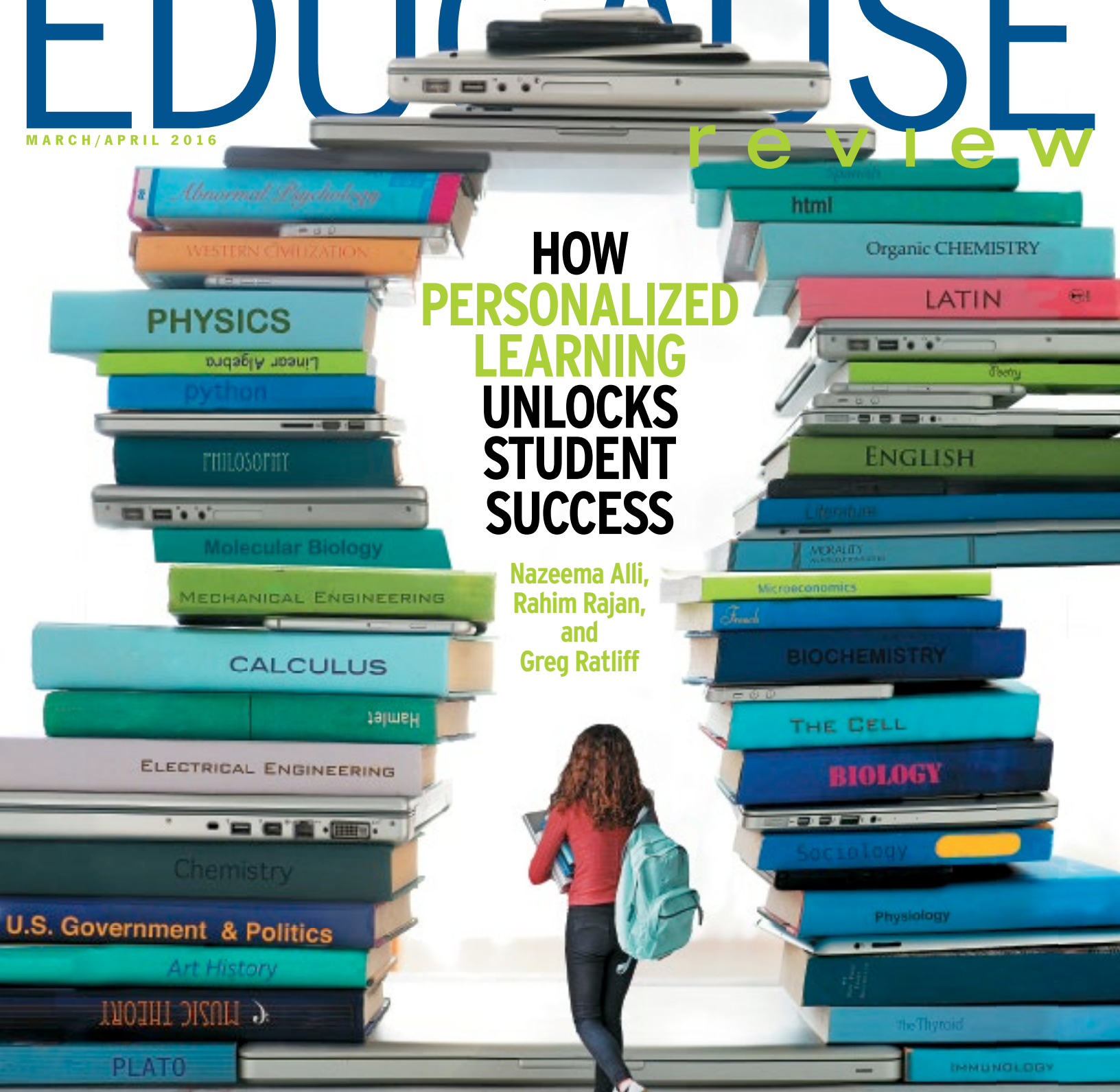
Why IT Matters to Higher Education

EDUCAUSE review

MARCH/APRIL 2016



HOW PERSONALIZED LEARNING UNLOCKS STUDENT SUCCESS

Nazeema Alli, Rahim Rajan, and Greg Ratliff

Personalized Learning: What It Really Is and Why It Really Matters

Michael Feldstein and Phil Hill

From Written to Digital: The New Literacy

Phil Ventimiglia and George Pullman

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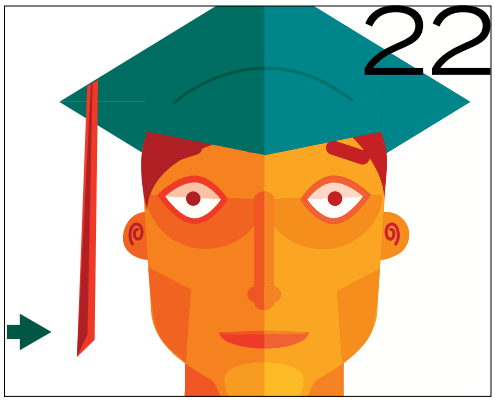

Why IT Matters to Higher Education
EDUCAUSE review

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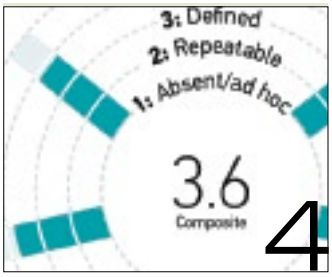

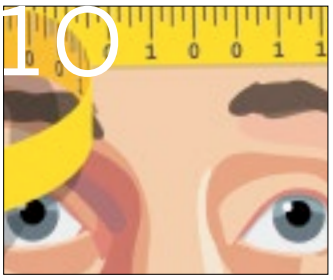

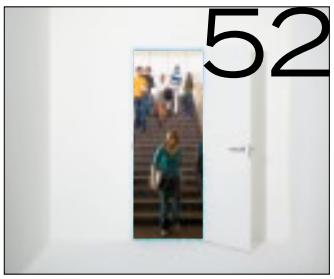

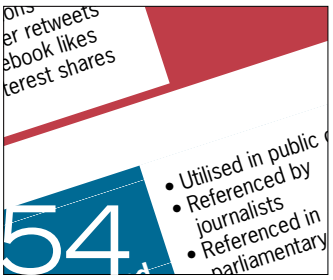

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By JOHN O'BRIEN

Personalized Learning: People, Practices, and Products

The transformation under way at the point where teaching, learning, and technology intersect is so promising and so complicated that it is no wonder those of us involved in talking and writing about these developments are looking for the perfect turn of phrase to bring it all together. It's our nature to seek out words to attach to the issues that matter, an inclination clearly at work within the universe of activities collected under the term *personalized learning*. The desire to name important trends in the technology landscape is hardly new: EDUCAUSE has made important contributions to the effort, capturing the imagination of the higher ed IT community by furthering both the idea of technology as a "game-changer" and the concept of "connected learning."

Yet when it comes to personalized learning as a transformational trend in higher education, we're not all sitting around and waiting for the right phrase to come along before springing into action. Spring has sprung—with activity, research, debate, and hype all fully in progress. Curiously, we appear to be searching for a flag to rally around even as we acknowledge that expectations for personalized learning are exceedingly high—and it either is exerting a major influence over or is already incorporated into IT strategy at 21 percent of colleges and universities surveyed.[1]

It's our nature to seek out words to attach to the issues that matter, an inclination clearly at work within the universe of activities collected under the term *personalized learning*.

For those of you who, like me, attended college at some point between the time of mood rings and the Internet, we certainly had plenty of opportunity to experience what personalization was *not*: being herded at registration from table to table to gather papers, sign documents, collect carbon copies, and generally do what we were told to do—before being shunted off to another table, office, or building. Notwithstanding this initial experience, our favorite staff and professors were the ones who personalized our experience. They recognized us by name and changed their teaching approach as they better understood our individual learning needs. I would meet Dr. Lucy Fryxell in her office to talk over some fine point of her inscrutable *Advanced Grammars* textbook, and a few days later in class she would work into her lecture some of the very same problems we had discussed in person. *Voila!* "Personalized learning."

The term *personalized learning* is both ambiguous and new, but the practice is not. What is new is the way that emerging technologies can amplify the experience, especially with the help of good course design and excellent execution. The articles featured in this issue of *EDUCAUSE Review* may debate various elements of how personalized learning can be deployed, but the many powerful examples of personalized learning in action speak for themselves.

In "How Personalized Learning Unlocks Student Success," Nazeema Alli, Rahim Rajan, and Greg Ratliff from the Bill & Melinda Gates Foundation note that student-centric approaches address the need for social justice and equity for underrepresented students. Pointing out that family income is currently one of the strongest predictors of whether a student will be successful, they advocate for personalized approaches, convinced that more individualized support will help to balance the scales. They report that some practices under the personalized learning umbrella—notably digital courseware and adaptive learning—can accelerate content mastery by 50 percent and can increase pass rates by one-third for at-risk students taking high-quality blended courses. Integrated Planning and Advising for Student Success (iPASS) systems, such as those supported by grants distributed by EDUCAUSE (http://www.educause.edu/library/integrated-planning-and-advising-for-student-success-ipass), also show particular promise. Arizona State University, for example, saw an 11.6 percentage point increase in its six-year graduation rate, and early results from the first round of iPASS

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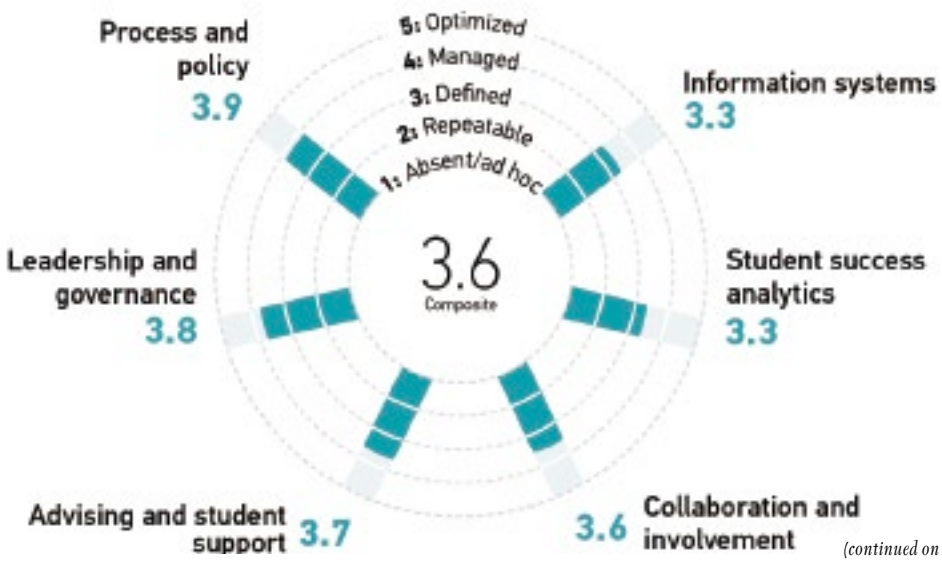
programs indicate a boost in retention rates of up to 10 percent. Similarly, Austin Community College found strong gains resulting from its movement from an analog to digital advising system.

In "Personalized Learning: What It Really Is and Why It Really Matters," Michael Feldstein and Phil Hill write that we should "think of personalized learning as a *practice* rather than a *product*." Essex County College, they point out, successfully redesigned a developmental math course with personalized learning approaches, yet the resulting benefits were not limited to the technology-enabled interactions: the redesign freed up time for faculty to meet individually with students to discuss their goals and progress. Redesigning courses should be the focus of the conversation around personalized learning, with technology as an important part, but only a part, of this larger picture. Likewise, the success of the large lecture course redesign at the University of California, Davis, extended beyond the technology itself and created new opportunities to connect with students: "Once again, in contrast to marketing pitches and popular narratives, the software played only a supporting role, albeit an important one." When we are disabused of the notion that simply procuring personalized learning technology is enough, the crucial work of course redesign can begin, for which Feldstein and Hill offer advice, nearly all of it related to people and practices—not products.

Moving on from practice, Phil Ventimiglia and George Pullman stress, in "From Written to Digital: The New Literacy," the importance of focusing not only on *how* we teach but also on *what* we teach. They suggest that whether a course deploys personalized, adaptive, differentiated, competency-based, or some other learning approach, course design and course content are crucial. Redesigning courses for digital literacy encourages intellectual independence: "The goal is to teach students how to think in digital ways in order to make informed technological decisions and even, in some cases, to develop their own technology." One way to do so, they note, is by encouraging students to write code. As Ventimiglia and Pullman explain: "One of the chief intellectual transformations that shifting from traditional written literacy to digital literacy requires is recognizing the difference between dynamic and static content."

EDUCAUSE research has shown that institution-wide collaboration beyond the technology itself is crucial. After all, launching an early-alert system is a waste of dollars and bytes if faculty don't use the tool in their courses, and the same dynamic holds true again and again. The EDUCAUSE Benchmarking Service, with its new maturity and technology deployment indices, makes this point in compelling ways (http://www.educause.edu/benchmarking). The student success technologies maturity index (see figure 1) provides an example. Staff wondering how far along a college or university is in its efforts to

FIGURE 1. Student Success Technologies Maturity Index



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improve student success technologies will immediately see that technology (information systems) is only a part of the broader puzzle that includes policy, leadership, student support, analytics, and collaboration. Managing change is not about technology alone; it is about the productive interaction of people, processes, and technology.

One would hope that none of this is a surprise in 2016. In the 1990s, I witnessed the great scramble to "throw up more courses on the web"—as I heard more than once (without irony). We imagined that the new technologies would solve so many problems, from overfilled parking lots to underfunded budgets. Since that time, I hope we have come to better understand that the most transformative technologies enable solutions that can't be realized without people taking the lead. In the case of personalized learning, we should let the genuine excitement and also the hype launch us forward, but without leaving people behind. With thousands of students falling short of realizing their academic hopes and dreams every semester, the stakes are too high to get this one wrong.

Note

1. New Media Consortium and EDUCAUSE Learning Initiative, *Horizon Report: 2015 Higher Education Edition*, https://net.educause.edu/ir/library/pdf/HR2015.pdf; Susan Grajek, *Trend Watch 2016* (ECAR, forthcoming).

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


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Personalized Learning: Toward a Grand Unifying Theory

The current context of personalized learning is technologically mediated curriculum that produces customized instruction in order to support optimal learning outcomes. Whether simple Boolean logic or advanced artificial intelligence and deep-data analytics, the engagement of personalized learning typically establishes learning pathways through assessments that identify learner deficits with the application of strategies, resources, and engagement to improve performance. The *NMC Horizon Report: 2015 Higher Education Edition* recognizes the importance of digitally driven personalization as a major trend in higher education, albeit with strong challenges for its nascent data-derived, scientific approach for improving student outcomes through customized learning experiences.[1] The report focuses on instruction as the center of personalized learning, but that is only one part of the mix needed to help students succeed. There is synergy waiting to happen if these processes for personalization occur not within a silo, but as an organic system of many data sources that collectively impact student success. After all, the same student being tracked and evaluated while using an adaptive courseware product has a digital footprint and legacy that extends well beyond the parameters of a singularly focused electronic learning environment.

In this age of big data analytics, the view of personalized learning as being centered on learning technologies invites only a limited opportunity for using the rich digital dossier of today's students to promote their success. Indeed, the definition of *personalized learning* can easily expand to include the digital footprint that a student creates in the journey toward an educational goal. This consideration of multiple inputs that influence success along a student's life cycle is not new. Indeed, it is considered within the scope of enquiry used to validate the educational practices and student outcomes in two of the most common measures of student engagement in the United States: the Community College Survey of Student Engagement (http://www.ccsse.org/) and the National Survey of Student Engagement (http://nsse.indiana.edu/). In measuring the practices that best support learning outcomes, these instruments reach for data not just potentially available through annual assessment but also already sitting and waiting to be ingested in real time from a multitude of technological interactions.[2] The NSSE unequivocally models this holistic view of student life by measuring the quality of outcomes through utilization of institutional resources, curriculum, and learning outcomes.

A Welcome Mat for Big Brother

More than a half-century ago, John W. Tukey asked: "What of the future? The future of data analysis can involve great progress, the overcoming of real difficulties, and the provision of a great service to all fields of science and technology. Will it? That remains to us, to our willingness to take up the rocky road of real problems in preference to the smooth road of unreal assumptions, arbitrary criteria, and abstract results without real attachments. Who is for the challenge?"[3]

The challenge has certainly been answered through the emergence of platforms that have realized the future of data analysis in higher education. Systems in the first generation of big data analytics platforms are integrating multiple data sources in order to personalize and inform actions that further student retention and completion. The landmark work started by the Predictive Analytics Reporting (PAR) Framework (http://www.parframework.org/) reflects this vision of personalization for students in an analytical engine that uses common data definitions and very large data sets to provision actionable information on student risk factors. Moreover, PAR is notable in that it provides cross-walking from student success challenges to resources that have been vetted for effectiveness through the data-driven institutional responses of multiple institutions (the Student Success Matrix).

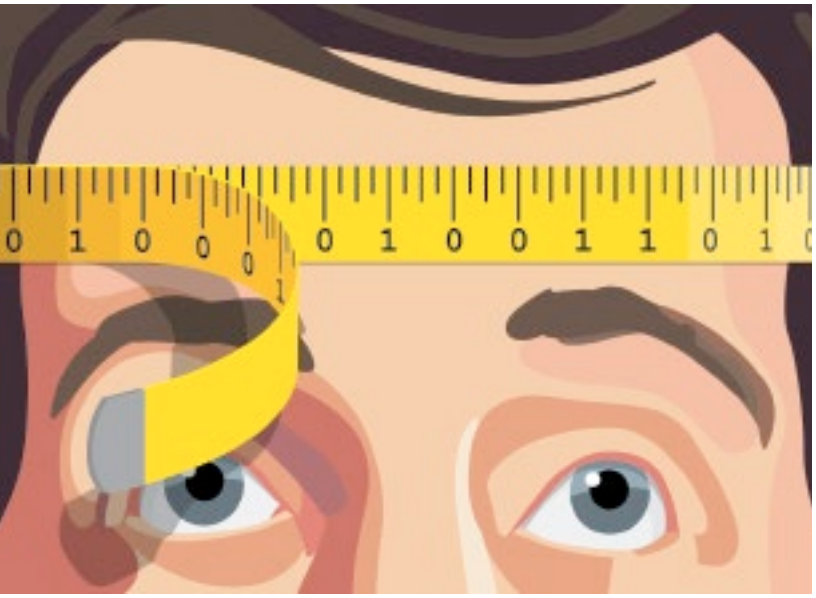
Civitas, a growing provider of big data analytical solutions for higher education, succinctly leverages "the best of data science, sophisticated predictive analytics, and machine learning" to ensure the individuality of interactions, interventions, and relationships between students, faculty, advisers, and ultimately administration (https://www.civitaslearning.com/about). Personalization extends to digesting data and providing students with the models to diagnose the time, financial, and credential implications of their choices. Civitas exemplifies the broader approach to data science and predictive analytics, drawing on multiple data sources to personalize and improve student completion. Examples of data sources now being brought into the mix extend beyond the student information system (SIS) to include the learning management system (LMS), smart card swipe activity, housing and demographics, library usage, and external data repositories.

The Education Advisory Board (https://www.eab.com), which provides consultative and technological solutions for higher education, has also entered the analytics-based platform development to harness big data for personalized support and guidance during the student life cycle. This includes bumpers that keep students away from excess credits, holistic data-driven academic planning and scheduling, and personalized advising. Although this may seem less idyllic or not even vital to

By DAVID SHULMAN

some sectors of higher education, for workforce-driven schools and those institutions with performance metrics that emphasize completion and job placement, this is certainly a welcome trend toward better outcomes for students.

With the emerging solutions just referenced, it's not difficult to imagine the not-too-distant future where a student's educational homeostasis is being maintained through the unified workings of e-learning technologies, recruitment systems, large student data sets, governmental resources, and college recruitment and onboarding platforms. Consider too the implications for personalizing educational services through a common state or even national student identifier that would follow students as intimately as their social security number—from their earliest days of schooling through college. At this point of evolution, the processes can begin to inform administrative and policy decisions. This scenario may produce an Orwellian image, but in reality it more closely resembles the ever-tighter coordination of personal data already feeding governmental and commercial entities. If a state or national common identifier



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becomes the key to relational data sources such as SIS, LMS, CRM, ERP, educational clearinghouses (and the list goes on), imagine the altruistic opportunities to personalize the student learning experience. Even facilities data could be mined and interpolated to provide optimal conditions for, as an example, disabled students. Apart from addressing ADA accommodations, why not also personalize the experience of special needs students by predictively plotting preferred distances to classes and by improving campus accessibility? Imagine the potential for informed leadership that, with a paramount goal of student success, could embrace highly productive, agile modeling for resource allocation with the greatest return on investment. It is little wonder that the data scientist has become a treasured commodity: the median salary in May 2014 for computer and information research scientists was $108,360, with job growth through 2024 expected to grow 11 percent, significantly more than the average growth for all occupations.[4]

In Closing: Leadership Counts

Perhaps I'm a dreamer for imagining a future state of personalized learning that can effectively tap the requisite data sources in order to ensure that each learner can reach his or her academic potential in the most efficient, customized way. However, whether cosmological or technological, human purpose coalesces around systemization and the normalcy of ontologies to understand our universe. While physicists view a grand unifying theory informing the questions of the universe, policymakers, college administrators, faculty, and students would most likely experience this system unification as a framework pulling together a personalized digital profile that most effectively guides each learner to success. The process has already begun with the emergence of the first data science platforms dedicated to higher education success through prototypes and visualizations now showing promise for realizing improved outcomes.

Even though I may be holding out for a grand unification of academic technologies and big data to support our students, the most important part of this quest will be leadership—and quite possibly leadership in roles that may not yet exist. All the elements are in place, from the ever-growing social and academic footprint of each student to the emergence of data science. It is unlikely that any single platform will ever fulfill the potential of an increasingly data-rich world by seamlessly melding social, educational, economic, historical, and even psychological data sources into a force for student success. Rather, it will remain the task of visionary leadership to incorporate personalized learning into a grand unifying theory—to build both the culture and the systems needed to combine these data sources into an effective analytical engine for student success. ■

Notes

1. New Media Consortium and EDUCAUSE Learning Initiative, *Horizon Report: 2015 Higher Education Edition*, https://net.educause.edu/ir/library/pdf/HR2015.pdf.
2. See Kay McClenney, C. Nathan Marti, and Courtney Adkins, "Student Engagement and Student Outcomes: Key Findings from CCSSE Validation Research" [2007], https://www.ccsse.org/aboutsurvey/docs/CCSSE%20Validation%20Summary.pdf.
3. John W. Tukey, "The Future of Data Analysis," *Annals of Mathematical Statistics* 33, no. 1 (1962), 64, http://projecteuclid.org/download/pdf_1/euclid.aoms/1177704711.
4. Bureau of Labor Statistics, "Computer and Information Research Scientists," *Occupational Outlook Handbook*, December 17, 2015, http://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm.

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HOW PERSONALIZED LEARNING Unlocks Student Success

By Nazeema Alli, Rahim Rajan, and Greg Ratliff

Over the past few decades, the profile of the typical college/university student has changed dramatically. Higher education needs to evolve as well. Members of today's new student majority—including students from low-income backgrounds, first-generation college-goers, students over the age of twenty-five, and students of color—demand a learning environment that is more *personalized*. That is, they require learning that is more specific to their individual needs and goals.

Fortunately, technology provides educators and administrators with tools that can tailor the learning experience to the individual, help at-risk students master core skills, and develop guided pathways that assess students' progress toward graduation and suggest interventions if challenges arise along the way. Although much must be done in order to implement the needed changes for personalized learning, the vision and evidence for unlocking student success drives us forward.

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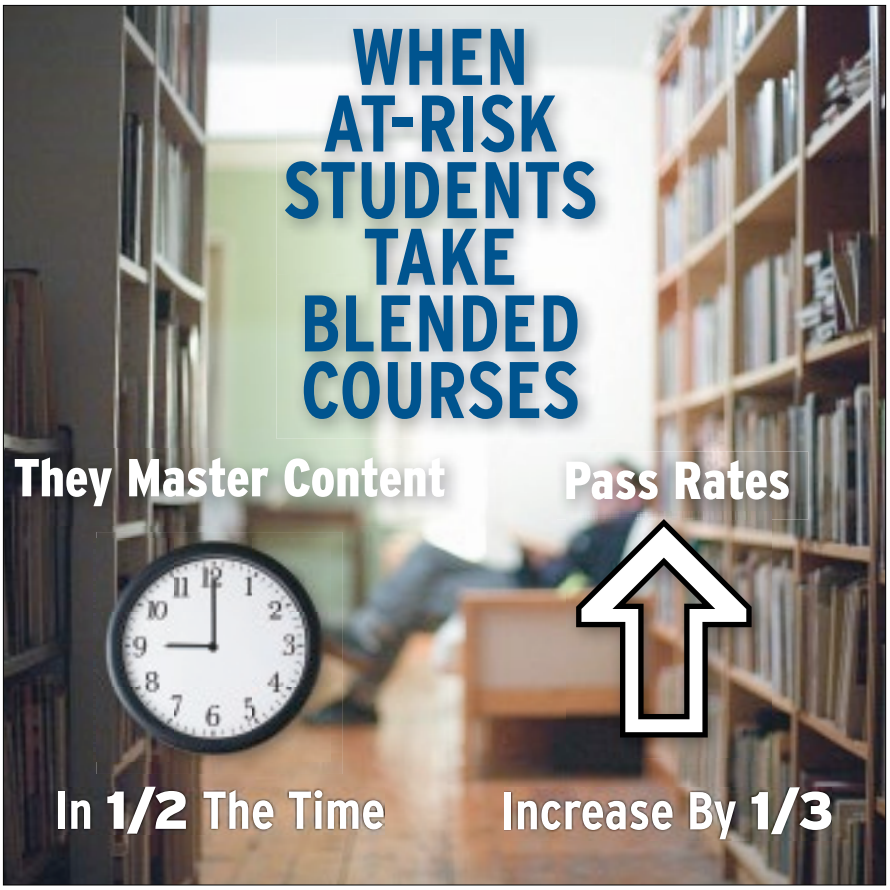

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Why College?

Completing a postsecondary program has never been more important—both to whether a student will thrive or struggle and to whether the U.S. economy will grow or stagnate. Students with a postsecondary credential or degree are more likely to be healthy, employed, and civically engaged. With each step of the educational ladder they complete, their average earnings also increase.[1]

By 2020, 65 percent of all jobs in the United States will require a postsecondary credential. Yet in 2013, only about 40 percent of working-age Americans had one.[2] Consequently, colleges and universities are under intense pressure to increase retention and completion rates.

At the same time, today's students come from diverse backgrounds, face unique challenges, and often juggle numerous responsibilities in addition to their studies:

- 40 percent are over the age of twenty-five.
- Nearly 40 percent are the first in their family to go to college.
- 40 percent of full-time students and 76 percent of part-time students work while going to college.
- 38 percent are part-time students.
- 26 percent are raising dependent children.[3]

This increasingly varied student population makes it more important than ever to ensure that those of us in higher education not only are helping students complete their higher education but also are doing everything we can so that colleges and universities are ready to meet the needs of today's students.

Getting to and through College

Enrollment in postsecondary education has grown by more than 50 percent over the last twenty-five years. However, over the past twenty years, more than 31 million Americans—15 percent of today's working-age population—left college without earning a certificate or degree, and millions more are dropping out every year.[4]

According to ACT, freshman/sophomore-year retention rates range from 55 percent (for two-year colleges) to 64 percent (for non-selective four-year institutions).[5] And according to the National Center for Education Statistics (NCES), the completion rate for first-time, full-time undergraduate students who began their pursuit of a certificate or associate's degree in fall 2010 was just 29 percent. The completion rate for first-time, full-time students who began seeking a bachelor's degree in fall 2007 was 59 percent.[6] These statistics are troubling, and unless they change significantly, the U.S. economy will face a shortage of workers with postsecondary education.

Unfortunately, one of the strongest predictors of whether a student will complete a degree or certificate is not his or her intelligence, test scores, or grit, but family income.[7] The hard truth is that although higher education has unique potential to be a bridge to opportunity and the middle class, it too often serves as a barrier.

The goal of the Bill & Melinda Gates Foundation is to ensure that students complete a postsecondary program that helps them support themselves, engage in their communities, and achieve their dreams. Our partners and grantees are tackling the challenge of how best to adapt to the new student majority. Their research shows that personalized learning can help students, especially underserved students, complete a certificate or degree.

What Is Personalized Learning?

Rather than trying to apply a one-size-fits-all approach to education, personalized learning offers students an individualized approach that is specific to their preexisting knowledge, learning needs, and goals. Students learn best when their education is targeted and


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tailored to them.[8] Examples of personalized learning activities that have been demonstrated to improve student outcomes include:

- adapting the scope of instruction based on assessments of students' existing knowledge, skills, and gaps;
- using personalized hints or prompts that support students during learning activities or assessment items;
- prompting learners to generate explanations of how they have approached an activity (e.g., "show work");
- employing algorithms that adapt the presentation of content based on relevance to learners' goals; and
- adapting the complexity or presentation of content based on a student's learning.

Research shows that powerful new teaching, learning, and advising tools can help advisors and educators to be more personalized in how they instruct and advise students.

Research shows that powerful new teaching, learning, and advising tools can help advisors and educators to be more personalized in how they instruct and advise students.[9] A personalized learning approach and environment can engage students and provide timely feedback and robust student supports. This higher-quality teaching and advising can result in greater retention and in higher rates of program completion.

"Good" Personalized Learning

Imagine that students everywhere are able to receive the most effective adaptive instruction at a reasonable price, using technologies and resources that tailor the learning to the individual. What if all of higher education had a strong culture of continuous innovation focused on adaptive learning experiences responsive to individual learners' goals? What if new, innovative tools could make personalized education not only effective in terms of learning outcomes but also economically feasible?

Imagine that remedial and general education programs are personalized to suit the prior knowledge, skills, and personal interests of each student. In place of large, anonymous lecture classes where many first-generation and low-income students struggle, students could instead participate in interactive, blended courses where they would have access to continuously improving content, adaptive simulations, problem sets, and assessments.[10]

Imagine that instead of an emphasis on lectures, the entire higher education system devotes time and attention to helping students achieve fluency and mastery through greater one-on-one tutoring, targeted group instruction, peer support, and other resources. In such an environment, students could take ownership of their learning and achieve mastery at their own pace.

Imagine that compelling personalization tools and advising applications are readily available to all students so that they can track their progress and achieve their individual goals. These tools would serve as personalized maps that motivate and guide students along every juncture of their postsecondary educational experience. Advisors and faculty would also use these tools to see where students are struggling and where they are succeeding, allowing the advisors to make real-time adjustments, deploy critical learning interventions, and apply increased or different supports based on the needs of each student.

Personalized Learning Today

The good news is that this world of innovative personalized learning interventions already exists. The capabilities are out there, and once they are adopted by more higher education institutions, more students will receive a personalized education and be able to reach their full potential. Technologies that boost the development of student-centered pathways, improve student supports with predictive analytics, and improve learning outcomes are emerging at postsecondary institutions around the nation. In addition, a growing body of evidence is demonstrating that new technologies can personalize learning at an unprecedented scale.[11] At the foundation, we are working to accelerate the development of these technologies and to increase an understanding of how they can be used by faculty and advisors to help students achieve greater success on their way to a credential. From our grantees and research, we've learned that when at-risk students take high-quality blended courses (i.e., a combination of in-class and online courses) they can master the same amount of content in half the amount of time. We've also seen pass rates for at-risk students increase by one-third in blended courses.[12]

Digital Courseware

Within personalized learning, digital courseware is a powerful lever to increase accessibility and affordability for students. The foundation partners with learning education technology organizations and colleges/universities to develop and scale the adoption of next generation digital courseware

FIGURE 1. Features Associated with More Positive Effects on Learning

1. Breadth	Effects were greater for projects either designing or redesigning an entire course than for those developing supplemental resources or early alert systems.
2. Field of use	Effect estimates were greater for projects implemented mainly in community colleges than in 4-year colleges.
3. Learners' preparation level	Effects were greater for projects targeting students with weak rather than moderate or advanced preparation.
4. Subject area	Mathematics courses had more positive effect estimates than courses in other subject areas.
5. Student:instructor ratio	Courses of medium enrollment size had more positive effects than the smallest and largest courses.
6. Pacing	Effects were larger for self-paced courses than for classes using cohort pacing or a mix of cohort and individualized pacing.
7. Dominant student role	Courseware in which the student's role was working on problems or answering questions had more positive effects than those where most time online was devoted to reading or listening to a video lecture.
8. Individualized	Courseware individualizing instruction on the basis of student performance on embedded assessments had more positive effects than those offering individualization based on student choice or no individualization.
9. Mastery based	Courseware determining when students are ready for new material by applying a standard of mastery had stronger learning effects than courseware allowing students to choose their own learning paths.
10. Adaptive technology	Learning systems that adapt to the individual learner had large learning impact estimates.
11. Modality	Effects tended to be more positive for courses using a blended learning model with more than half of the instruction occurring online.

Source: Barbara Means, Vanessa Peters, and Ying Zheng, *Lessons from Five Years of Funding Digital Courseware*, exhibit 12. *Reprinted with permission.*

that delivers personalized learning. Through our Next Generation Courseware Challenge,[13] we are funding high-quality courseware solutions to help low-income students succeed in high-enrollment general education courses, where they often struggle.[14]

Adaptive Courseware

While the available evidence shows that adaptive digital courseware can yield better outcomes for learners, it also points to the possibility that these innovations may assist in reducing instructional costs by unlocking the potential of accelerated course completion.[15] Research also has been able to identify where and how adaptive learning can have the biggest impact (see figure 1), so that institutions and policymakers can make the most of their resources for increasing student success.

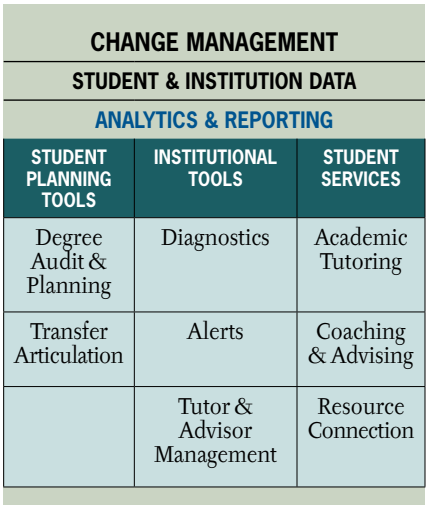
Integrated Planning and Advising for Student Success

Integrated Planning and Advising for Student Success (iPASS) gives students and administrators the data and information they need to plot a course toward a credential or degree, along with the ongoing assessments and nudges necessary to stay on course toward graduation. iPASS combines advising, degree planning, alerts, and interventions to help students navigate the path to a credential. These tools draw on predictive analytics to help counselors and advisors determine in advance whether a student is at risk of dropping or failing out, and it can help assist students in selecting courses (see figure 2).

Multiple studies have documented the impact that these types of tools can have on student success. "The Effects of Student Coaching in College" report found a 4 percentage point gain in completion from interventions such as iPASS—and often at lower cost than other types of interventions.[16] iPASS has also improved student success at early innovators like Arizona State University, which saw its graduation rate increase by 11.6 percentage points.[17] Furthermore, results from the first round of iPASS programs demonstrate an increase in full-time enrollment, which research finds leads to a greater likelihood of college competition.[18] Finally, the use of iPASS is tied to stronger advisor engagement, higher-quality data to guide and inform student plans, and increased likelihood of student success.[19]

One example of iPASS is Degree Map at Austin Community College (ACC). In 2011, ACC transitioned from an all-paper advising process to an e-advising system, in an effort to better track progress and conversations for its students. With Degree Map, students are engaged and

FIGURE 2. iPASS Taxonomy



Source: Gates Bryant, "Driving Toward a Degree: The Evolution of Planning and Advising in Higher Education," Tyton Partners paper, August 28, 2015, p. 9. *Reprinted with permission.*

FIGURE 3. Norris/Baer Framework: Optimizing Student Success through Analytics

ELEMENTS	DESCRIPTION	EXAMPLES
1. Manage the student pipeline	Scientifically refine strategic enrollment management of the student pipeline.	• Use data mining and predictive analytics to improve the recruitment, admission, and enrollment of entering students (raise numbers) and improve chances of student success; and • Use longitudinal and predictive analytics to craft policies for improving success of *at-risk students*.
2. Eliminate impediments to retention and student success	Eliminate structural, policy, and programmatic impediments to retention and success.	• Use analytics to support *comprehensive* first-year programs; • Eliminate bottlenecks in courses and program progressions; unreasonable pre-requisites and other requirements; and • Use predictive analytics to shape policies and practices to enhance retention in sophomore-senior years.
3. Utilize dynamic, predictive analytics to respond to at-risk behavior	Embed analytics in academic and administrative support processes to enable real-time interventions dealing with at-risk behaviors, both academic and co-curricular.	• Use dynamic, predictive analytics to determine at-risk behavior in courses early in the semester; • Embed predictive analytics in processes; and • Monitor levels of student engagement in academic and co-curricular activities and intervene with students who can be saved.
4. Evolve learner relationship management systems	Build tracking systems that can track and manage the many facets of learner progress and identify and respond to at-risk behavior.	• Create the learner equivalents of customer relationship management functionality, supported by predictive analytics; and • Extend dynamic, predictive analytics to learner relationship management.
5. Create personalized learning environments/ learning analytics	Embed personalized learning analytics into learning management systems and learner relationship management systems.	• Create personalized learning modes with embedded predictive performance analytics; • Use these analytics-rich systems to personalize learning outcomes; and • Create learning experiences reaching beyond formal curricula.
6. Engage in large-scale data mining	Use data mining to illuminate pathways to student success and discover unforeseen insights.	• Leverage data mining to drive predictive modelling in processes; • Use forensic data mining to explore unthought-of correlates of success; and • Engage in cross-institutional comparison and cross-sectoral comparison.
7. Extend student success to include learning, workforce, and life success	Expand the definition of student success to include the entire student lifecycle—cradle to career, including learning, work, learning-to-work transitions, and workforce success.	• Extend into Alumni analytics; • Undertake data mining spanning institutions, industries, and sectors; and • Pioneer pathway-to-success analysis.

Source: Donald Norris, Linda Baer, et al., *A Toolkit for Building Organizational Capacity for Analytics* (Strategic Initiatives, 2012), p. 34. *Reprinted with permission.*

have genuine conversations with their advisors. This advising system provides students with a clean, clear snapshot of their current degree plan; allows advisors and students to get a quick comparison of different degrees; and enables students and advisors to focus their efforts on elevating the advising conversation. ACC found that students who used Degree Map two or more times to plan their courses experienced a 3.3 percentage point increase in persistence over students who did not use Degree Map—rising up to a 7.3 percentage point increase when used five or more times.[20]

Today, the iPASS market includes over 100 vendors offering solutions that include components such as degree audit and planning, analytics and reporting, and alerts.[21] The strongest iPASS programs combine these tools to best support students, advisors, and faculty members. Working together with the Community College Research Center, and in partnership with technology providers and colleges/universities, the foundation supports the development of technologies that improve student retention through iPASS, recently helping to provide grant awards to twenty-four institutions that are transforming advising in higher education.[22]

Essentials for Successful Implementation

The successful implementation of personalized learning usually comes with a strategic shift at higher education institutions—from leaders to those working directly with students. As a result, the institution focuses on allocating resources and implementing business practices in a way that ensures each student's success. This requires that institutions and their leaders build core capabilities in student analytics and change management.

What underpins personalized learning and advising environments, however, is the use of learner analytics to drive institutional improvement around individual student success. This requires moving from the static data traditionally used for accountability purposes to gathering and

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using real-time learning and advising data, which can inform decision making for administrators, student supports, and students themselves. This type of data allows important stakeholders to make informed, action-oriented decisions and allocate resources for student success.

faculty, advisors, and other staff to learn to use new technologies and analytics. To be successful, institutions must move forward with administering business practices that better support student success (despite existing environmental constraints) and with fostering

students. However, it had experienced challenges in getting faculty to use the new tools and the network in a proactive way. One of QCC's ongoing challenges in change management will be enabling students to benefit earlier from the support network.

Swift and meaningful changes must be made to the outdated design of the postsecondary system in order to create the flexible and personalized learning environment needed by today's student majority.

The Norris/Baer Framework (see figure 3, p. 18) highlights the interdependence of different dimensions of the college/university when planning to use data for student success. For many institutions, transformation starts with engaging students, then collecting and using predictive data to inform retention, create learning environments, and support students moving into the workforce. Norris and Baer also offer a diagnostics review that institutions can use to determine how they should develop their analytics capabilities.

Change Management and Continuous Improvement

Personalized learning interventions cannot be effectively utilized and deployed without the connective tissue of organizational strategy and change management. This means aligning organizational processes such as strategic planning and capacity building. It also requires providing appropriate time, development, and supports for leaders, a culture of continuous improvement using the newly available tools.

An example is Queensborough Community College (QCC), which used Starfish Early Alert and Connect modules to create a network of student support services across the campus, including the Academic Literacy Center, the Campus Writing Center, the College Discovery Center, the Math Learning Center, and the Student Learning Center.[23] This Student Support Network gathers real-time feedback from faculty and students to guide students to the resources that are most pertinent to their needs at the right time. This has allowed a breakdown of silos between support services, as well as between faculty and students. The redesign also provided a structure that can respond intentionally to student needs with the right intervention resources available on campus. For example, QCC found that academic tutoring was one of the more promising interventions when delivered appropriately to at-risk

The Time Is Now

With more than 40 percent of first-time, full-time bachelor's degree-seeking students at four-year postsecondary institutions dropping out before finishing a certificate or degree within six years, we can't afford to stand by and do nothing.[24] Swift and meaningful changes must be made to the outdated design of the postsecondary system in order to create the flexible and personalized learning environment needed by today's student majority.

Benjamin Franklin is said to have observed: "Tell me and I forget; teach me and I remember; involve me and I learn." Personalized learning involves students in their own growth and encourages them to take ownership of their learning. The structured, individualized, and supported approach helps them see a clear and guided pathway to academic and career success.

Bringing personalized learning solutions to the broader U.S. higher

education system will require major system changes and buy-in from colleges and universities around the nation. We have no time to waste in unlocking student success. Students deserve the environment and supports that will help them reach their full potential and earn their higher education certificate or degree. ■

Notes
Yvonne Belanger, Julia Gray, Jason Palmer, and Tracy Sherman also contributed to this article.

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Photo by Brandon Hill

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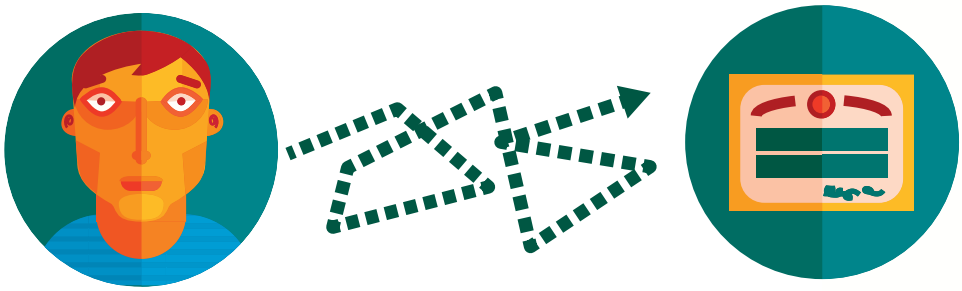
EDUCAUSE RESEARCH SNAPSHOT

PERSONALIZED PATHWAYS

THE CHALLENGE

Students take too long to graduate or don't graduate at all.



35% of students in bachelor's programs and just **10%** of students in associate's programs graduate on time.

THE SOLUTION

Integrated Planning and Advising for Student Success (iPASS)

Academic maps allow students to plan their course schedules with the most efficient and effective path to graduation and provide institutions with data to develop course schedules that align with students' plans.

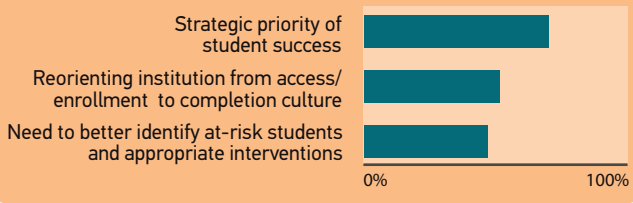
Progress tracking helps students stay on the path to degree or certificate completion, eliminating potential dead-end course registrations and reducing higher education cost and debt.

Advising/counseling provides students with access to campus resources, provides advisors and counselors with data about students, and reduces barriers to following up with students.

Early-alert systems enable faculty and advisors to send manual alerts or to trigger automated alerts providing students with reasons for the alert, recommendations, and next steps.

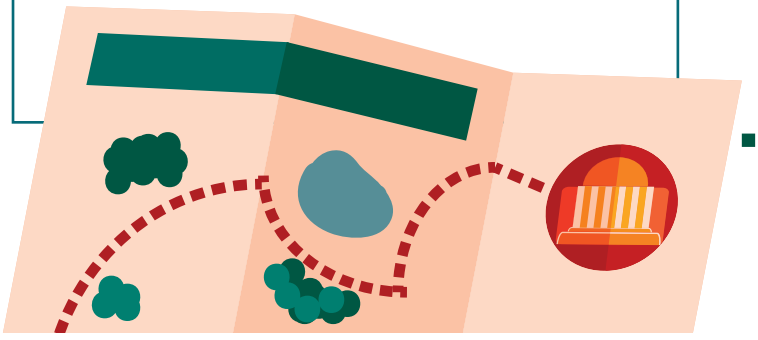
Why do institutions use iPASS solutions?

iPASS services account for an important part of student success initiatives. The top motivators for institutions to adopt them are:



[1]Complete College America, "Guided Pathways to Success: Boosting College Completion," Washington, DC, 2012, http://completecollege.org/docs/GPS_Summary_FINAL.pdf.

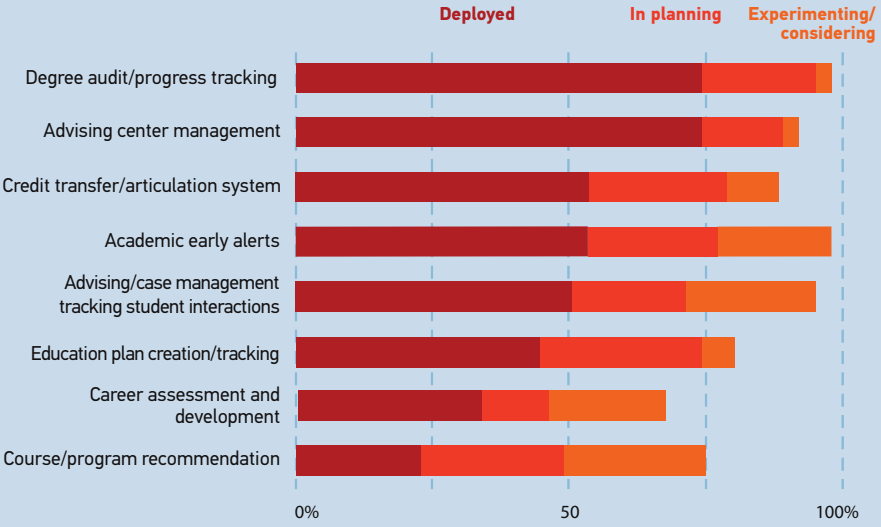
Retention of at-risk students **increased 10%** among pilot participants.
(Northeast Wisconsin Technical College)



Emerging tools and technologies help students make better-informed choices to reach their educational goals.

iPASS TOOLS

Numerous, wide-ranging tools and technologies support student success. Some have been more broadly adopted than others.



Deployment at a targeted set of early-adopter institutions using student success and iPASS tools

Students **prefer tech tools** for "formulaic" tasks like course registration but **prefer in-person support** from advisors for more complex tasks, such as planning courses and developing academic maps.[2]

These tools work to improve community college student outcomes.[3]

Students enrolled in a program utilizing iPASS tools

Students not enrolled in a program utilizing iPASS tools

Credits earned within 3 years	Completed associate's degree in 3 years	Transferred to 4-year institution within 3 years
48 credits	40%	25%
39	22	17

LEARNING ANALYTICS

Learning analytics and adaptive learning are up-and-coming technologies that many institutions are actively tracking.

Organizational maturity and technology deployment of student success analytics

34% of institutions have learning analytics in place or will within the year.

10% of institutions have mobile BI apps or dashboards available or will within the year.

[2]Hoori S. Kalamkarian and Melinda Mechur Karp, "Student Attitudes toward Technology-Mediated Advising Systems," CCRC Working Paper No. 82, August 2015, http://ccrc.tc.columbia.edu/publications/student-attitudes-technology-mediated-advising-systems.html.

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PERSONALIZED LEARNING: What It Really Is and Why It Really Matters

By Michael Feldstein and Phil Hill

Let's be honest: as an academic term of art, *personalized learning* is horrible. It has almost no descriptive value. What does it mean to "personal*ize*" learning? Isn't learning, which is done by individual learners, inherently personal? What would it mean to personalize learning? And who would want *un*personalized learning? Because the term carries so little semantic weight, it is a natural for marketing purposes: "Our personalized learning is new, improved, and 99.44% pure!" Unfortunately, this also sets it up perfectly for the inevitable War of Definitions. Remember the Great MOOC War a few years ago? Were MOOCs the creation of the Canadian Constructivists or of the Stanford professor who invented a self-driving car? Are we talking about an xMOOC or a cMOOC? Which one is the good one, and which one is the bad one? Now that the furor has died down, there is relatively little debating over the definition of the term *MOOC* and much more focus on how the family of approaches that are collected under that term can best serve different educational purposes.

Let's just skip to the end this time, shall we?

The two of us spent the past three years visiting colleges and universities that have undertaken so-called personalized learning projects, and we talked to the students, teachers, and administrators about what they are actually doing and why they are doing it. We visited a wide range of institutions and talked to a wide range of stakeholders, based on our daily work as consultants to colleges and universities and as analysts of the educational technology industry and our work on a grant funded by the Bill & Melinda Gates Foundation. Through these observations, we have been looking for the ground truth underneath the hype of personalized learning. As a result of this process, we observed a family of technology-enabled educational practices that are potentially useful for a range of educational challenges. We would like to share our framework, which we hope will be useful for thinking about (1) the circumstances under which personalized learning can help students and (2) the best way to evaluate the real educational value for products that are marketed under the *personalized learning* banner.

Personalized Learning as Practice

Imagine for a moment that *personalized learning* is not already a term in the ed tech lexicon and, further, that there is no need for any new term to be "catchy" or "sticky." The most descriptive label we could come up with for the practices that the two of us have observed in our school visits might be *undepersonalized teaching*. If the ideal, most personal teaching modality is one-to-one tutoring, there are many reasons why we fall short of this ideal in real-world classrooms. The most stereotypical depersonalized teaching experience is the large lecture class, but there are many other situations in which teachers do not connect with individual students and/or meet the students' specific needs. For example, even a small class might contain students with a wide-enough range of skills, aptitudes, and needs that the teacher cannot possibly serve them all equally well. Or a student may have needs (or aptitudes) that the teacher simply doesn't get an opportunity to see within the amount of contact time that the class allows. The truth is that students fall through the cracks all the time, even in the best classes taught by the best teachers. Failing a course is the most visible evidence, but more often students drift through the class and earn a passing grade—maybe even a good grade—without getting any lasting educational benefit.

If we choose to think of personalized learning as a *practice* rather than a *product*, we can start by taking a hard look at course designs and identifying those areas that fail to make meaningful individual contact with students. These gaps will be different from course to course, subject to subject, student population to student population, and teacher to teacher. Although there is no generic answer to the question of where students are most likely to fall through the cracks in a course, there are some patterns to look for (as we will discuss later in this article).

If we choose to think of personalized learning as a practice rather than a product, we can start by taking a hard look at course designs.

Technology then becomes an enabler for increasing meaningful personal contact. In our observations, we have seen three main technology-enabled strategies for lowering classroom barriers to one-on-one teacher/student (and student/student) interactions:

1. *Moving content broadcast out of the classroom*: Even in relatively small classes, a lot of class time can be taken up with content broadcast such as lectures and announcements. Personalized learning strategies often try to move as much broadcast out of class time as possible in order to make room for more conversation. This strategy is sometimes called "flipping" because it is commonly accomplished by having the teacher record the lectures they would normally give in class and assign the lecture videos as homework, but it can be accomplished in other ways as well, for example with reading-based or problem-based course designs.
2. *Turning homework time into contact time*: In a traditional class, much of the work that the students do is invisible to the teacher. For some aspects, such

as homework problems, teachers can observe the results but are often severely limited by time constraints. In other cases, such as comprehension of assigned readings, the students' work is invisible to the teacher and can be observed only indirectly and with significant effort. Personalized learning approaches often allow the teacher to observe the students' work in digital products, so that there is more opportunity to coach students. Further, personalized learning often identifies meaningful trends in a student's work and calls the attention of both teacher and student to those trends through analytics.

3. *Providing tutoring*: Sometimes students get stuck in problem areas that don't require help from a skilled human instructor. Although software isn't

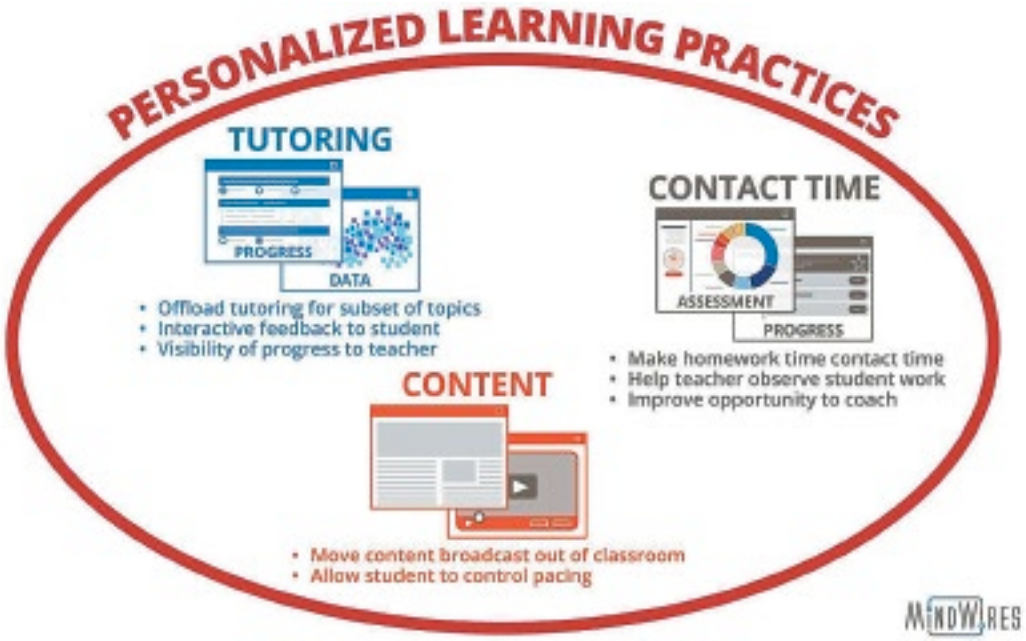
e-Literate TV and the e-Literate Blog

Many of our discussions with students, teachers, and administrators about personalized learning are documented in a series of rich-media case studies that we call *e-Literate TV*. The episodes include embedded links to more detailed content that is relevant to the conversations happening on-screen.

- Series home page: http://e-literate.tv/series/personalized-learning/
- Overview episode for the series: http://e-literate.tv/s3-intro/
- Blog posts on topics related to the series: http://mfeldstein.com/tag/e-literate-tv/

Most of our public writing, including additional analysis of *e-Literate TV* episodes, is shared on the *e-Literate* blog: http://mfeldstein.com/.

good at teaching everything, it can be good at teaching some things. Personalized learning approaches can offload the tutoring for those topics to adaptive learning software that gives students interactive feedback while also turning the students' work into contact time by making it observable to the teacher at a glance through analytics.



None of these techniques, by themselves, undepersonalize the teaching. They generally need to be designed and implemented by skilled educators as part of a larger course design that is intended to address the particular problems of particular students. In the business world, an analogous initiative might be called "business process redesign." Emphasis is on *process*. The primary question being asked is, "What is the most effective way to accomplish the goal?" The redesigned process may well need software, but it is the process itself that matters. In personalized learning, the process we are redesigning is that of teaching individual students what they need to learn from a class as effectively as possible (though we can easily imagine applying the same kind of exercise to improving advising, course registration, or any other important function).

We saw a noteworthy example of this educational design work in action at Essex County College (ECC) in Newark, New Jersey. The majority of ECC students need to take developmental math in order to complete their degrees, and the majority of those do not pass developmental math. Of those who do, the majority do not pass the college-level math course that follows. ECC leadership believed that this educational failure could be attributed to two main factors. First, students came into developmental math with an enormous range of prior knowledge: some had the equivalent of a fourth-grade math education; others needed to learn only a few concepts. Students on one end of the spectrum typically got lost because they were not receiving the individual help they needed, whereas those on the other end often got bored and eventually failed or dropped out because they were being forced to spend a lot of their time on skills that they had already mastered. Second, many ECC students had never been taught good study skills, and faculty did not have the class time needed to teach those skills. So to address the two personalization gaps in this particular course, the college redesigned developmental math using personalized learning techniques.

ECC used an overall pedagogical framework called Self-Regulated Learning. Students in the course spend part of their class time in a computer lab, working at their own pace through an adaptive learning math program. Students who already know much of the content can move through it quickly, giving them more time to master the concepts that they have yet to learn. Students who have more to learn can take their time and get tutoring and reinforcement from the software. Teachers, now freed from the task of lecturing, roam the room and give individual attention to those students who need it. They can also see how students are doing, individually and as a class, through the software's analytics. But the course has another critical component that takes place outside the computer lab, separate from the technology. Every week, the teachers meet with the students to discuss learning goals and strategies. Students review the goals they set the previous week, discuss their progress toward those goals, evaluate whether the strategies they used helped them, and develop new goals for the next week.

Note the role of the software in this design. In the lab, it primarily takes on the role of tutor, helping most of the students most of the time with routine skill coaching and practice so that the teacher is freed up to give individual attention to those students who really need it. In the goal-setting sessions, the

software acts mainly as a record keeper. It helps students track their time on task, number of problems solved, and so on. The teacher then helps students figure out what to do with that information. In both cases, the software is an important enabler of the new teaching practices. But the value that it adds is quite different from the way personalized learning software products are often characterized by sales reps, marketing materials, and many news stories. It is thus worth taking a minor detour from our exploration of personalized learning as a practice to examine the significant gap between the ground truth of the practice and the popular characterizations of the products.

Why Such Hype?

So far, we have deliberately and explicitly set aside the various policy, political, and business pressures that have brought the term *personalized learning* into broader use so that we could focus on the educational value that lurks underneath the hype. But it is also important to understand these pressures so that we can be on guard for the ways in which they might deform the discussion and distract us from the real value that we should be talking about. None of the three approaches that we identified above are particularly new; nor do they require fancy algorithms and expensive products to achieve. There are two specific reasons why these approaches are being attached to heavily marketed products right now.

First, on the policy side, there has been a shift in emphasis from access to degree completion. President Barack Obama set the tone by announcing a goal that the United States be number one in the world in the proportion of college graduates by 2020. Since then, state and federal policy makers have followed suit. Colleges and universities now have to account for gainful employment metrics and track their institutional scorecard results. Base funding, particularly for public institutions, is increasingly tied to performance against these and similar metrics. Grant funding is also increasingly outcomes-driven. As higher education institutions have narrowed their focus on these metrics, the students who fall through the cracks and fail out of the standard educational model have come into sharper relief.

With these policy changes and the funding that follows them, being "student-centric" is no longer a nice-to-have goal. Rather, it is a critical success factor for improving measurable student outcomes and therefore getting funding and being seen as a successful institution. For example, whereas in the past a few forward-thinking community college administrators might have thought to take on a project like ECC's personalized learning developmental math redesign out of a sense of mission, now every community college administrator must be looking for ways to improve degree completion by eliminating failure traps such as developmental math. The security of institutional funding depends on it.

Being "student-centric" is no longer a nice-to-have goal. Rather, it is a critical success factor for improving measurable student outcomes.

The second big change has been the widespread commercialization of the *adaptive learning* techniques that have existed in educational research laboratories for over fifty years.[1] As the term adaptive learning suggests, these products provide students with a certain amount of one-on-one tutoring (although the methods that these systems use for analyzing students' progress and providing useful feedback vary widely by product and discipline). This change in the market has been enabled

by technological advances that are increasingly resulting in one networked computer for every student in a class and affordable developer access to machine learning tools.

Market forces are playing a big role in publishing too. Textbook publishers have found that their traditional business model is collapsing as more students find ways to avoid buying new textbooks. Cengage, for example, was forced to go through bankruptcy. McGraw-Hill Education was sold to a private equity firm. Pearson's stock is near historic lows. All of these companies have had multiple rounds of major layoffs. They are in desperate need of a new product, and they are increasingly latching onto the personalized learning trend as the cure for what ails them. Meanwhile, according to Ambient Insight, U.S. ed tech companies received $3.6 billion of angel and venture capital funding in 2015.[2] (This doesn't even include mergers and acquisitions, which have also been huge.) Startup founders find themselves in an increasingly crowded field and are under strong pressure to promise and produce big results. Every vendor of a developmental math product, whether that vendor is an established textbook publisher or a young startup, is aware that campus presidents and provosts need to solve their degree-completion problem and that developmental math is very likely to be a big part of that problem. The vendors therefore market their products as a solution to degree completion. Every textbook vendor and aspiring textbook disruptor knows that stories about improving pass rates through technology sell. But what to call these products? *Personalized learning* is a term that sounds good without the inconvenience of having any obviously specific pedagogical meaning, so it becomes the flag that all vendors fly, even though different products do very different things and even though undepersonalization is rarely accomplished through software alone.

Thus, through policy and commercialization, the personalized learning marketing juggernaut was born. Unfortunately, the combination of the marketing shortcuts and the funding pressures created a strong temptation for magical thinking. Campus leaders are being asked to believe that they can solve their degree-completion and other accountability metric problems by buying software that will somehow magically provide personalized learning (in a way that faculty members, by implication, do not). For obvious reasons, faculty are likely to reject this stunted conception of personalized learning. Leaders who want to see their campus communities benefit from personalized learning approaches need to guard against product-centric characterizations and should suggest that discussions of vended solutions take place in the context of course and curricular designs that undepersonalize teaching. Otherwise, the baby will probably get thrown out with the bathwater.

Good Candidate Opportunities

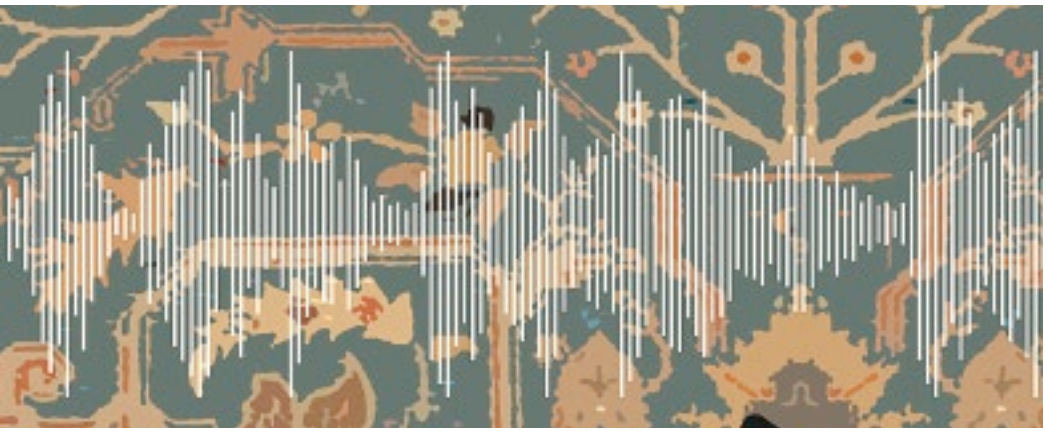
One of the benefits of reframing personalized learning as undepersonalized teaching and focusing on the three techniques we outlined earlier is that faculty can readily translate this framework into their own contexts and start identifying opportunities that are good candidates for undepersonalization (not all of which will require vended products). In contrast to a product-centric conception of personalized learning, a practice-centered conception is something that faculty can own. That said, we have seen areas of opportunity where personalized learning is often a good fit, and not all of those areas are always obvious.

To begin with, any course that students enter with a wide range of prior knowledge and ability is a good candidate. ECC's developmental math is a prototypical example. Another example is Austin Community College's ACCelerator lab, used heavily for developmental math courses.[3] But the course doesn't have to be remedial and the institution doesn't have to be access-oriented in order for personalized learning to be helpful. For example, at Middlebury College, a geography professor realized that some students in his course on geographical information systems (GIS) were struggling. For context, this is a general education course that is taken by students in a wide range of majors and specialties. In an elite college like Middlebury, nobody worries too much about completion rates, particularly at the institutional level. The professor simply observed that some students were working very hard. In fact, the course had such a strong reputation for difficulty that taking and passing it was considered a badge of honor. Students were sleeping in the labs. But the professor didn't see this as a sign that he was inspiring his students to work hard. He saw it, rather, as a course-design problem. Some students were working harder than they should because he wasn't reaching them in the way that they needed to be reached.

We have seen areas of opportunity where personalized learning is often a good fit, and not all of those areas are always obvious.

As it turns out, one critical skill that the course was teaching—spatial reasoning—is rarely taught in high school. A handful of the students in the class came in with either prior training or natural talent. They did well. The others were the ones who were sleeping in the labs. They needed more time and more help. The professor decided to make videos of his lectures and assign the videos as

homework. With this change, struggling students could watch the videos as often as they needed in the (relative) comfort of their own dorm rooms while the professor's class time was also freed up for more interactive work. (After he had done this, a colleague told the professor that this technique is called "flipping the classroom"—a term he had never heard before.) He is also thinking about developing tutorial software that can help students work through the homework problems in ways that best suit their needs.



Another obvious opportunity to undepersonalize teaching is in large lecture courses. For example, administrators at the University of California, Davis, became interested in redesigning their survey biology and chemistry courses because they recognized that they were losing a high percentage of first-year students—the ones who typically take these large lecture courses. It is very easy for a student to become passive in this broadcast-heavy course design. The team involved in the course-redesign projects wanted students to both get more individual attention and take more individual responsibility for their learning. To accomplish these goals, the team employed personalized learning practices as a way of making room for more active learning in the classroom. Students used software-based homework to experience much of the content that had previously been delivered in lectures. Faculty redesigned their lecture periods to become interactive discussions. Meanwhile, the teaching assistants who ran the discussion sections used analytics from the homework software to identify the areas where students were struggling; as a result, they could better focus their class time on those areas. Importantly, teaching assistants received additional training in how to employ active learning principles in their teaching techniques. Once again, in contrast to marketing pitches and popular narratives, the software played only a supporting role, albeit an important one, in undepersonalizing the large lecture.

A less obvious opportunity for personalized learning is in the design of problem-based learning courses. The previous two examples fit within the common understanding of personalized learning being used to help students work through traditional, didactic courses with more support. But Arizona State University incorporated the "flipping" aspect of the technology into an online STEM lab course for non-science majors. In this course students, for their final project, are asked to evaluate the likelihood that there are other intelligent civilizations in a randomly assigned field of stars. The teaching philosophy of the faculty member who was the lead

designer of the course is that he should be a coach or a guide, helping students navigate difficult problems. In his view, both content delivery and assessment are activities that take time away from that core function. He and his colleagues framed the course, Habitable Worlds, as a series of challenges. Overcoming each challenge requires the students to learn new knowledge and skills. The course design is based on mastery learning: students must demonstrate that they have learned one skill before moving on to the next. The course is also difficult. Students often get stuck, which is by design. Faculty and teaching assistants, freed up from both content delivery and assignment grading, spend most of their time responding to students' questions. And because the coursework is all software-based, they can see exactly what students are doing, how far students have progressed, and where students are struggling. Students can proceed at their own pace, moving quickly where they can and getting help where they need it. Yet despite the self-paced nature of the course, there is also a strong social component. Students can and often do seek out each other's help. Because personalized learning practices make space for more interactivity, these practices often go hand-in-hand with active learning. And active learning is often social.

We suspect there are many opportunities in addition to the ones we have identified here. If faculty are given a commonsense framework and a chance to experiment, refine, and share, they will find novel and exciting ways to better support their students' individual educational needs.

Doing It Right

Because personalized learning is a family of educational practices that support good course designs, implementing those practices well is not as simple as buying a product. To begin with, course design is always a time-consuming process when done correctly. Second, in many cases faculty will be trying techniques they have not used before, requiring them to teach in ways that are very different from how they have taught before, that are far removed from their experience (and therefore instincts) of what works and what doesn't, and that may have ripple effects they don't anticipate. On top of all this, the vast majority of faculty are neither trained in course design/research nor compensated for any time they invest in it. They will need time and support. In many cases, implementing personalized learning well can require an institutional effort analogous to the one required to implement an online learning program well.

Looking across a range of personalized learning projects that have had varying degrees of success, both at the schools we visited and elsewhere, we can identify six steps for a successful strategy. It should be noted that these themes could be applied to any number of pedagogical innovations.

1. *Identify the student need that is to be addressed*. The various personalized learning approaches are just one set of tools in the toolbox. Successful programs generally start by identifying a significant educational problem that faculty and program staff believe can be corrected with a change in course design.
2. *Design the pedagogical structure*. If the problem that is identified can be addressed through personalization, then how will the course support different students differently? The answer has to be more than just "adaptive learning." Successful programs identify opportunities in the course design to improve individual support for students.
3. *Pick the products or technologies*. The details of different products or technological approaches are most meaningful when they impact what can be done with the course design. Successful programs pick the right tool based on the job at hand rather than on who has the best marketing pitch.
4. *Don't forget faculty training*. Because personalized learning, done properly, generally means implementing new pedagogical approaches, faculty may

Implementing personalized learning well can require an institutional effort analogous to the one required to implement an online learning program well.

need to learn to teach in ways that they haven't taught before. Successful programs provide faculty with training and pedagogical support.

5. *Don't forget technology support*. Software helps with learning only when it works, and Murphy's Law can hit with a vengeance when technology is mixed with teaching. Successful programs make sure that faculty have the technology training, equipment, and support staff that they need in order to be successful.
6. *Be prepared to measure, fail, and iterate*. Because personalized learning approaches often require new software, new teaching techniques for faculty, new responsibilities for students, and in some cases new scheduling challenges, institutions will almost inevitably get some things wrong in the first couple of iterations, and those mistakes may have real impact on outcomes. Successful programs approach implementation empirically but with patience.

On the bright side, the fact that personalized learning is now being attached to funding-related metrics such as degree-completion rates means that attaching institutional support costs to a funding stream will also be easier. In many cases, schools can build personalized learning "muscle mass" by focusing on metric-relevant projects first and then expanding the initiative once the critical institutional knowledge and support mechanisms have been put in place.

Final Thoughts: Ed Tech Groundhog Day

There is a lesson to be learned here, and it is broader than personalized learning. Every popular ed tech trend, going at least as far back as the original online asynchronous distance learning courses in the 1990s, has brought with it a food fight, with proponents hyping the trend as revolutionary and opponents attacking it as harmful. And in every case, a policy or other institutional driver has resulted in a rush of companies responding to the market opportunity created by that driver. Together, these forces generate hype and magical thinking, which in turn provoke an equal and opposite reaction.

In this article, we have tried to identify specific teaching practices being used by educators, and we have tried to describe them in commonsense terms that should make intuitive sense to experienced teachers. These practices always exist at the beginning. Some teacher somewhere comes up with a specific approach to a specific problem. External forces then make that problem a more institutionally consequential one, and companies rush in to name, market, and sell solutions. In the process, we lose track of the original educational idea. It's like playing a game of telephone in a noisy airport. Except in this case, the message in the game is an actual plan for how we are going to help our students, and when it gets to the end of the telephone line, we will act as if we received the message with perfect fidelity. And then fight over it. Endlessly. Much of the Gartner hype cycle can be attributed to this process.[4]

We can break out of this hype cycle with a fairly simple (though not necessarily easy) approach. Whenever a new ed tech trend gets named—whether it is distance learning, adaptive learning, personalized learning, competency-based education, MOOCs, or something else—we should start trying to understand that trend by looking for the best examples of what teachers and students are doing when they are doing the thing we just named. We should ask them what they are doing, and why. We should ask how their practice is working and what they are learning and what they don't yet know. We should attach the name of the new trend to those educational practices and those reasons—rather than to any products, technologies, or services. We should not waste time debating whether the name we came up with for those practices is the perfect name or exactly what it includes or excludes. Instead, we should spend our time trying to understand the practices themselves and their

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applicability to the educational problems we are trying to solve.

Yes, *personalized learning* is a lousy term, but it is attached to legitimate educational practices that have the potential to improve the lives of many students. It is also a term that is trapped in the early stages of its hype cycle. So let's just skip to the end and break personalized learning out of the hype cycle by doing our best to understand—and explain—what it really is and why it really matters. ■

Notes

1. For more on adaptive learning, see Michael Feldstein, "What Faculty Should Know about Adaptive Learning," *e-Literate*, December 17, 2013, http://mfeldstein.com/faculty-know-adaptive-learning/.
2. Ambient Insight, "The 2015 International Learning Technology Investment Patterns," January 2016, p. 8, http://www.ambientinsight.com/Resources/Documents/AmbientInsight_2015_International_Learning_Technology_Investment_Patterns.pdf.
3. For more on Austin Community College and its emporium-based personalized learning approach, see Phil Hill, "Austin Community College's ACCelerator: Big Bet on Emporium Approach with No Pilots," *e-Literate*, March 22, 2015, http://mfeldstein.com/austin-community-colleges-accelerator-big-bet-on-emporium-approach-with-no-pilots/.
4. For more information, see the Gartner website: "Gartner Hype Cycle," http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp.

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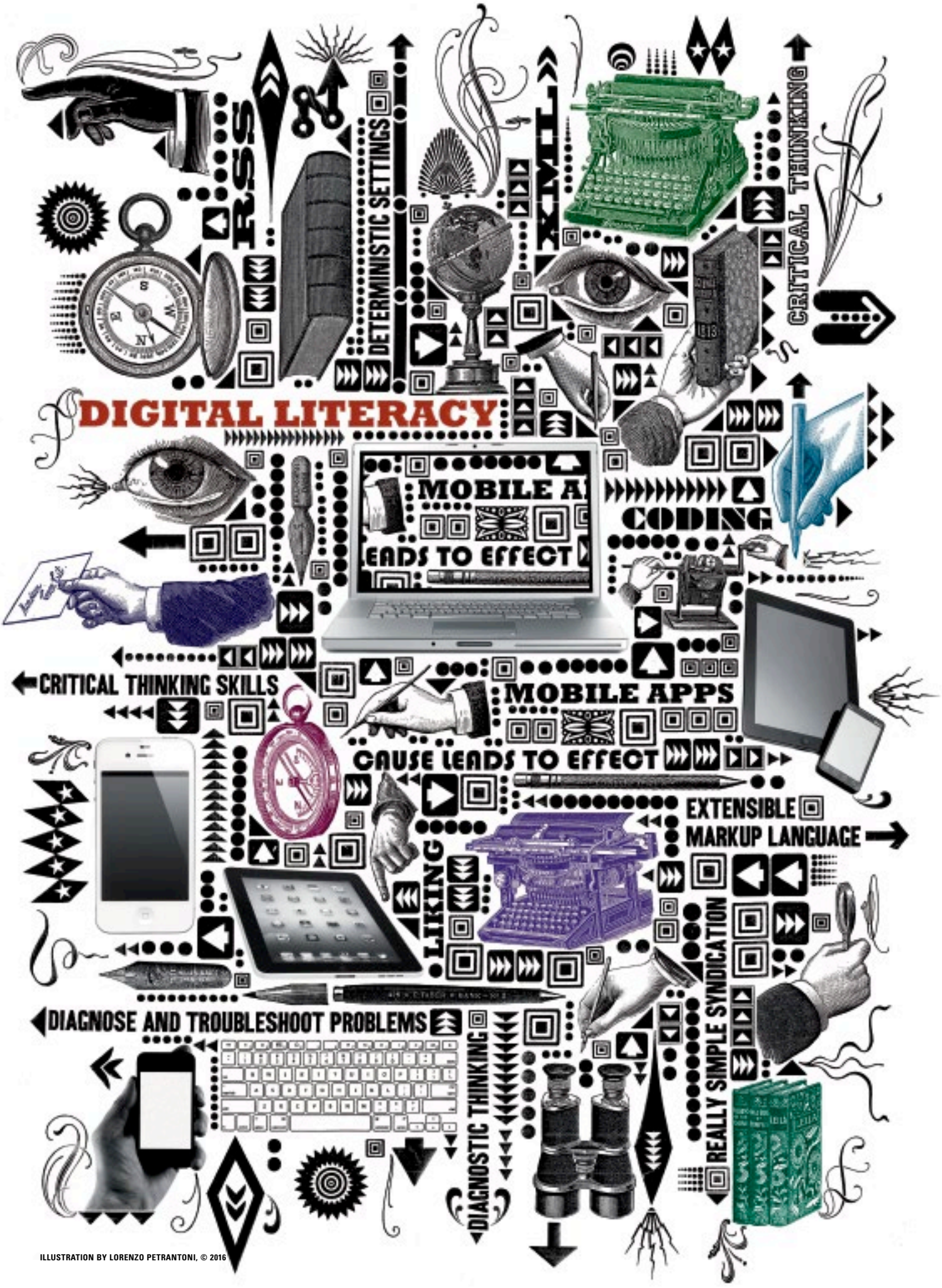
FROM WRITTEN TO DIGITAL: The New Literacy

By Phil Ventimiglia and George Pullman

"The people who were comfortable at this humanities-technology intersection helped to create the human-machine symbiosis that is at the core of this story."

—Walter Isaacson, *The Innovators: How a Group of Inventors, Hackers, Geniuses and Geeks Created the Digital Revolution* (2014)

In his book about the history of the digital revolution, Walter Isaacson contends that the major innovations of the digital revolution—from the first general-purpose computer to the transistor to the iPhone—were all created by individuals who understood how to synthesize the humanities with technology. Yet even though there is much focus in higher education on how we teach using technology (e.g., e-texts, flipped classrooms, adaptive learning, personalized learning), what we teach about technology is just as important. Because technology enables students to solve problems across a range of disciplines, those of us at higher education institutions need to rethink not just *how* we teach our students but *what* we teach our students.



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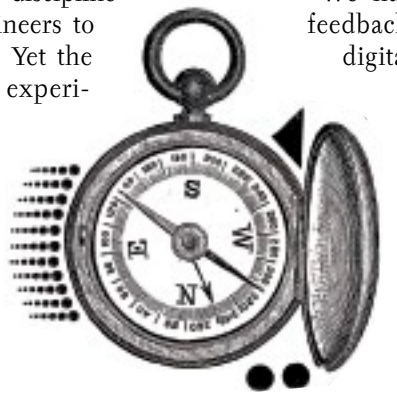
Digital Literacy and 21st-Century Success

In today's world, college/university graduates come into contact with a quickly evolving range of technologies and have access to a wealth of information. Students can be more successful after graduation if they are digitally literate—having learned how to identify and create digital solutions, adapt to new tools, and discover more effective and efficient ways of doing things in their fields. The use of technology has transformed every discipline and career, from engineers to doctors to politicians. Yet the traditional academic experience does not prepare many students for the challenges they'll face in these professions today. For instance, young campaign managers must be versed in tasks such as writing a blog and analyzing a social networking initiative, rather than just planning traditional stump speeches and campaign rallies.

This gap between employers' expectations and students' skills is demonstrated by disparities in perceptions of students' readiness to enter the workforce. In a recent study, when students were asked if they felt digitally prepared for work, 44 percent responded that they felt "well-prepared" or "very prepared." In contrast, only 18 percent of surveyed employers responded that students are prepared for entry-level positions.[1] Additionally, employers often find digital tools more valuable than traditional tools in evaluating job applicants. In a Hart Research Associates study, employers found electronic portfolios significantly more useful than a college transcript in assessing whether students had the skills necessary to fill a position: 80 percent of employers found electronic portfolios fairly or very useful, but only 45 percent of employers found traditional college transcripts helpful.[2]



Despite having grown up with access to an increasing amount of technology, students now need to learn how to use technology to solve problems in academic and professional settings.

We have heard the same feedback about the value of digital skills to graduates directly from some major corporations. Jaime Casap, Google's Chief Educational Evangelist, told us: "Digital citizenship is the minimum requirement for the new economy. We need strong digital leaders!" Victor Montgomery, State Farm Business Analyst in charge of local recruitment in Atlanta, stated: "Digital literacy bridges the opportunity divide for students. With that in mind, we are looking for students that display initiative, innovation, and creativity while transforming the communities they live in."[3]

The need for students to learn digital literacy skills should not be surprising, given that this generation of students has known technology only from a consumer perspective. Whereas older technologists first experienced technology in the workplace and then found ways to merge technology into their personal lives, the current generation of students first experienced technology as a means of entertainment and social communication. Despite having grown up with access to an increasing amount of technology, students now need to learn how to use technology to solve problems in academic and professional settings. Historically, we in higher education have not readied students for this transition, even though students are increasingly asked to use technology in their learning experiences. Many students enter college having already used technology to complete academic assignments: 75 percent of high school students have accessed class information through an online portal, 52 percent have taken tests online, and 37 percent have used online textbooks.[4]

Learning to write, learning to think, and—these days—learning to form computational structures and to think digitally are requisites not only for employment but also for intellectual independence. Traditionally, the liberal arts have been about learning to think logically and to express ideas. The "liberal" in the liberal arts is about freedom. Some people have argued that widespread literacy (understood as reading at an eighth-grade level) was about making sure factory workers could read manuals well enough to keep machines running, rather than about providing for an informed citizenry. The equivalent for digital literacy would be to define it simply as being able to learn software quickly. Instead, digital literacy should be defined as knowing the effective practices suited to the dominant media. We should not teach students just the skills that will prepare them to follow instructions or quickly comprehend a user interface; instead we should aim to help students develop the expertise that will allow them to combine and create technologies to develop new and dynamic solutions. Just as traditional literacy and the liberal arts have

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been the key to independence since the advent of public schooling, digital literacy today is about intellectual freedom (see figure 1).

Many early digital literacy efforts in higher education focused on providing a single class that covered base-level skills, such as creating a PowerPoint presentation or spreadsheet. But what is truly needed in higher education today is integration of digital literacy throughout the curriculum, so that students are able to do the following:

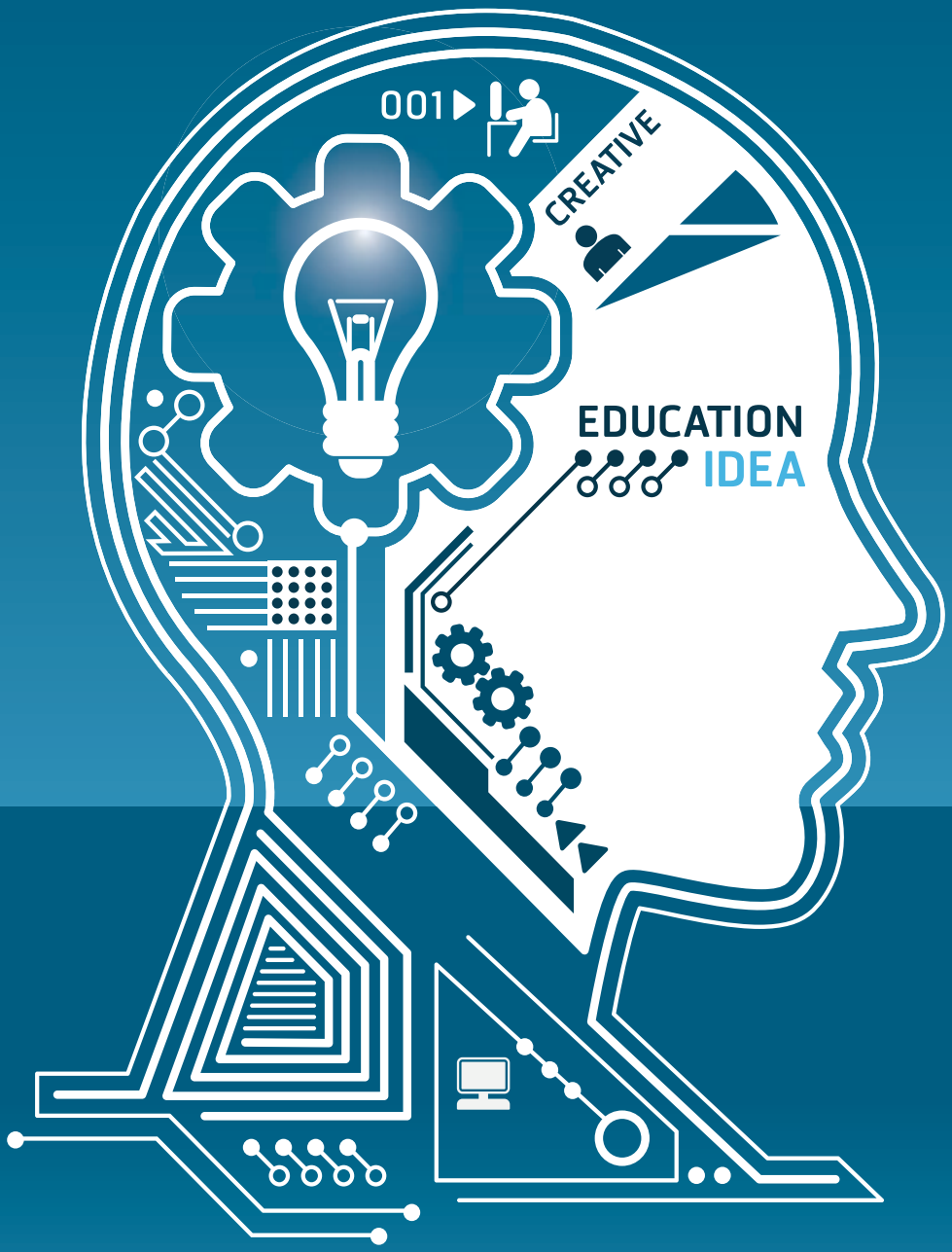
1. *Find and vet information online.* In the digital world, being able to not only find information online but also determine its quality and validity is crucial.
2. *See problems from digital perspectives.* Students need to be able to analyze a problem and determine how to use digital tools to solve it. For example, can a problem be solved more quickly by creating a spreadsheet or by working the problem manually?
3. *Become self-directed learners.* The Internet has put all of the world's knowledge at our fingertips. Students should know how to take advantage of that availability of information to become lifelong learners.
4. *Obtain digital solutions.* Technology is constantly changing. Students must learn how to evaluate and buy the right digital tools to solve the problem at hand, rather than just relying on the tools they have used in the past.
5. *Learn software quickly.* Software is also always changing and improving, so students need to be able to quickly teach themselves new tools. For example, whereas being an expert in spreadsheets was an important quantitative skillset in the past, now it is increasingly important to be an expert in visualization tools such as Tableau.
6. *Design and create digital solutions.* Ultimately students should build a skillset that allows them to develop or customize their own digital tools. This does not necessarily mean that students need to be able to write their own applications from scratch. Rather, they should be comfortable customizing and combining tools to create a complete solution—for example, creating a web-form to automate the collection of customer evaluations and then outputting the results to a spreadsheet for analysis.

FIGURE 1. Traditional Literacy vs. Digital Literacy

Traditional Literacy	Digital Literacy
Finding information	Vetting information
Reading (emersion)	Skimming (searching for solutions)
Note-taking	Curating
• transcribing	• linking
Prose composition	Multimodal composition
	• information design
	• data visualization
	• dynamic storytelling (video)
	• coding/programming
Static artifacts	Dynamic assets (multiple, diverse, reusable)
Learns from teachers	Teaches self
Permanence	Change

To understand the fundamental impact that digital literacy can have, we can look to history. Whenever the dominant medium of communication changes, controversy follows. When oral communication was replaced by written literacy as the main means of recording and transferring knowledge—a transformation that took place over decades and at different rates in different places—Socrates was recorded to have complained: "No written discourse, whether in meter or in prose, deserves to be treated very seriously."[5] Socrates was concerned that transitioning from oral communication to written literacy would degrade people's intellect. If people learned by reading books, rather than by debating with their elders, they would replace a real education with a superficial likeness of one. They would have the appearance of learning because they could talk about all the things they had read, but they would be unable to think for themselves or even know they needed to, having become accustomed to simply looking things up in books and accepting what they read.

From today's perspective, Socrates' rejection of literacy seems irrational, yet echoes of the same argument are raised about information being found by searching the Internet rather than by combing through printed source materials. As we transition again, this time from written literacy to digital literacy, the fears that Socrates voiced are



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resurfacing. We know the transition will be profound and we can't yet anticipate the consequences, so it's reasonable to be concerned. Resistance, however, is as futile now as it was in Socrates' day.

Designing Courses to Encourage Intellectual Independence

To address the value of digital experiences in providing a strong foundation for success, Georgia State University has launched a Digital Literacy Initiative.[6] In the first phase of this initiative, we are incorporating digital literacy skills into our 2015–2016 Honors College freshman curriculum. This pilot program has worked with faculty who teach core courses, ranging from composition to calculus, to build digital literacy skills into their classes. In addition, the pilot provides students with a set of personalized learning tools that include lightweight personal computing devices, online portfolio-development tools, open-source electronic texts, and learning materials that interactively adapt to meet the learning needs of individual students.

The goal is to teach students how to think in digital ways in order to make informed technological decisions and even, in some cases, to develop their own technology as they gain intellectual independence.

An example of what can be done if we embrace digital literacy is how we have rethought and redesigned the Honors English Composition course. The course examines how learning the art of rhetoric can introduce students to writing for the digital age. The course curriculum asks students to consider "the full stack"—not just the surface but also how the back end works. We are adding coding to reading and writing. The goal is to teach students how to think in digital ways in order to make informed technological decisions and even, in some cases, to develop their own technology as they gain intellectual independence.

What do we mean by *intellectual independence* in this context? Understanding publication options in today's digital environment is one example. An important goal for academics is to publish the results of their research in journals. Academics very often offer this work free of charge in order to reach a community of peers. Academic journals are typically published by a small, overworked, and largely volunteer staff. They survive on donations and departmental and college subsidies, generally selling the rights to the results of their labor to distribution houses. The distribution houses then sell the work back to the institutions and individuals who produced the work for free to begin with. In the digital age, when journals are distributed electronically and when resources for professional printing are no longer needed, the distribution houses add little or no value. Slowly, libraries and journals are starting to break free of this model. In November 2015, for instance, the editors and editorial board members of *Lingua*, a linguistics journal, resigned.[7] They then established *Glossa* (http://www.glossa-journal.org/), a new open-source linguistics journal. Given that the prestige of a journal is determined by the rigor of its peer-review process, a value added entirely by the academics working and networking among themselves, the primary reason for remaining indentured to distribution houses is lack of technical knowledge on the part of those running the journals. If the graduate students of today learn how to select and build their own content-management systems and digital networking tools, they can control production and distribution. They will then be free to create their own value and to share (or sell) that value as they see fit.

Digital literacy isn't just about economic freedom, however. Digital literacy enables forms of thinking that are not as readily enabled by traditional literacy. Without these forms of thinking and communicating, people are at a social and economic disadvantage. They are unable to think outside of the software they have memorized or to express themselves beyond the no-longer-relevant constraints of the printed page.

This is why learning to code is invaluable. Even at a basic level, coding helps a person develop critical thinking skills. In a deterministic system, like that of a computer, a single input leads to a single output: cause leads to effect. If you don't understand how something works, you can change one element and carefully observe the result. In addition, diagnostic thinking, which is critical thinking in deterministic settings, is an iterative process of hypothesize, test, refine, repeat. Given enough iterations, patience, focus, and discipline (changing only one variable at a time), a coder can start to build a mental model that

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solves a mystery or illuminates the black box behind how a system works.

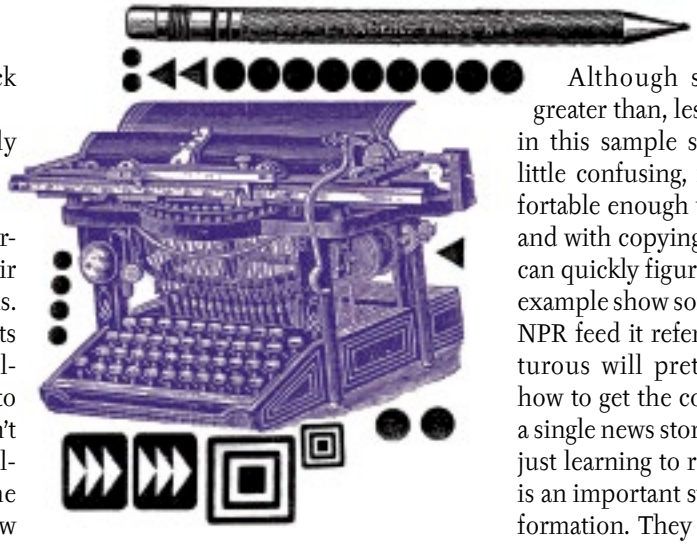
People who think diagnostically don't do the same thing over and over again while expecting different results each time. They don't jump to unwarranted opinions. They learn to test their beliefs and uncover their assumptions. In a computer coding setting, students can practice diagnostic thinking in a fail-fast way. Transference of these skills to more complex, real-world systems isn't guaranteed, of course, and most real-world problems aren't without some element of randomness. But given how common digital tools are, knowing how to diagnose and troubleshoot problems is a valuable skill on its own, and the practice offered is a great foundation for increasing a learner's digital literacy.

First Steps toward a Different Kind of Literacy

Nontechnical people tend to resist the idea of writing code, but we have found that some relatively simple pieces of code can interest people who are more excited by ideas than technicalities.

For example, many people of a certain generation are accustomed to reading the same newspaper every day. They like their news from "trusted sources." The digital, they feel, can't be trusted. But an emerging model of receiving news is through mobile apps such as Flipboard. These apps ask us what we want to see and then provide relevant stories, with results that are constantly refined and that are based on what we interact with and what we say we like. The goal of these apps is to make us happy, and their assumption is that our happiness is reflected in our "liking" what we read. So, our tool for acquiring information helps reaffirm our biases. We aren't being informed so much as we are being further convinced of our own current thinking. It's our passivity in the process, and our ignorance of code, that helps ill-inform us.

Telling nontechnical people that Really Simple Syndication (RSS) and the Extensible Markup Language (XML)



could liberate them from decisions made by their apps would likely cause their eyes to glaze over. RSS? XML? Alphabet soup. But if instead you give them a bit of code to copy-and-paste, code that requires very minimal modification to change what it displays, you may be able to push them gently toward liberation. For example:

```
<?
print "<a href='https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=rss%20feeds'>Search for more rss feeds</a><br>";
$html = "";
//change url below to an rss feed of your choice.
$url = "http://www.npr.org/rss/rss.php?id=1032";
$xml = simplexml_load_file($url); for($i = 0;
$i < 1; $i++){ $title = $xml->channel->item[$i]->title; // change < 1 to 5 for 5 articles instead of 1
$link = $xml->channel->item[$i]->link;
$description = $xml->channel->item[$i]->description;
$pubDate = $xml->channel->item[$i]->pubDate;
$html .= "<a href='$link'><h3>$title</h3></a>";
$html .= "$description";
$html .= "<br />$pubDate<hr />";
}
echo $html;
?>
```

Although symbols such as the greater than, less than, and dollar sign in this sample script can at first be a little confusing, most people are comfortable enough with the idea of a URL and with copying-and-pasting that they can quickly figure out how to make this example show something other than the NPR feed it refers to. The more adventurous will pretty quickly figure out how to get the code to show more than a single news story. At this level, they are just learning to read code, but doing so is an important step in the digital transformation. They aren't afraid, and they aren't content with letting others do the work entirely for them.

Economy of Language and Code

Another example moves the new coder from reading to writing—or at least to modifying with more complexity. It also directly demonstrates that the values of digital literacy are entirely compatible with the values of traditional written literacy. New coders generally learn relatively early in the process to follow an "if, then" branching statement. If "a=value," then do the following. When they combine "if, then" statements, ever-lengthening code can allow for more complex combinations. For instance, consider the code for a slot machine. If "a=lemon" and "b=cherry" and "c=orange," then print that the user has lost because the values don't match, and so on for every possible winning and losing combination of a, b and c. Brutal. A simple "while" loop can do that same computing with much less code. A "while" loop more concisely says: continue automatically changing the values of a, b, and c until all three values match; when that happens print that the user won, otherwise print that the user lost.

The goal of understanding how to make code more efficient requires learning how to execute a loop. This might seem confusing at first for those with no programming experience, but with a bit of effort, and a few instructional hints, most people will get there

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pretty quickly. The game-like emersion of hitting refresh and seeing nothing change, with the promise that when the learner gets the code right, the slot machine will spin, keeps most people focused on the task until the code works more efficiently.

This looping code can be used for more than just spinning fruit images on a slot machine. A coder could use images of food groups, for example, to create a game that randomly generates a recipe out of three lists of ingredients. Or a coder could create a list of pants, shirts, and accessories and then have the machine randomly generate outfits. With a little basic CSS and the right images, the coder could even have the machine put the outfit together as if on a person. None of this requires sophisticated coding or thinking. But it does require a kind of thinking that most humanities majors don't realize they can do because they are focused on static content—on cutting words for economy of language rather than code.

This example underscores the fact that economy of effort is a shared virtue. Whereas economy of code creates faster applications, economy of prose creates faster comprehension for the reader. If a writer can get an insight across by saying something unexpected but immediately understandable, the writer can generate delight and admiration. Most great writers, and all memorable writers, have many of these flashes of simple brilliance to offer. Consider Mark Twain's statement: "The difference between the *almost right* word and the *right* word is really a large matter—'tis the difference between the lightning-bug and the lightning."[8]

One important intellectual transformation that shifting from traditional written literacy to digital literacy requires is recognizing the difference between dynamic and static content. A key element is automation. Something printed remains as it was forever, until it fades away. In a digital environment, by contrast, the writer can have words come and go in response to events, such as the passing of a certain date. The basic thought pattern is "if event," then print. Added to that might be a time limit: after event + X time, unprint. Some high-profile misprints of celebrity deaths have made it obvious that obituaries are written long before a celebrity dies. These days, just about the only thing that gets written on the fly is weather reports and sports scores. Everything else is written in advance and saved in a content management system for when its moment arrives. Students in our example composition course learn to understand this principle with a very simple PHP date function that allows them to release information for web publication when a certain date, such as Valentine's Day, arrives.

```
$valentines = date('m d');
if($valentines == '2 14'){
include ("origin_of_valentines_day.
php");
}
```

This may be trivial as code, but it is useful as an inducement to digital thinking and writing. What anticipated event should trigger what message? The piece can be written over time and presented as a carefully crafted finished product when the appropriate moment triggers the machine to print it.

These few lines of readable code are enough to encourage writers to see code as adaptable, learnable, and even kind of interesting—or at least a fun challenge.[9] Having come that far, students will soon start thinking about what things code can do that words on paper cannot.

Learning Digitally

Beyond the basic utility of knowing a bit about digital ways of thinking and communicating, learning to code provides students with another critically important learning opportunity. Because coding languages evolve and because there are many ways to do more or less the same thing, students have to learn how to learn online and how to teach themselves to become at least minimally capable with code. This means finding tutorials, breaking down complex problems into parts, seeking alternatives, and engaging with a community of like-minded learners. Being able to teach yourself is far more important than being learned because what we need to know changes constantly, what we know today may be useless five years from now, and what we know now

One important intellectual transformation that shifting from traditional written literacy to digital literacy requires is recognizing the difference between dynamic and static content.

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may even get in the way of learning if we aren't flexible.

The days of specialization among professionals and businesspeople are long gone. If you can't do a great many different things, and a few of them at once, you will be unable to compete successfully. If you wanted to drive a taxi five years ago, you secured a class E license, and someone else took care of the car maintenance and insurance. All you had to do was drive. Today the "gig economy," which empowers workers to shift jobs throughout their career, has changed all that. Now you are on the hook for all aspects of the business. You are the business, if not the profit center. *The specialist is dead. Long live the entrepreneur.* As a result, the entire definition of what it takes to be literate has changed.

Technology allows educators and students to more easily reach audiences outside of the college or university, to employ a variety of media in communication, to create simulations, and to access a host of other tools that would not have been as available before the rise of computing. The Digital Literacy Initiative that we are undertaking at Georgia State University challenges faculty members across core disciplines—including English, history, math, science, and art—to ask: "What is digital literacy?" They are considering this question within their own subject areas and creating assignments that allow their students to apply these skills to real-life situations so that the students can demonstrate to future employers an ability to solve problems using the full range of available tools.

Students constantly ask how to discover their best career options. Our answer? Focus on developing skills such as computational thinking, team building, adaptive communication skills, and algorithmic design—all key elements of digital literacy. Both the 21st-century economy and the careers needed to fuel it are changing at an unprecedented rate. Constant business process disruptions, powered by technology, are challenging companies to find employees with the skills needed to navigate the future. Students must be prepared for nonlinear careers, pivoting to match the ever-changing work landscape. At the end of the day, digital literacy is about solving the problems facing today's world. By incorporating digital literacy across core subjects, colleges and universities will prepare their students to live at the intersection of humanity and technology. ■

Notes

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5. Plato, *Phaedrus*, 277e.
6. For more information, see the Honors Digital Literacy Initiative webpage: http://technology.gsu.edu/technology-services/services-for-you/honors-digital-literacy-initiative. We will be rolling the initiative out to additional colleges beginning in the fall of 2016.
7. Scott Jaschik, "Language of Protest," *Inside Higher Ed*, November 2, 2015, https://www.insidehighered.com/news/2015/11/02/editors-and-editorial-board-quit-top-linguistics-journal-protest-subscription-fees.
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9. For more code examples, see George Pullman, *Writing Online: Rhetoric for the Digital Age* (Indianapolis: Hackett Press, 2016).

Phil Ventimiglia (innovation.gsu.edu) is Georgia State University's first Chief Innovation Officer. In this role, Phil is helping to shape the university's exploration of new ideas for teaching and learning.

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An Open-Access Opportunity

What does it mean to attend a community college? Answers to this question may include phrases such as *technical training, associate's degrees,* and *high school completion.* Or a longer answer: "Community college is a more affordable way to get basic college requirements out of the way prior to transferring to a four-year college or university." Although all of those are still major components of the community college experience, we are increasingly offering more. Our institutions, which began as junior colleges, are just over a century old, with many celebrating 50- to 75-year anniversaries. Despite this relatively short tenure, we have been at the forefront of nearly every major development in higher education during that time.

When I am out in the community, people often ask why they've seen so many changes on our campus in Bellevue, Washington. Why are we changing? And how can we continue to serve our traditional populations? My answers lie in our mission: To advance the lifelong educational development of our students while strengthening the economic, social, and cultural life of our diverse community. In adjusting to these needs, we cannot help but mirror the changes that are influencing our student and business communities. At Bellevue College (BC), we have responded by (1) bringing in more research opportunities for our students, (2) increasing bachelor's degree offerings, (3) building on-campus housing, (4) offering competency-based education (CBE), and (5) considering a major partnership with our state's land-grant institution. These are moves that other community colleges might want to consider, if they are not already.

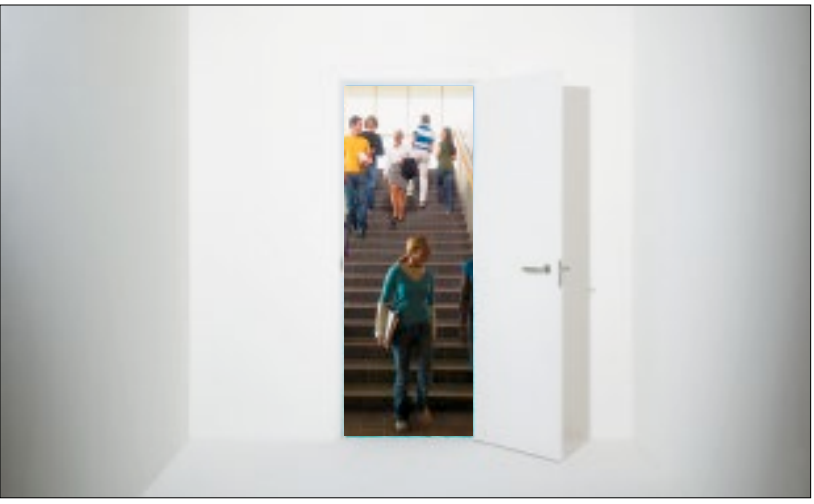
Not long ago, it was rare for an undergraduate student to become involved in scientific research—something that was even rarer for a community college student. These days, however, most undergraduates bound for grad school or industry do laboratory or fieldwork beyond what's required. Undergraduate research, which can take many forms, gives students not only a taste of what a career in their field would be like but also an edge in applying for graduate schools and jobs. But that edge isn't what it used to be, because many graduate schools and employers have come to *expect* it. So at BC, to ensure that our students are school- and work-ready, we have developed the RISE (Research, Innovation, Service and Experiential Learning) Institute and have dedicated precious resources, including a Dean of Undergraduate Research and new classroom/laboratory space, to support student research efforts through grant-funded projects, curriculum development, faculty support, and partnerships with other research labs and industry/community organizations.

The modern workforce is changing. Education, government, and human resource department officials alike recognize that the major gaps between traditional programming, pedagogies, and graduation rates in the areas of health care, energy, and information technology demand increased training opportunities to meet workforce need. To address this need, BC recently received approval to offer two new bachelor of applied science degrees—one in Health Promotion Management and the other in Healthcare Management and Leadership. These degrees are specifically designed to provide residents with affordable paths to family-wage jobs in growing fields. The two programs will begin classes in the fall of 2016, raising the total number of four-year degrees offered at BC to 10, almost all of which are STEM related. All are filling crucial unmet workforce needs.

The affordability of community college bachelor's degree programs and the ease of access are particularly important in attracting students from first-generation and traditionally underrepresented groups. In addition, BC programs are tailored to the state's workforce needs, so our graduates are able to quickly find living-wage jobs. According to the State of Washington Education Research & Data Center, BC graduates who were awarded bachelor's degrees in 2011–12 earned a median salary of $48,200 in 2013.[1] To take this approach a step further, in July 2015 the Washington State Legislature approved a budget proviso giving BC a state appropriation to develop a bachelor of science degree in computer science. This will establish BC as the first community college in the state to offer a four-year bachelor of science program open to freshmen, sophomores, juniors, and seniors. To date, community college bachelor's degree programs have all been two-year, applied baccalaureate degrees, designed for the professional/technical student with an AA degree.

As the local demographic has changed and grown, and as we at BC have expanded our offerings in line with community need, we are now finding ourselves in need of on-campus housing. For many community colleges, a combination of various factors—from an increasing number of international students to the influx of bachelor's degree students whose demand for housing is expected to grow—is prompting the building of student housing. Our new building at BC, scheduled to start construction in April 2017 and to be completed thirteen months later, is planned to be four stories tall with just over 350 units. This building will be the first of several housing units, of varying style and size, that the college will build over the next decade to meet this new challenge.

By DAVID L. RULE



Door photo: Anthony Harvie/Getty Images, Students: Fancy/Glow Images © 2016

Like many other community colleges, BC is also exploring CBE degree offerings—a unique way of approaching education for students who come to us with an established understanding of a subject and who would like to progress quickly through their coursework. CBE courses measure students' course completion by what they have learned, via successful demonstration of specified and agreed-upon learning outcomes, rather than by how much seat-time they have put into a course. CBE students participate in a self-paced, online course with the support of a student navigator and the course instructor, allowing them to quickly progress through topics they understand well. CBE is not suited to all students, but for a growing population, this style of learning is proving beneficial. In addition to offering the CBE certificate, BC is part of a consortium of community colleges that have come together to fund and build an entire associate's degree in business (http://cbewa.org/).

Finally, one of the more attention-grabbing changes at BC is our potential partnership with Washington State University (WSU). The two institutions signed a Memorandum of Understanding (MOU) in 2015, allowing for further discussions. By signing the MOU, BC was able to begin investigating some of the details that a partnership might entail: benefits to students, accreditation and governance issues, financial implications, and requirements to move such a partnership through the state legislature. The discussions developed organically as our institutions sought to find solutions to address some of the state's higher education shortfalls. House Bill 2626, passed by the Washington State Legislature in 2014, strengthens the state's commitment to educational attainment, in part by setting two goals for the state: (1) that all adults ages 25–44 will have a high school diploma or equivalent by 2023, and (2) that 70 percent of those adults will have a postsecondary credential. These are excellent goals, but they will require some creative thinking. To meet them, the state of Washington will have to increase postsecondary graduation rates by roughly 56,000 students each year through 2023.

Partnerships like the one being explored between BC and WSU are one way to reach this goal. BC is located within the Puget Sound region of Washington State, an area that has both the major metropolitan city of Seattle and fast-growing satellite cities like Bellevue. These "east side" cities are home to growing corporations such as Microsoft and Boeing. Yet this metropolitan area has only one state-supported, bachelor's-degree-granting college: the University of Washington, the state's flagship research university, which is highly selective and limited in its enrollments. The region thus has a severe lack of access to affordable and local bachelor's degrees for thousands of high school students annually. As outlined in the MOU, Bellevue College would become Washington State University-Bellevue College (WSU-Bellevue College) and would continue to offer an array of two-year degrees. But BC would also augment its four-year degree offerings over time. We are viewing this possible partnership through the lens of how to best serve our region and our students. Looking at both the land-grant and community college missions, one can easily envision the benefits of this partnership. The ideals of land-grant universities include making high-quality education accessible, developing research and technological innovations that address the public good, and infusing contributions to solving the world's grand challenges into the undergraduate experience. Community colleges aim to provide a comprehensive educational program for individuals in their region through an open-access admissions policy and to serve as a community-based institution of higher education, teaching, and lifelong learning. A partnership between WSU and BC could significantly increase access to higher education, which we greatly need right now.[2]

This is an exciting time to be in higher education. Change is all around us. With community and workforce needs evolving at breakneck speed, community colleges can offer a nimble response. We should address these needs through creative and innovative models, while at the same time we must continue to offer an excellent and affordable education to anyone who is willing to put in the time and effort.

So, returning to the question that started this column: What does it mean to attend a community college? I believe it is an open-access opportunity to explore just about every aspect of the undergraduate experience.

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David L. Rule (dave.rule@bellevuecollege.edu) is President of Bellevue College.

The Use of Altmetrics in Promotion and Tenure

Promotion and tenure decisions in the United States often rely on various scientometric indicators (e.g., citation counts and journal impact factors) as a proxy for research quality and impact. Now a new class of metrics—altmetrics—can help faculty provide impact evidence that citation-based metrics might miss: for example, the influence of research on public policy or culture, the introduction of live-saving health interventions, and contributions to innovation and commercialization. But to do that, college and university faculty and administrators alike must take more nuanced, responsible, and informed approaches to using metrics for promotion and tenure decisions.

The Current Problem

It is a poorly kept secret in academia that faculty members being reviewed for promotion and tenure in the United States are often encouraged (if not required) to quantify the value of their work: the number of works published, the number of citations received, the impact factor of the journals in which they have published, the number of grant dollars obtained, and, more recently, their h-index. This approach, though well-intentioned, has several flaws: productivity does not necessarily equate to quality; citation counts vary widely across and even within disciplines; the journal impact factor is a poor metric by which to judge the quality of individual articles; grant funding is topically dependent and disproportionately distributed; and the h-index can be easily inflated through self-citation and collaboration.[1] Furthermore, citation-based metrics can shed light on only a very narrow type of impact (i.e., scholarly) and are predominantly employed for a very specific type of output (i.e., articles). Such indicators fail to fully capture the nuanced landscape of scholarly "impact."

In the humanities and more qualitative social sciences, the monograph is still the gold standard for promotion and tenure committees.[2] These disciplines tend to rely on publisher brand as an indicator of good scholarship, rather than on the quantitative metrics employed by their scientific counterparts. However, this approach largely replicates the same kind of publisher hierarchies underpinned by the journal impact factor—without the objective measures (albeit statistically flawed) for understanding what makes an outlet prestigious in the first place.

Therefore, the traditional ways in which promotion and tenure committees assess scholarship—whether quantitatively or qualitatively—are either inappropriate or insufficient for capturing its true value.

Altmetrics as a Potential Solution

In 2010, the Altmetrics Manifesto (http://altmetrics.org/manifesto/) was penned as a "call to arms" to disrupt the primacy of citation-based metrics in favor of using a more diverse, complementary suite of metrics—altmetrics—that are based on data from the social web. Altmetrics can help fill in the knowledge gaps that citations leave, allowing researchers to understand the use of their research by diverse groups including policy makers, practitioners, the public, and researchers from other disciplines. Altmetrics also reveal the impact of non-article research outputs: data sets, software, presentations, white papers, and other scholarly objects.

This move toward more diverse impact data has been enabled by the rise in web-native scholarship: scholarship that is not only created on the web (e.g., by using Dropbox to store and manage research data or Google Docs to collaboratively author a paper) but also discussed, shared, reviewed, saved, and recommended on the web, moving the informal scholarship conversations that happen in faculty lounges or around the family dinner table into the digital realm. With these abundant digital traces, researchers are now empowered to tell the stories of their scholarship as they never could before. In their tenure dossiers, they can now show the diverse impact of their research:

- *Societal impact*: Examples include citations to research in public policy documents, which can indicate effect of the research on the realms of public health, law, and other societally relevant domains; references in patents, which can show indirect effect on technology commercialization; and citations to research in Wikipedia (a resource referenced by over half of all doctors)[3]—which can showcase impact on the work of healthcare professionals.
- *Educational impact*: Articles and books that are canonical enough to be included in syllabi have arguably made a major impact on education. Similarly, data and other learning objects that are used to teach research concepts in the classroom have important educational impact and should be recognized as such.
- *Public engagement and outreach*: With researchers facing increasing demand to create scholarship that engages their communities, how well and how widely they disseminate their work is an important piece of evidence to include in tenure dossiers. Examples of outreach and engagement can include press coverage, social media buzz, and downloads and views of scholarship and public dissemination of science.

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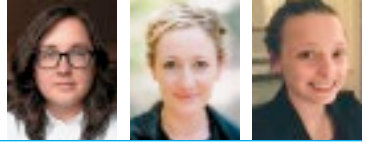
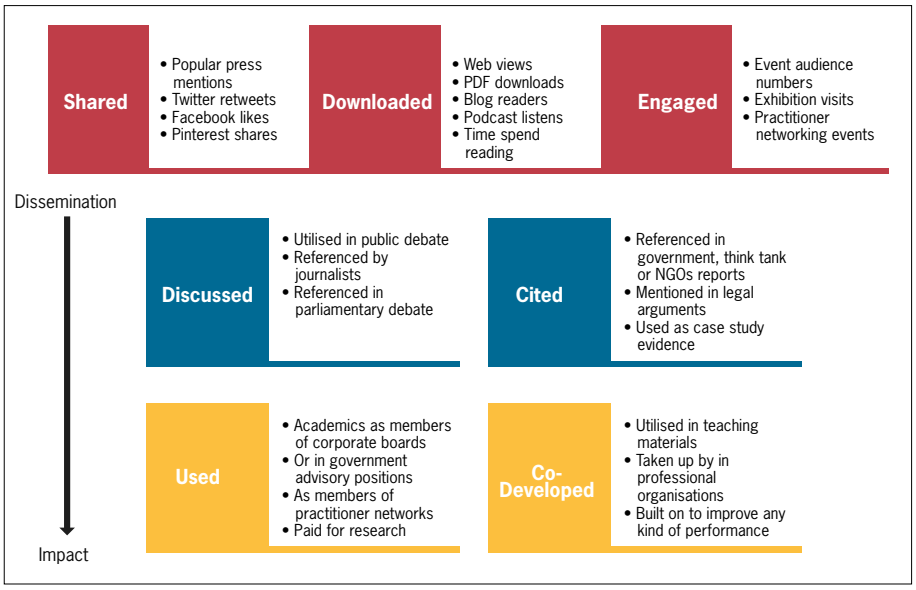


By STACY KONKIEL, CASSIDY R. SUGIMOTO, and SIERRA WILLIAMS

Humanists and social scientists tend to be skeptical about quantitative measures of impact, since these vary from the normative practices of evaluation for many disciplines. However, altmetrics provide a ready array of digital traces of impact and engagement and present an opportunity for scholars in the humanities and social sciences to understand and demonstrate the impact of their work. For example, many of these scholars may find that their work has made it into policy documents or is mentioned in the popular press. They may be able to use discussions of their books on GoodReads as indicators of public reception of their work.[4] As opposed to the more traditional, prestige framework of assessment, altmetrics can point to the wider context of how their research operates in the world.

FIGURE 1. Examples of Types of Impact Metrics Tracking How Research Has Been Used



Source: Image by Jane Tinkler, published in James Wilsdon et al., *The Metric Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management* (HEFCE, July 2015), DOI: 10.13140/RG.2.1.4929.1363, reused under an Open Government License 2.0 (http://www.nationalarchives.gov.uk/doc/open-government-licence/version/2/).

Cautionary Measures

Quantitative measures of scholarship are but a single lens to view quality and impact. Indicators—alt or not—can provide a measure of the diffusion of work; however, richer narratives can always be found by digging deeper into the qualitative data behind the metrics: *who* is saying what about the scholarship, *where* the scholarship is being diffused, and *how* the scholarship is being translated into tangible benefits to society. A hundred thousand tweets about a paper on HIV may be a signal of *attention*; the fact that many people have read the paper and have changed their personal practices evidences *impact*. In short, we must take care not to mistake attention for impact.[5]

The scholarly community faces a challenge. On the one hand, altmetrics can help to capture patterns of influence and can broaden our understanding of how scholarship is being used, communicated, and acted on. Yet in using these metrics, the academic community is implicitly condoning their use and redefining our notions of what constitutes valuable scholarship. There are implications for goal-displacement as the academic community seeks to write "tweetable" papers in order to maximize success. Furthermore, such judgments may limit society's future understanding of impact and value.[6]

Changing the conception of impact is not entirely unwarranted, however. Tenure has long been linked with an obligation to disseminate scholarship both within and outside the academy.[7] Informed with the strengths and limitations of the tools and data available, researchers can construct more comprehensive portfolios and richer narratives of the ways in which their scholarship is diffused and the impact it has on society. With proper understanding, altmetrics can help to tell this story. ■

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The Future of Faculty Development in a Networked World

Let's start with a question: What if approaches to faculty development within higher education have been overly focused on "teaching to the middle"? Much like the continued prevalence of the generic, one-size-fits-all that still informs the stand-and-deliver mode in too many lecture halls across colleges and universities, long-standing efforts to garner widespread adoption of innovative technologies for teaching and learning via workshops and faculty development institutes may have run their course (so to speak). As higher education moves toward anytime/anywhere, self-paced learning, personalized learning may be an important focus not just for students but also for faculty who are learning about emerging technologies.

At most institutions, however, learning technology units are far too understaffed to provide one-to-one, on-call "Geek Squad" support for faculty. As a result, faculty depend on IT organizations as technology service providers rather than as interrelated and collaborative partners with whom they can work to improve teaching and learning. Although personalized learning is not a new idea, ramping up personalized learning in educational technology for faculty development may indeed be a new idea—particularly if we think about putting personalized learning into the framework of connected learning, with faculty becoming networked learners within and across institutions.

Recent investments in education from the Bill & Melinda Gates Foundation and Mark Zuckerberg have reignited interest in personalized learning for students in various educational environments.[1] Personalized learning emphasizes pedagogies and strategies that enhance student success by moving from the generic to the specific and the individualized. Currently, systems for personalized and adaptive learning most often use student data to inform which strategies or interventions are required for an individual student to reach a learning goal or objective.[2] In addition to individual assessments, data analytics allows content to be populated from a wide variety of data points. Learner profiles can be created based on behaviors tracked during interaction with the system and with course content. Predictive modeling has enhanced the ability of technology to foretell student learning and behaviors.

Instead of normative, one-size-fits-all curricular delivery where content for an entire class is designed toward and aimed at "the middle"—based on the assumption that some students will lag behind while others will be able to achieve content mastery more quickly—personalized learning aims to provide interventions and accelerations that are catered for the individual student. Off-the-shelf products are prepopulated with content integrated with specific textbooks. Other products serve as authoring tools that allow instructors to create their content within a structured system. Currently, some authoring programs allow instructors to provide content and guidance for the learning path, but such options should be more routinely available and should become essential design tools that enable faculty to customize their courses. Although not yet as robust or as prevalent, open-content generators have exciting implications for the future of personalized learning.

We are most excited by what is on the horizon, by the potential for personalized learning to go even further in recognizing and fostering learner "agency." Students are more likely to thrive in learning environments that ask them to participate as active contributors.[3] Becoming a reflective and critically engaged learner could begin with an awareness and analysis of the successful learning behaviors that most systems track. In other words, understanding what kind of data is collected and analyzed and having the learner provide interactive feedback is still an untapped opportunity for developing learner agency and self-efficacy via current analytics. This feedback information loop could potentially impact how data analytics informs the ways current systems communicate with learners, shifting away from the predictive *in loco parentis* notifications that may inadvertently perpetuate less proactive learner behavior.

Of more importance, personalized learning that routinely provides opportunities for students to become co-creators and curators of content as part of the learning process should become a normative learning objective and expectation. Assessments that not only allow but expect learners to demonstrate curricular mastery through knowledge application, rather than knowledge consumption, are likely to become increasingly important over the horizon. As Seth Godin has recently suggested, the "industrial-education process" has relied on (and teaches students to rely on) the traditional "visible metrics" of "doing well on the assignments." Graduating seniors dutifully list majors and grade point averages on resumes, but those metrics, according to Godin, actually tell employers far too little about what they really want to know. He argues that all students ought to be demonstrating what they can do and showcasing their abilities in the open and on the web (beyond the confines of a class assignment) because their potential future employer will be asking: "Where online can I see the trail of magic you regularly create?"[4]

New Horizons Editor: **Shelli B. Fowler**


BY SHELLI B. FOWLER and M. AARON BOND

This continued evolution in personalized learning with coursework that challenges students to create in addition to complete content will require a shift in how faculty view and interact with students.[5] Connected learning is a useful model that can guide this transformation. Although many faculty have always seen themselves as interactive "guides on the side," and model curiosity and other essential lifelong learning behaviors as part of their teaching, much modularized content is still based on the "sage on the stage" paradigm. Learning systems need to become less static and more dynamic.[6] The tenets of connected learning are changing student learning, and they can also help move faculty development in ed tech from the closed setting of a course-redesign workshop to an open and networked community of peer-to-peer learners within and across institutions of higher education. Rebuilding faculty development experiences to better align with connected learning would highlight technology-enhanced active and problem-based learning course (re)design across disciplines and content areas. Connected learning for faculty development would emphasize the same engagement and outcomes expected of students. As stated on the CLA and DML Research Hub's Connected Learning website, these qualities can be grouped into three primary learning principles:

- *Shared purpose*. Connected learning environments are populated with adults and peers who share interests and are contributing to a common purpose. Today's social media and web-based communities provide exceptional opportunities for learners, parents, caring adults, teachers, and peers in diverse and specialized areas of interest to engage in shared projects and inquiry. Cross-generational learning and connection thrives when centered on common interests and goals.
- *Production-centered*. Connected learning environments are designed around production, providing tools and opportunities for learners to produce, circulate, curate, and comment on media. Learning that comes from actively creating, making, producing, experimenting, remixing, decoding, and designing, fosters skills and dispositions for lifelong learning and productive contributions to today's rapidly changing work and political conditions.
- *Openly networked*. Connected learning environments are designed around networks that link together institutions and groups across various sectors, including popular culture, educational institutions, home, and interest communities. Learning resources, tools, and materials are abundant, accessible and visible across these settings and available through open, networked platforms and public-interest policies that protect our collective rights to circulate and access knowledge and culture. Learning is most resilient when it is linked and reinforced across settings of home, school, peer culture and community.[7]

As all of us in higher education move closer to what's on the horizon, let's explore the power of connected learning, which brings individualized work into the open and into the networked learning communities that our technology and social media tools so easily engender. With students and faculty so closely connected in today's networked world, perhaps we should begin asking faculty: "Where online can I see the trail of magic you regularly create?" It's time to move faculty development away from the idea of teaching to the middle and toward a connected learning framework that embraces personalized learning. ■

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Foundations: Past and Future

To educators and students, technology is not an end in itself but rather a set of additional tools to help enable a more productive educational experience. The dramatic growth of online and hybrid courses and degree programs reflects the enabling power of technology to help serve broader student populations. However, to meet U.S. national goals for college completion and the needs of future students, colleges and universities will need new policies and new approaches. A growing number of higher education leaders believe that technology has a critical role to play in providing the foundations for improving educational outcomes and student success.

The Interoperable Foundation

Nearly ten years ago, I became CEO of the IMS Global Learning Consortium (IMS). I believed that the education sector needed to develop a working open-source foundation that would accelerate the progress in applying technology to educational innovation. Although open source was beginning to achieve substantial gains in education around that time, I also believed that interoperability and open standards held the potential to maximize the return on investment across a wide variety of commercial and noncommercial sources.1 But I knew that a new leadership culture that prioritized the application of technology to enhance the educational mission would be required.

I'm pleased to report that IMS has grown from 50 to 350 member organizations. This amazing growth is a testament to the leadership and cooperation of the IMS member organizations (leading institutions, suppliers, government organizations, and foundations worldwide) on breakthrough interoperability such as Learning Tools Interoperability (LTI). Clearly, interoperability that is led and owned by the education sector not only is possible but is taking hold. As of today, more than 375 products have achieved IMS conformance certification, resulting in significant savings for both suppliers and institutions. And these savings are being redirected toward more innovative products and approaches. Indeed, IMS standards are helping to define the key architectural innovations needed to support evolving educational models.

The NGDLE Foundation

Two years ago, Jack Suess, Malcolm Brown, and I wrote an *EDUCAUSE Review* article titled "A New Architecture for Learning."[2] We posited that to support students and faculty as connected learners and instructors, higher education must rethink its approach to academic technology architecture to scale connected learning. At the foundation of that architecture is information technology. As the number of educational apps, tools, and platforms explodes, institutional information technology needs to find more efficient ways to integrate them into the enterprise, thereby providing a seamless, connected experience for faculty and students. We noted that bringing about the change we were seeking would require historic levels of cooperation and collaboration across U.S. higher education institutions, national organizations, the commercial sector, and educators.

Today I am glad to report that I see tremendous progress—thanks to support from the Bill & Melinda Gates Foundation, the leaders of national organizations, commercial suppliers, and many campus instructional technologists and leaders. One showcase of this progress is the report by Malcolm Brown, Joanne Dehoney, and Nancy Millichap: *The Next Generation Digital Learning Environment*. Through extensive interviews with more than seventy thought leaders across higher education, the authors examined the current learning management system (LMS) and extended the technical description earlier described in "A New Architecture for Learning," noting: "Over time, the LMS needs to be supplemented (and perhaps later replaced) by a new digital architecture and components for learning that contribute to and enable the transitions that higher education is currently experiencing."[3]

They identified several dimensions to be addressed as we move toward the Next Generation Digital Learning Environment (NGDLE):

- Interoperability and Integration
- Personalization
- Analytics, Advising, and Learning Assessment
- Collaboration
- Accessibility and Universal Design

I agree. I recently attended a day-long event focused on the next steps needed to advance the NGDLE. I left the meeting believing that four areas will be key to making the NGDLE a reality. The good news is that they are all in the works.

First is the opportunity associated with accessibility and, more generally, personalization. Those in our meeting discussed the fact that many of us, though not officially designated as "special needs," often used accessibility features on our phones to improve the experience. The group examined the IMS standard Access for All (https://www.imsglobal.org/activity/accessibility), which allows individuals to create global

Viewpoints Editor: **John Suess**

By ROB ABEL

preferences that will work across all tools and content solutions. Although ubiquitous adoption of Access for All will take time, it defines a comprehensive set of personal attributes that could greatly advance accessibility and the personalization of learning environments for each user.

Second are the opportunities in analytics. The IMS Caliper Analytics standard (https://www.imsglobal.org/activity/caliperram) has been released, and we have begun to see leading organizations achieve conformance with the standard. Caliper will allow institutions to get interoperable data on how students use content and tools provided in a course. With data, we can help students succeed, and we can improve the tools we create.

Third, related to the dimension of interoperability and integration, the release and adoption of LTI2 (https://www.imsglobal.org/lti-v2-introduction) is enabling much richer integration to occur between the LMS and tools or content. With LTI2, institutions can support the sharing of an accessibility profile, data about where to place the tool, and rich outcomes, thereby improving the user experience. Perhaps just as important, LTI2 will allow "integration at the speed of now"—one-click integration with automated negotiation of which services are supported.

Fourth, in terms of collaboration and personalization, the IMS Community App Sharing Architecture (CASA) project (https://www.imsglobal.org/activity/community-app-sharing-architecture-casa) provides an open standard for publishing and sharing catalogs of applications (mobile, web, embeddable learning tools) with application metadata about features and functions. CASA will enable the construction of affinity-focused peer environments where each peer (e.g., a university) can apply local policies for both publishing and receiving app catalogs. We expect most suppliers and vendors to have a CASA, as will many educational institutions. The goal for CASA is that as cloud-based applications use LTI2 and Caliper Analytics, we can give faculty the control to add new learning tools and content in their courses.

■ ■ ■

Over the last few years, I have been heartened to see a number of colleges and universities step up and engage their campuses in furthering the NGDLE:

- Twenty-two institutions have joined Unizin (http://www.unizin.org) and are working to improve the digital learning experience by providing an environment built on collaboration, data, standards, and scale.
- Twenty-four institutions have received iPASS grants from EDUCAUSE to build better advising systems.
- Twenty-two institutions have joined the Personal Learning Consortium at the Association of Public and Land-grant Universities (http://www.aplu.org/projects-and-initiatives/personalized-learning-consortium/).

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- Hundreds of corporate, K–12, and college/university members of IMS are enabling the interoperable foundation for all of the above.

Ten years ago when I joined IMS, the topics discussed above were considered esoteric. That is not the case today. The idea that ed tech should be "plug & play" via an interoperable foundation is rapidly becoming mainstream. If your institution has not been engaged directly, I invite you to participate in one or more of these efforts. Another opportunity is to join the EDUCAUSE Learning Initiative (ELI) and actively follow the developments taking place. At a minimum, the one thing that each higher education institution can do is require new and existing suppliers to achieve conformance certification with the standards noted above (all certified products are listed here: https://www.imsglobal.org/cc/statuschart.cfm). By citing standards certifications as requirements, you are helping to protect your own investments, enabling a more innovative IT environment, and advancing the community toward achieving the NGDLE. ■

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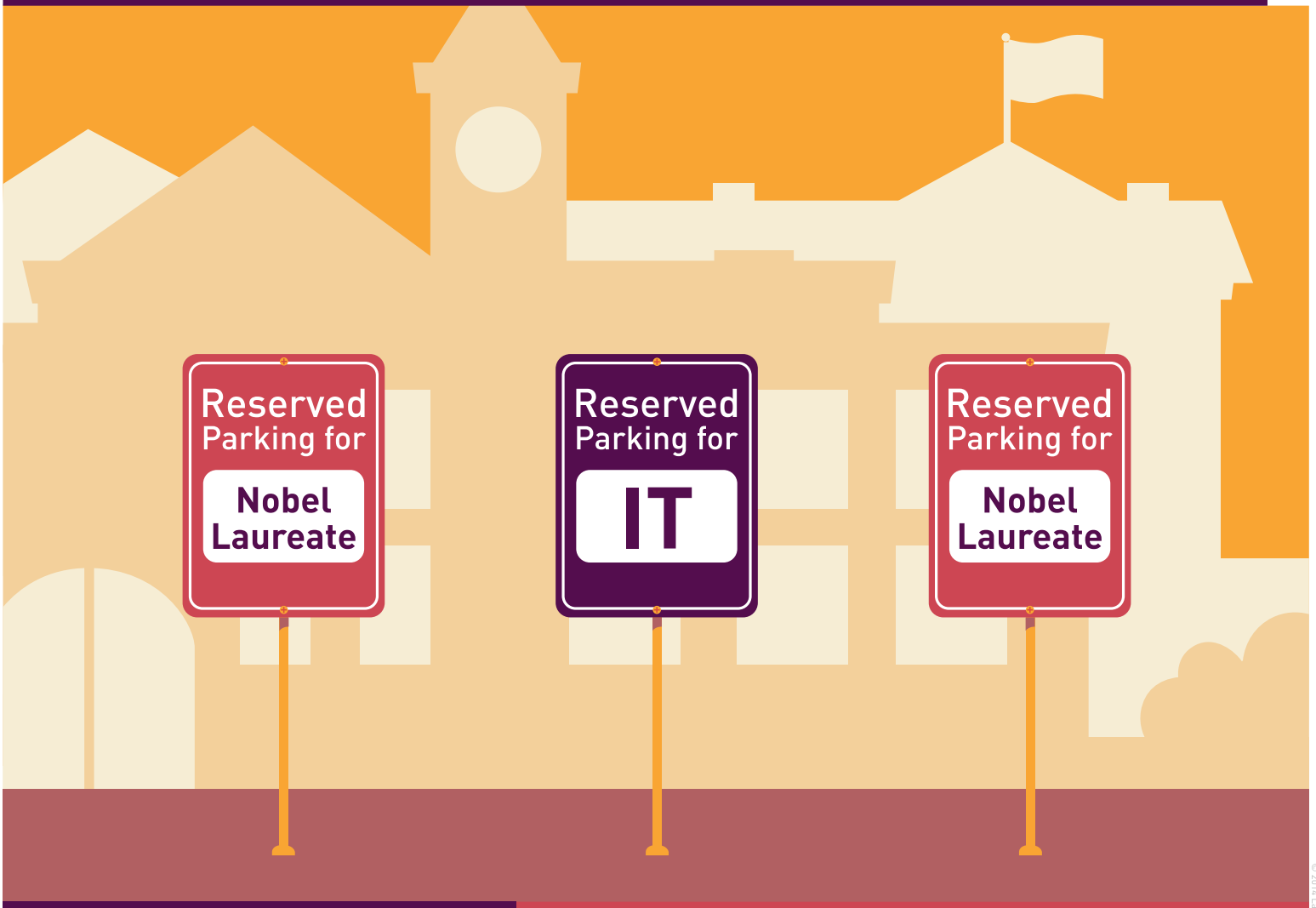

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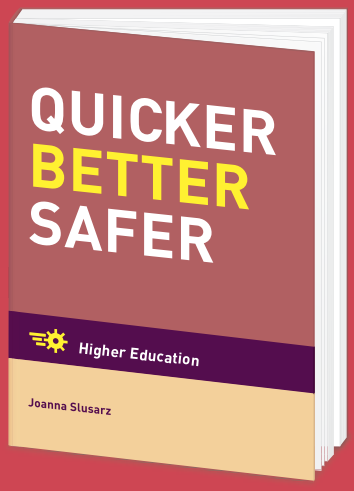

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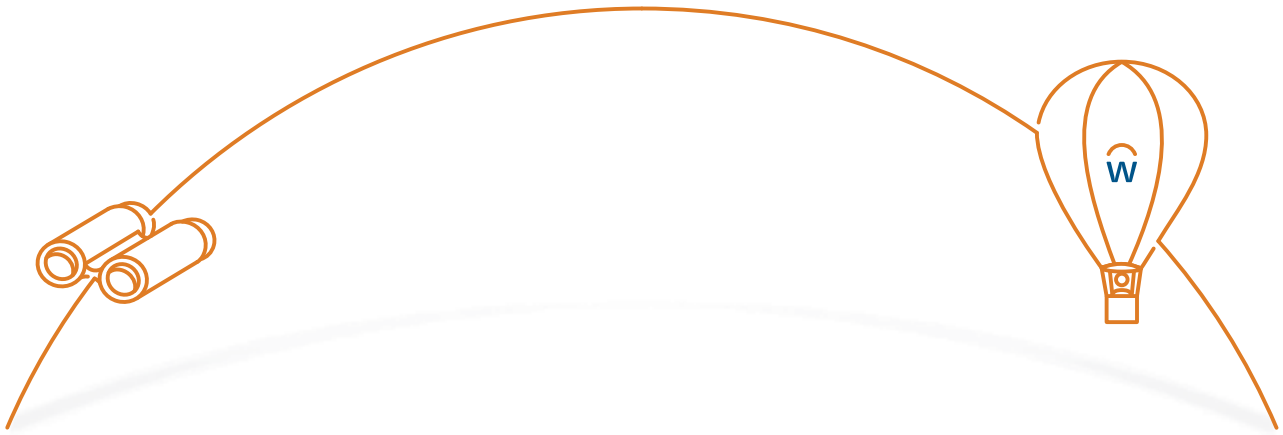

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