CATCHING THE WAVES:
TECHNOLOGY AND THE COMMUNITY COLLEGE

By John O’Brien and Mark Milliron
The role of problem-solver is one that community colleges are well-equipped to play. Just over a century old, community colleges have been at the forefront of nearly every major development in higher education since their inception. To appreciate the role that community colleges can be expected to play in reforming higher education today, Americans would do well to consider their long history of innovation.

—Sean Trainor, “How Community Colleges Changed the Whole Idea of Education in America,” Time, October 20, 2015

In 2000 the book Taking a Big Picture Look @ Technology, Learning, and the Community College was released by the League for Innovation in the Community College. It was a collection of reflective essays, research reviews, and model program highlights showcasing the coming of age of technology in the bastion of educational access and innovation, the community college. As the research and case studies in the book illustrated, community colleges have a deep commitment to innovating around increasing access and opportunity in higher education. Moreover, when exploring new technology, the usual fear of change notwithstanding, they were more than willing to try, test, and share—more so than other sectors of education.

Little has changed, yet much has changed. Community colleges remain focused on access and innovation aimed at helping more, and more diverse, students be more successful on their higher education journeys. In addition, the mission and vision of these colleges attract innovative, deeply committed professionals who remain more than willing to try, to test, and to share.

What has changed, however, are the cultural dynamics, the funding levels, the policies, the political environment, the expectations, and critically … the technology. With respect to the latter, the predicted “waves” of technology definitely came ashore, sometimes crashing, at other times rolling in more slowly. Indeed, higher education is swimming in more technology today than could have seriously been imagined in 2000. Remember, in the year 2000 GPS was still science fiction for most, smartphones did not exist, social media sites were years away, and the internet was dominated by technology devotees who spoke in a shorthand language most did not understand.

As such it is important to take a step back and a hard look at the waves of technology that have washed over the community college shores during the last few decades. It is important also reflect on the core commitment to access coupled with the willingness to apply technology to new pressures, problems, and priorities. In addition, there is opportunity to look out to the horizon at some waves just crashing in and examine others on their way. All the waves, however, begin with access as the anchor, which to the seasoned community college observer, is no surprise.

Wave 1: Access and Efficiency

The community college movement was inspired by an unwavering passion to expand access to higher education, and so it makes perfect sense that the first wave of technology adoption at community, technical, and comprehensive colleges was focused on access. Southern New Hampshire University (SNHU) president Paul LeBlanc writes in EDUCAUSE Review that technology implementations can be broken down into three levels:

1. Technology that allows us to do what we have been doing but to do it better.
2. Technology that allows us to do what we have been doing but to do it less expensively.
3. Technology that allows us to re-invent what we do.

This first wave of technology falls squarely in the foundational position of doing the work of the community college better. After all, while there is now a broader completion challenge, in the first decades of community college evolution, college—in very concrete ways—represented a ticket out of poverty, and access was interchangeable with success, not a separate milestone to be accomplished. While later waves of technology innovation focused on success, initial technology was more about building better, more convenient systems and less about dramatically changing the student experience or improving outcomes.

For example, until the 1990s, it was not uncommon to see deans building their course schedules using magnets on whiteboards to represent individual course sections. Finding ways to use spreadsheets or databases to accomplish this chore certainly improved the handling of this task, but it did not appreciably improve course offerings
themselves, strategically adapt or expand course availability, or necessarily change a student’s registration experience. Students who could register for courses by phone very much appreciated the convenience, but the deployment of this technology innovation was not a sea change when it came to course schedules or registration itself.

While these creative applications of existing technologies mattered, they were also very much in the style of Roosevelt’s belief in “doing what we could with what we had.” At this time, college information technology (IT) was very widely understood to be a utility, and this mindset is apparent in the tools that were deployed. Utilities provided needed infrastructure, though they are typically not even visible until they break in one way or another.

Internet technologies and their applications were conceived of as water from a tap or electricity from a wall socket, as evident from the tendency in this first phase to put an “e” in front of everything under the sun: e-learning, e-tutoring, e-applications, and so on. More than once, people used “E” alone as shorthand to refer to the universe of technology innovation, and EDUCAUSE even published a book noting the ubiquity of the E: The E Is for Everything: E-Commerce, E-Business, and E-Learning in Higher Education. Technology leaders became so e-happy in the first wave that one exasperated two-year college faculty group declared in a newsletter that they had, in fact, had “e-nough!”

This initial wave of changes was hardly transformational, but they provided incremental qualitative improvement. For example, spreadsheets were an existing tool, but in the 1990s faculty began to realize the power of deploying these standard office productivity tools to keep grades—making it possible to track student performance, discuss grades in process with students, and experiment with weighted gradings of assignments with ease. At the same time, faculty began to experiment with videos, though seldom breaking free of the standard “talking head” framework. Early WebCT systems even preserved the brick-and-mortar framework, creating discussion groups within the online course environment in traditional “classroom” configurations.

Nonetheless, a powerful, heady optimism prevailed as technology opened eyes to a future that was bright. In fact, this first wave brought a powerful sense that technology could solve countless challenges. Not enough revenue? E-learning enrollments! Not enough parking? E-learning! And the list went on and on. Two-year colleges, with a long history of open access and serving the underserved, swooned at the potential of new technologies to extend reach (while also promising to solve nearly every fiscal problem imaginable).

Those who feel that the massive open online course (MOOC) mania of a later decade was unprecedented clearly were not working at a community, technical, or comprehensive college in the late 1990s or early 2000s.

This initial surge of technology captured the imagination of academic leaders and faculty when it came to instructional technology and academic applications. Also in the 1990s, the enterprise resource planning (ERP) systems offered colleges an integrated approach to the business that supported institutions, working behind the scenes (the dreaded “back office”) to manage financial transactions, human resources, student aid, housing, registration, and other critical core business components. A good amount of this ERP energy was helped along by the Y2K panic: the pernicious fear that current enterprise systems were going to collapse because of their codes’ inability to handle the switch from 1999 to the year 2000.

Similar systems began to bring powerful organizational savvy to resource management, including classroom scheduling. “E-fficiency” may have been a forbidden utterance in faculty circles during the first wave, with the exception of advancements like Scantrons, CFOs, and other enthusiastically launched systems that provided insights and efficiencies where they were very much needed. And the most forward-thinking colleges invested the money saved in the longer term through ERP systems back into the academic enterprise.

Wave 2: Access and Learning

The first wave of technology at community colleges was all about access and about opening eyes to the enhancements and efficiencies technology made possible. The wave that followed (of course the metaphor simplifies the reality of concurrent waves) begins the rise of learning technologies, which has continued through the present time.

If the first wave relied on technology as a utility, this second wave could be understood as demonstrable evidence of technology making a difference beyond access alone into the realm of teaching and learning.
These online options that were not dependent on buildings and the synchronous attendance of teachers and learners led to new strategies to engage, involve, solicit feedback from, and improve the learning of striving students. Most importantly, this capability allowed community college educators to remove online learning from the sole purview of “distance learning.” Time shifting was particularly important for working students. The Sloan Foundation, and its driving program officer, Frank Mayadas, were the real patrons of this work in the community college sector. The Sloan-C network—now the Online Learning Consortium—became a major catalyst and support system to help ramp up these offerings.

Still, the credibility of pure-play online learning was a challenge. This challenge, along with the need to ready reluctant faculty, is one of the reasons the main use of learning management systems (LMS) in the early days was to create online resources for in-class experiences. This was a light version of blended learning, which was to become more and more the norm over the next ten years. Today most classes in community colleges are supported by an LMS, and a solid number of community college students (almost one in three) are also blending their learning journeys with some on-ground classes and some online. Interestingly, research is showing that these students are some of the most successful, while EDUCAUSE’s recent survey shows that both students and faculty prefer hybrid environments.

Coincidental with the rapid expansion of online course and program development, these dynamic technologies allowed students to create content for instant worldwide consumption (blogging), collaborate, make social connections for learning, create mashups, and more; the idea of a static World Wide Web gave way to a dynamic, interactive web of connectivity, all of which lent itself to improved learning. For example, Practical Magic: On the Front Lines of Teaching Excellence found that award-winning faculty were most likely to leverage technology for student-driven learning and engagement.

Reenergizing Teaching Materials
Community college faculty enjoyed a growing palette of possibilities that helped engage students in learning in both face-to-face and online environments. Early LMS systems with one-dimensional resources now offered the means to compile multimedia resources. With the appearance of YouTube in 2005, not only were instructional videos easier to find, but also the broad access to...
videos and their exponential growth exposed faculty to new ways to use video for learning beyond simply recording lectures. Michael Wesch’s 2007 viral video A Vision of Students Today not only demonstrated new visually powerful ways to use video to make a compelling point but added a sense of urgency about updating teaching approaches to better reach these “digital native” students who are no longer content to learn passively.

Learning objects that offered illustrative images or interactive learning experiences were shared through web-based hubs like the Multimedia Education Resource for Learning and Online Teaching, better known as MERLOT. Interest in e-portfolios took off, giving students a way to capture learning as they chose to define it—including learning artifacts and accomplishments at any age. In addition, new software tools encouraged and facilitated attention at the curricular level, with systems like WIDS making it considerably easier to document learning outcomes and align them to larger department or institutional academic goals.

Reimagining Learning Spaces

Technology tools provided new inspiration for community college faculty and the fledgling group of academic technology professionals supporting them, always on the prowl for new approaches to inspire the imagination of students. However, new learning materials were only part of the picture. At the same time, learning spaces enjoyed something of a renaissance.

Community and technical colleges were, from their inception, designed to be less tradition-bound (e.g., the 1960s “classroom without walls” enjoyed some traction). Nonetheless, even at these institutions, the vast majority of students lined up in rows facing a teaching stage. Technology dramatically changed the configuration of space in industries around the world, yet higher education held on tenaciously to the classical classroom.

During this second wave, the physical classroom began to change to unleash technology-enhanced learning. Horizontal rows could be moved into circular groupings around a laptop or smartboard, and colleges worked hard to increase the proportion of wired classrooms, multimedia classrooms, or whatever else classrooms were called at that time that were flexibly designed and technology ready. The broad range of excitement around advanced and flexible learning spaces is evident in the EDUCAUSE book Learning Spaces, which is replete with campus examples.

So, frequently struggling with finances, at many community colleges technology-ready classrooms often amounted to AV carts, with technology wheeled in and out as needed, until fully wired classrooms became more ubiquitous. As these classrooms became more commonplace, other technologies were developed to further engage students, most notably student response systems (“clickers”) that fit in well with the active learning movement that saw a resurgence during this same period—perhaps as technology innovations created new possibilities for active engagement.

Beyond the sea change in physical classrooms, surely one of the most exciting changes experienced during this period was the creation of virtual learning spaces. As online enrollments continued to climb year after year at community colleges, more attention was focused on how to make virtual classrooms as engaging as or more engaging than traditional ones. In many respects, the reach clearly exceeded the grasp.

During this time the idea of games and simulations, as well as virtual worlds, was stimulating, though the actual experience was often less exciting than the idea itself. “Games for learning” and games for social good were inspiring, but early efforts were often clunky and more bolted-on than integrated into a given course.

Grant funding would spur development of simulations that were often not sustainable beyond the initial infusion of cash, and a standard development engine was not in place. In short, games and simulations were arguably ahead of their time. It is difficult to find a better example than virtual worlds used for learning spaces to make this point.

A. J. Kelton was hedging his bets when he said that the “outlook is good” in this area while acknowledging the uncertainty around platforms like Second Life. Alas, those who spent countless hours creating Second Life islands for their college, department, or course now find these sites barren and empty. Those who need to experience firsthand the downside of ed tech hype could certainly go on a cautionary tour of some of these abandoned locations.

As IT staff and faculty wait to see how consumer virtual, augmented, and mixed reality products resolve into leading products and platforms, there is little doubt that what they thought might happen in the first decade of this century will happen in the years ahead. Recent EDUCAUSE research suggests that 40 percent of colleges and universities will have institution-wide deployments of augmented and virtual reality technologies in the next five years, and the flood of technology innovation anticipated a decade ago may well be fully realized now that AR and VR technology has advanced more fully.

Coinciding with these many layers of incremental and sometimes dynamic change, wave 2 was also a time of planting seeds. In many ways the conversations happening today related to potentially new models for higher education found their beginnings during this period—and were to some degree enabled by technology advances and applications. Broader creative reconfigurations of the semester may well be traced to Rio Salado College (AZ) in the Maricopa Community Colleges system, whose online offerings were far ahead of their time in allowing
multiple start times throughout an academic year instead of a few fixed start dates. Similarly, this second wave of new technologies also encouraged broad interest at two-year colleges in credit for prior learning and competency-based education at scale with the creation and growing influence of Western Governors University.

Finally, an important spirit animating this period was the drive to more openness. This is not the flashy media story of later MOOCs, which was really more of a rogue wave than anything else, but a comprehensive belief in openness of all kinds. Certainly, the “O” in MOOCs is involved, but also the many other open initiatives during this time, including MIT’s Open Courseware initiative (OCW), open source software and systems, Open Educational Resource Commons, creative commons, and more. The Hewlett Foundation was particularly important in expanding this work.

This interest in openness at community colleges was an important offsetting response to persistent concerns at this time related to a growing realization of the digital divide, whereby online access (and later broadband connectivity) was discouragingly linked to socioeconomic status and location. Naturally, community colleges were uniquely sensitive about issues of equity and focused on narrowing any digital divides. In some cases, local community colleges served literally as a connection hub not only for the college but for the greater community as well.

Wave 3: Access and Success
Both access and efficiency and the access and learning waves put technology “on purpose” in their own ways. Put simply, once a need was identified, the available technology was applied to meet that need. Early on, the pressing need was to address access and efficiency, as the ever-scrappy community colleges were trying to do more with less in their work to bring more students into the fold. As the internet expanded and technology matured, it was clear that these tools also held the potential to bring the access and learning imperative to life.

However, in a presentation at the League for Innovation in the Community College’s Conference on Information Technology in 1996, Terry O’Banion made a prescient and intentionally provocative observation: “The World Wide Web holds the horrible potential to make already terrible instruction that much more available.” Indeed, many early online classes ended up being illegible overheads repurposed to stale web pages.
At the same time, the “learning paradigm” and “learning revolution” work began asking driving questions about how technology could be used to improve and expand learning significantly. However, a follow-on question—a far less comfortable question—was also asked: How do we know? Specifically, if technology was used, how is it known if it improved or expanded learning? For that matter, even if technology was not used, how do we know if any innovation or initiative improved or expanded learning? Where are the data?

The how-do-we-know questions are both learning-moments questions and learning-journeys questions. As a result, technology tools emerged around learning outcomes mapped to learning journeys. Most notably, digital learning portfolios allowed for more expansive and accessible strategies to capture the results of capstone or project-based learning strategies. Then technology tools to capture in-class learning progression and mastery began taking shape.

Learning outcomes assessment became a toolset available to colleges that needed to map and document learning mastery for accreditation, licensure, and professional certification. As discussed in Learning Outcomes for the 21st Century, leveraging technology to help answer the how-do-we-know questions at this level was vital if learning-centered innovation were to expand. However, these conversations were in some ways eclipsed as the completion agenda exploded on the scene in 2009–2010.

From Reporting on Access to Leveraging Analytics to Improve Completion

It could be argued that up until the latter part of the first decade of the twenty-first century, enrollment still ruled as the measure of a successful and healthy community college. While there had been clarion calls for an increased focus on other metrics, enrollment was the measure that mattered above all others in terms of public perception and fiscal stability. From diverse tuition strategies to the array of state and local funding models, operational sensitivity to enrollment was high. But the public perception and levers of funding were about to shift.

Suffice it to say that a confluence of federal, state, foundation, association, and intermediary initiatives, innovations, and research led to a clear understanding that access was simply not enough. For students, communities, and the nation to realize the potential of community college education, the completion of credentials had to be taken far more seriously. Therefore, data...
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However, given the long-standing focus on enrollment—particularly its close ties to funding models in most states and systems—getting enrollment data and high-stakes reports right still mattered. Technology had been and still was being deployed to meet this need. From sophisticated spreadsheets to advanced business intelligence systems anchored in data warehousing and reporting tools, the goal was to get good information to boards, state regulators, federal agencies, and accreditors. This work was at best required and at worst existentially threatening.

Institutional research (IR) departments took their work seriously—so much so that they were typically overwhelmed with requirements and particularly protective of their products and processes. Harvesting data from existing ERP systems was often difficult, made even more so by the need to bring together data from disparate systems outside of the purview of the student information system.

Still, through a variety of technology tools—and sometimes very creative workarounds, innovations, and sleepless nights—progressive data-centric colleges collected key performance indicators (KPIs) and followed emerging continuous quality improvement (CQI) traditions. For example, the Continuous Quality Improvement Network (CQIN), an early and effective data-centered organization, featured colleges that won the Baldrige Award (e.g., Richland College, TX) in key publications and (e.g., Community College of Denver, CO, in Embracing the Tiger). These early leaders were shining examples of the courage to learn and guide organizational change with data.

As noted previously, over the last decade the field began to respond to emerging—and at times explosive—policy changes, practice pressures, and proactive leadership voices that made the case that enrollment and access were only part of the student success picture; progression and completion were core metrics that mattered as well. Responding, however, meant an expansion of what was expected in the reports more than it meant the move to advanced analytics and predictive modeling right away.

Indeed, the most pressing needs were technology tools that would better respond to increasing calls for more, and more nuanced, data demands by large-scale initiatives—for example, Achieving the Dream, Completion by Design, Complete College America, and the Aspen Prize—and newly motivated boards, state agencies, accreditors, and federal agencies. At the same time, leading voices at the Association of Community College Trustees (ACCT) began telling community college board members, “You may know your enrollment numbers, but if you don’t know your institution’s retention and completion rates, you’re not able to effectively govern your college.”

As outlined in the white paper Making the Most of a Healthy Change in Education, as early expanded
data efforts gained steam, the higher education sector also began learning that an important innovation to help their students succeed at higher levels, and for the corresponding outcomes to improve, would involve putting data to work in new ways; in other words, they needed to explore advanced analytics.21 Much as electronic medical records and digital tools had created deeper and richer information streams in health care, the access and instruction wave that flooded across community colleges had created deeper and richer data pools from which to draw insight on learners and their success pathways.

Initiatives like the Action Analytics Symposiums at the Minnesota State Colleges and University system, the EDUCAUSE Next Generation Learning Challenge analytics challenges, and the Predictive Analytics Reporting (PAR) framework, and companies began showing how institutions could bring together the best of modern data science (e.g., predictive modeling, machine learning, and sentiment analysis) and creative design thinking to better understand and respond to student challenges and opportunities. From deeper intelligence to targeted mind-set nudging, a whole new suite of tools was now on the table.

The next step in this journey, however, involved developing tools, technologies, and apps that could be deployed directly to faculty, advisers, and students to enable them to make better decisions on their journeys. Researchers could “democratize the data” and involve more educators in student success innovation. The Integrated Planning and Advising for Student Success System (iPASS) work funded by the Bill & Melinda Gates Foundation arguably was one of the largest scale projects that attempted to explore the potential and impact of this work on student completion.

Focusing mainly on advising technology, iPASS explored a family of technologies—such as adviser case-management apps, early-warning systems, and career planning tools—coupled with process and policy change. What became clear from these efforts was that advanced analytics held the potential to move the needle on student success. However, new systems, processes, and even leadership strategies would need to be put in place to truly make the most of these efforts.24 Moreover, there was culture work to be done to help institutions embrace new perspectives on data and governance to create organizational readiness, particularly around privacy and ethical uses of analytics.25

**Embracing “How Do We Know?”**

There is compelling work under way on exploring learning moments and journeys. For example, leaders at the Open Learning Initiative at Stanford University and the Link Research Lab at the University of Texas at Arlington are pushing the boundaries on linking learning technologies to learning science and affective response. Moreover, analytically powered systems are now available to leverage student and institutional data to more precisely understand which innovations are working, at what level, and for which students. Austin Community College (TX) has done some impressive work to explore the impact

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of its ACCelerator learning lab on developmental math leveraging these tools.24

The student success matrix is a useful tool for conceptualizing the how-do-we-know anchoring question and its role in informing, improving, and shaping student success work (figure 1). It is a simple 2-by-2 that shows the potential of combining the power of technology-enabled systems with the change management work focused on helping more students learn well and finish strong.

On the X-axis of the matrix is the level of capacity an institution has in conceptualizing and implementing change in policy and practice around student success, such as supplemental instruction, learning labs, flipped classrooms, and so on. The Y-axis tracks the capacity of an institution to develop insight, often through reporting and advanced analytic technology tools and systems.

The resulting matrix provides a typology of community colleges and their ability to make the most of their student success work. Not surprisingly, there are low/low institutions that focus on data work because they are required to do so by accreditors and state agencies. Moreover, they are deeply uninterested in changing how
they are doing things. Indeed, for them, a “culture of evidence” means they work to find evidence that what they are already doing is working. Then there are institutions that are high on insight, yet low on change capacity. In these institutions, the institutional research shops work hard to develop sophisticated reporting and analytic strategies and systems. However, more often than not these data remain trapped in reports and or committees, confounded by analysis paralysis.

More common, however, are institutions that are doing hard work around change in the low-insight, high-change-capacity quadrant. They are adopting best practices that have worked at peer institutions, often a cornucopia of best practices. What they lack is the ability to use the data to try, test, and tune the possible practices based on their data. Far too often these institutions experience initiative fatigue as they continue to innovate but don’t see substantial progress—or they cannot decide which of their initiatives are responsible for any progress they see, or do not see.

The good news is that the upper right quadrant is becoming more crowded as it becomes more common for student success leaders to expand and improve their capacity through advanced analytics and qualitative explorations. This insight is then coupled with skill and will in change management to measurably move the needle on student success work. Most exciting is that the deep work in this quadrant also holds the potential to bring more of the access, efficiency, learning, and success innovation together for students. Indeed, it may be the key to community colleges making the most of the next wave: access and transformation.

Wave 4: Access and Transformation

I never try to teach my students anything; I only try to create an environment in which they can learn.

—Albert Einstein

In the wave to come, the momentum will shift toward access and transformation—to afford more and more diverse students the opportunity to engage with a transformative college, do transformative learning work, and experience a learning journey that opens transformative pathways to possibilities for learning and work. Higher education is likely to see an explosion in digital curricular pathways to possibilities for learning and work. More personalized pathways and precise outreach to support their learning journeys.

While these tools will make for more engaging spaces for students to learn than ever before, the Internet of Things (IoT) will become more the norm, connecting a host of devices, appliances, clothing, health monitors, and more. Using data from IoT for improving the student experience, learning, and completion will become commonplace. As a result, privacy, governance processes and security in data use will remain critical topics. These challenges notwithstanding, students will press for far more personalized pathways and precise outreach to support their learning journeys.

All this means analytics will need to rise to the next level. IT staff and faculty will have to create optimization strategies that support efficiency, learning, student success outcomes, and transformative student experiences. The tools will be diverse, the data will be deep, and the expectations will be high.

An exciting time is at hand. Community college faculty are poised to have more tools, techniques, and technologies at their fingertips than ever before to help students access learning, succeed on their learning journeys, and ready themselves for productive careers and lives. Kash calls it the coming “golden age of learning,” when key players are able to try, test, tune, and learn together all in a collective effort to watch students make the most of their time in the nation’s community colleges.

Given the waves already here, not to mention those to come, community college leaders had all better collectively grab their boards, check their balance, and get ready to ride!


22. See the research (publications and presentations) of the Community College Research Center (CCRC) on the Evaluation of Integrated Planning and Advising for Student Success (iPASS), March 2012–August 2020.


25. Richard N. Van Eck, “Digital Game-Based Learning: Still Restless, After All These Years,” EDUCAUSE Review 50, no. 6 (November/December 2015).


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