, the title Chief Information Officer is a misnomer. I would argue that our title should be Chief *Integration* Officer. We have a fundamental responsibility to see that an institution pays careful attention to the processes and people roles, not just to data and tools. Why, you may ask? Processes span organizational boundaries. For example, think of all the different organizations that play a part in admitting a student. Certainly the admissions department has a major role. However, many other organizations are often involved as well: financial aid, international studies, the bursar/controller function, housing, food services, parking, legal, and don't forget athletics if the prospective student is an athlete. Whether procure-to-pay, hiring, planning, or virtually any other process, the challenge is integrating all the design requirements across organizational boundaries.

If someone does not help integrate the process requirements across all the various organizations and functions, the institution will face significant challenges (e.g., cost overruns, time overruns, or undelivered functionality) when implementing a new tool as part of implementing a new system. Few organizations have the breadth and depth of exposure to the entire institution as does the IT organization. This is a tremendous opportunity that should be seized.

I fear that if CIOs do not step up and lead in the design of enterprise processes, we will be one step closer to the CIO becoming more a director of infrastructure than a critical partner in the president's cabinet. This is the primary reason that a growing number of CIOs are sponsoring a process innovation team that helps the college or university rethink the nature of its processes. Doing so will keep the CIO in the middle of any transformation effort rather than being relegated to the "tech person." And doing so will help higher education avoid the déjà vu of repeating the mistakes from years past. ■

Notes

1. Robert B. Kvavik, Richard N. Katz, et al., "The Promise and Performance of Enterprise Systems for Higher Education," *ECAR Research Study*, vol. 4, 2002, 17.
2. Ibid., 16.
3. Vicki Tambellini, conversation with the author, November 8, 2016.
4. If you want the file for printing these on your own, email me and I will send you a copy.

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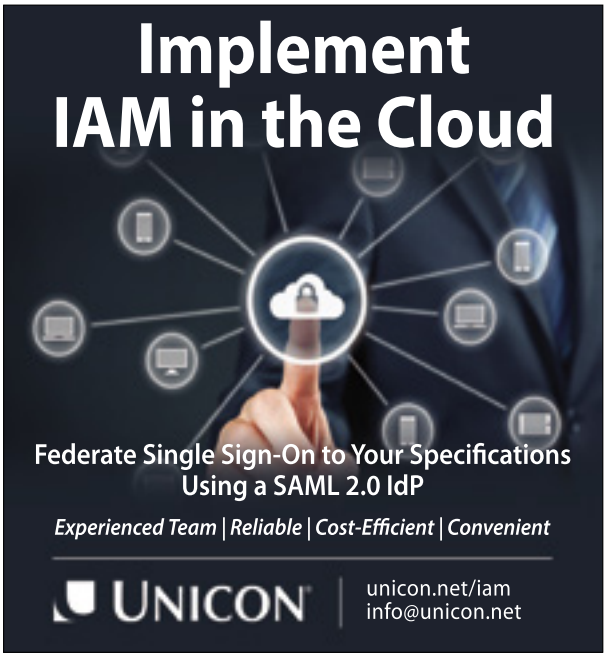

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