

Making Digital Learning Work

Success Strategies from Six Leading Universities and Community Colleges

Appendix

Case Studies

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This work was supported by a grant from the Bill & Melinda Gates Foundation. The findings and opinions expressed are those of the authors.

Appendix

Case Studies

This appendix presents in-depth case studies for six institutions of higher education—three four-year research universities and three two-year community colleges.

University of Central Florida: Transforming Undergraduate Education

The University of Central Florida, a four-year research university located in Orlando, Florida, is among the largest universities in the country, serving more than 64,000 degree-seeking students in 2016. For almost two decades, UCF has been an innovator in digital learning, and it is unique among research universities in focusing its online and mixed-modality learning offerings primarily on its undergraduate population. Today, fully online and mixed-modality courses account for almost one-third of the student credit hours available at UCF. The university also offers some courses in lecture capture format, which accounts for an additional 9% of student credit hours, though our analysis focused on fully online and hybrid courses.

UCF's online and mixed-modality offerings provide more flexible access for all students. In mixed-modality courses, for example, one weekly section may occur in a classroom while the other two sections take place online. This is particularly helpful for students who balance full-time jobs with their studies or who live far from campus. UCF students enrolled in both online and mixed-modality courses were more likely than students taking face-to-face courses to be transfers (90% versus 50%), female (67% versus 43%), and older (on average, 28 years old versus 22). "Our digital offering is part of giving students choices—courses online and on ground, and in multiple locations. Students choose where and how. It is about access and flexibility for students," said an administrator at UCF.

The greater flexibility that online access allows has helped students complete their degrees faster. Undergraduate first-time full-time students who took between 41% and 60% of their student credit hours in online classes completed their degree in an average of 3.9 years, roughly four months less than the average for students who took all of their courses face-to-face. This shorter time to graduation lowers the cost to students of earning a degree, and it increases their earnings potential by enabling them to enter the workforce sooner. Moreover, students in mixed-modality courses were about 3 percentage points likelier than their counterparts in face-to-face courses to receive A, B, or C grades.

UCF's implementation of digital learning not only improves access and success for students, but also does so at a lower institutional cost. For UCF, the marginal cost of fully online courses is 20% to 30% lower per student credit hour than the corresponding cost of face-to-face courses.

Somewhat larger class sizes (on average, 45 to 55 students in online or mixed-modality courses versus about 30 in face-to-face courses) and lower operations and maintenance costs (due to avoiding use of campus physical facilities) are the main sources of institutional savings. UCF would have had to expand its physical footprint by more than 500,000 square feet to accommodate equivalent enrollment growth if the additional students had enrolled in face-to-face courses rather than in digital modalities. UCF saved an estimated \$150 million in avoided construction costs and increased the size of its student enrollment faster.

A number of unique factors enabled UCF to develop a successful model, but UCF's centralized management and support of digital learning offers some helpful lessons for the rest of the field. The university's Center for Distributed Learning is a 90-person team that includes instructional

designers, media support staff, faculty professional development staff, and quality assurance staff; 25 of the 90 team members are part-time employees or students. Together, CDL team members help maintain the quality of courses that they convert from face-to-face form to digital form.

Each faculty member assigned to teach online courses must participate in 80 hours of professional development and training, and must work alongside instructional design staff to develop digital classes. Each term, the central team meets with academic deans to discuss the development of new online courses. These regular meetings have led to the addition of two to four entirely online majors each year. “We emphasized design and faculty development, and required training from the start,” said an administrator at UCF. “We were smart and lucky; it sets a cultural expectation.”

By approaching digital learning at an institutional level, rather than only at an academic department or individual faculty level, UCF can take a more strategic and continuous view toward developing its portfolio of course offerings. “We want it not to be something the university *does*, but something the university *is*,” said an administrator at UCF. “Doing it for financial reasons is the wrong way to go. If you do it for academic reasons and do it well to scale, the money will take care of itself.” This approach has allowed UCF to develop a highly successful digital learning environment, with improved academic outcomes and access for a diverse population of students, and lower costs for the institution.

Houston Community College: Solving the Digital Learning Paradox

Houston Community College, one of the nation’s ten largest higher education institutions, serves about 56,000 degree-seeking students in the greater Houston metropolitan area. Its student body is diverse: 41.1% Hispanic, 26.2% white, 22.6% African-American, 8.5% Asian, and 1.7% other. Building on a long-standing commitment to using distance education to give students greater flexibility, HCC has offered both fully online and mixed-modality courses since the early 1990s. Today, about half of HCC’s students take at least one online or mixed-modality course each semester. The growth of student enrollment in digital learning modalities has helped HCC offset a slight decline in its face-to-face enrollment.

Like other institutions, HCC has experienced a digital learning paradox: students who take a combination of digital and face-to-face courses complete their degrees at a higher rate than those who take all of their classes face-to-face, but average student performance in individual courses (as measured by the proportion of students receiving an A, B, or C grade) is lower in online and mixed-modality courses than in face-to-face courses.

HCC administrators hypothesize that this gap may reflect a lack of preparedness for online learning and teaching among some students and faculty; lower levels of student-instructor interaction because of the asynchronous delivery of courses; and expectations among some students and faculty that online learning will take less time than face-to-face.

To improve course-level outcomes, HCC is investing in several strategies to support students and faculty. To provide academic support when students need it most, HCC Online hired 27 tutors who are available for regular online tutoring of any student, not just those taking online courses. Like on-campus tutoring, this service is free to all students.

In addition, HCC students with fewer than 12 credit hours must take a “Student Success” course designed to help them prepare for the demands of college. Students learn about time management, effective note taking, test-taking skills, setting educational objectives, and task prioritization in the context of an academic workload. Students can take the success course in person or online. In order to take it online, however, they must first pass specific sections of the

“SmarterMeasure” assessment, which gauges their readiness to succeed in an online learning environment. This assessment tests individual attributes such as motivation and likeliness to procrastinate, as well as specific abilities such as technology, typing, and reading skills.

HCC Online hired 27 tutors to provide free tutoring to all students enrolled at HCC.

To raise the quality of its digital courses, HCC has invested in a central team of 20 instructional designers who help faculty design digital courses (both individual courses and courses that will be used by multiple faculty members). The instructional designers also provide professional development (for example, training faculty to use a rubric similar to those developed by the nonprofit education organization Quality Matters to ensure that new courses meet quality standards). And finally, HCC Online has its own set of advisors, who, although they can advise any student, primarily focus on advising students taking online courses.

At the institutional level, HCC is transforming its institutional organization to streamline its program offerings and eliminate redundancies. It has established Centers of Excellence that aim to give students the skills they need to succeed in such careers as accounting, auto maintenance, and fashion design. The Centers of Excellence and all other academic instructional units are now available district-wide at HCC, enabling all of its branches to offer more uniform quality across all courses. And since students now take courses across the entire HCC system, it is more important than ever that faculty engagement, content, and student expectations be consistent across campuses. HCC Online has also created a president of HCC Online and hired a dean of HCC Online and instructional technology to provide stronger leadership for these efforts.

HCC’s reorganization will allow it to manage its entire course portfolio more strategically, reducing duplication of courses across colleges. The cost to HCC of delivering online and mixed-modality courses varies. The incremental costs of online courses are small (about \$2 million annually, or approximately \$6 per student credit hour), including the cost of a lean central team with about six instructional designers, along with operations, technical, help desk, tutoring, and administrative staff). And those costs are more than offset by savings elsewhere, as instructional costs for online classes are \$19 per student credit hour lower than for face-to-face classes, due in part to larger average class size (26 for online versus 21 for face-to-face). Personnel costs are slightly lower than average, too (\$3,400 per online course versus \$3,800 per face-to-face course), owing to HCC’s increased use of adjuncts and its policy of paying full-time faculty at adjunct rates when they teach online courses in addition to a full course load.

At HCC, the cost of mixed-modality courses is about \$1 per student credit hour more than the average cost per credit hour for courses of all formats taken together, including face-to-face, online, and mixed-modality courses. That is chiefly because, unlike with online offerings, class sizes and personnel costs for mixed-modality courses are quite similar to those for face-to-face courses. The average class size for mixed-modality courses is 22 students, and for face-to-face courses it is 21. Also, HCC has used instructional designers less often for mixed-modality courses than for fully online or model courses (courses designed by a small team of faculty and instructional designers, and delivered by many faculty across the campus), and students taking a mixed-modality course use the same academic advisors as students who take all of their courses face-to-face. The additional cost of \$1 per student credit hour for mixed-modality courses reflects time spent by HCC administrators on tasks related to these courses.

Unlike other institutions in our study, HCC does not save significantly on operations and maintenance expenses for its online and mixed-modality courses. Because its physical facilities are at full capacity only about 10% of the time, the amount that online courses save is low

(\$110,000 total, or about \$0.30 per student credit hour). However, HCC leaders have undertaken efforts to improve scheduling and optimize use of instructional spaces.

To further its mission of making higher education accessible to the local community, HCC is exploring two additions to its digital portfolio: online degrees and open educational resources (OER). Although HCC offers 25 credentials that students can earn by taking all of their courses online, it does not yet separately market specific online degrees. Given the value of flexibility for HCC's student population (almost three-quarters of whom are attending school part-time), however, HCC Online is now identifying and implementing high-value degrees and certificates that it can regularly offer entirely online.

HCC is also acutely aware of the financial fragility of typical students; a significant life event or even a flat tire (about the cost of a textbook) can be the tripwire that prevents a student from coming to class or getting to work, threatening his or her future educational success. Textbook replacement can save a student hundreds of dollars per semester, sometime more than the cost of community college tuition.

To reduce the cost of course materials, HCC is increasing the use of OER. A recent pilot of three humanities courses (11 sections with OER and 11 sections with textbooks) showed promise: the share of students who received an A, B, or C grade in the OER-based sections was 10 percentage points higher than in the textbook-based sections. Following up on the success of this pilot effort, HCC is now offering a Z-Degree program (a degree with zero textbook and instructional material costs) in these associate degree programs. HCC has allocated internal funding to support this initiative, along with funding from a local foundation and contracted services from Lumen Learning, an OER provider and consultant.

"We have learned so much about ourselves from this study," said an administrator at HCC, "from the way that digital learning can impact class sizes to the way it impacts student time to degree."

Kentucky Community and Technical College System: A System-Level Approach

The Kentucky Community and Technical College System consists of 16 individually accredited two-year colleges throughout the state. Each year the system serves about 100,000 students, who are predominantly white, Pell Grant eligible, and in-state. KCTCS offers a wide range of programs for degree-seeking and non-degree-seeking students. These programs include traditional face-to-face learning; Learn by Term online courses and programs that have a single start and end date each term; and Learn on Demand, a newer program focused on competency-based education that offers asynchronous learning terms with multiple Monday starts per semester. In a given semester, nearly three-quarters of KCTCS students today take at least one class online, and about 5,000 students are enrolled in the new Learn on Demand program.

Like some of the other institutions in our study, KCTCS is experiencing a digital learning paradox. Graduation rates are 25 percentage points higher for students who take 21% to 40% of their courses online than for students who take all of their classes face-to-face (37% versus 12%), but course-level outcomes are lower. Over the past six years, the average pass rates for students in traditional campus-based courses have ranged from 77% to 81%, while the average pass rates in online courses are 8 to 9 percentage points lower.

In terms of access, KCTCS launched its online modalities in order to expand access and offer more flexibility to less traditional students. Though online students at KCTCS are slightly less racially diverse (15% of online students versus 21% of face-to-face students are nonwhite), they tend to be older (27% online versus 25% face-to-face), lower income (67% Pell online versus 60% face-to-face), and female (67% online versus 53% face-to-face).

KCTCS delivers Learn by Term online courses at a cost per student credit hour that is lower than the combined average for all online and face-to-face modalities by about 8%, primarily owing to larger online section sizes (the average online section size is 21 students versus an average face-to-face section size of 14 students) and to greater use of part-time faculty online (they account for 46% of online faculty versus 41% of face-to-face faculty).

KCTCS's efforts to move toward a more centralized administrative and educational model, highlighted by its unique, systematized way of using third-party vendors, offer useful lessons in the effective implementation of digital learning and its impact on ROI.

To maintain consistent quality across its 16 institutions, KCTCS has worked to centralize several of its academic services. Online courses are designed at the individual institution level, but KCTCS's central curriculum review and approval process ensures that courses and programs meet system-wide academic quality standards. Although its individual institutions currently provide uneven levels of instructional design support, KCTCS is creating a central team to help faculty improve online course quality, with the goal of improving the pass rate for students in online courses.

KCTCS has centralized its student support and administrative functions, too, to ensure that students receive access to similar academic services across all of the colleges in its system.

The system offers a digital tutoring service that all KCTCS students—including students enrolled in face-to-face courses—can use. For Learn on Demand courses, KCTCS provides six student coaches to guide students through the challenges of self-paced online learning. It has also strategically called upon third-party partners to provide some of these services, which has helped it avoid the large upfront investments that would be necessary to develop such functions in-house. KCTCS contracts externally with vendors to provide student outreach software, student support, faculty grade-book management, and guidance to students in “degree mapping” to provide a standard interface across institutions. An interface of this sort is particularly important for online students who take courses at multiple KCTCS institutions. By contracting with vendors centrally rather than at the individual institution level, KCTCS secures significant volume discounts.

A central curriculum review process ensures system-wide academic quality standards.

KCTCS has centralized many of its administrative functions, too, including course registration, financial aid, and grading, further standardizing the overall student experience for online and face-to-face students across all 16 member institutions.

Perhaps most significantly, KCTCS plans to launch a pilot financial aid program that will use newly purchased commercial software. Administrators expect the initiative to help KCTCS manage financial aid data so that students who enroll in courses with schedules that do not coincide with the standard start and end dates of the semester can still receive financial aid in a timely manner. This initiative could unlock one of the key advantages of the Learn on Demand program: the ability of students who have jobs, children, and other demanding life commitments to build an education that fits their own busy schedules.

Operating as a system of individually accredited colleges presents unique challenges. For instance, it limits KCTCS's ability to strategically design online programs, owing to regulatory constraints imposed by regional accreditation bodies (in this case, the Southern Association of Colleges and Schools Commission on Colleges) that limit students' ability to take courses across multiple institutions. The regulations stipulate that students must earn at least 25% of their credits at a particular institution in order to earn a degree from that institution.

The system's residency requirement makes it harder for KCTCS to design programs and offer courses at the system level. Instead, each individual degree-conferring institution designs its own programs and courses, leading to duplicative costs and resource deployment. Some college and university systems (such as Houston Community College) have navigated regulations such as these by operating as an umbrella system with a single accreditation.

Internally, a system's revenue-sharing model can further affect the duplication of costs and resources invested in course development. Under KCTCS's revenue model, 100% of tuition per credit goes to the institution where the student takes the course, rather than to the student's home (that is, degree-conferring) institution. This arrangement incentivizes KCTCS institutions to compete with one another, each developing its own separate online courses to attract students from the other 15 member institutions and to prevent its own students from going elsewhere to take a course—even if the course already exists elsewhere in the system. Such competition is particularly lively in Kentucky, where enrollment in two-year colleges has been declining for some time.

These challenges have a significant economic impact. For example, eight KCTCS colleges offer competency-based courses, and some include a faculty stipend, use of an instructional designer, and quality assurance. If the course were developed only once, rather than as many as eight times, the institution could save up to 88% on course development costs. Likewise KCTCS offers online courses in separate sections for each member college, with an average class size of 21 students, although the class size cap for online courses is 30 students. If the system could fill classes across campuses, it would be able to serve the same total number of students in about 30% fewer course sections.

Operating as a system of 16 autonomous institutions provides unique opportunities and complex challenges for KCTCS in strategically and effectively implementing digital learning.

Rio Salado College: Focus on Online Education

Rio Salado is a two-year community college located in Tempe, Arizona. It is one of ten institutions in the Maricopa County Community College District (MCCCD), but Rio Salado's 47,000 students account for more than 20% of the district's total enrollment. Unlike most institutions within MCCCD, Rio Salado predominantly offers online programs and courses: more than half of all student credit hours are earned online. Rio Salado offers instruction both in online programs and courses (56% of student credit hours) and in face-to-face programs and courses (44% of student credit hours). But while Rio Salado confers face-to-face credits, it does not itself provide face-to-face instruction.

As the primary provider of online courses in the MCCCD, Rio Salado sees considerable cross enrollment with other district colleges. Nearly a quarter of Rio's students take courses elsewhere in the district, a sign of the value of online course flexibility. Overall, Rio Salado's students tend to be more heavily female (63% Rio versus 56% MCCCD) and older (57% of students at Rio Salado are 25 or older; the median age for MCCCD is 22).

Rio Salado's success is not defined solely by improvements in graduation and retention rates. In particular, the college has a high transfer-out rate (32% compared to an average of 19% for other MCCCD colleges), and the students who transfer to Arizona universities from Rio Salado have a 74% four-year graduation rate—3 percentage points higher than the average for other MCCCD transfer students. At Rio Salado itself, students' course-level success rates have slowly been improving over time, to about 64% in 2016.

“At Rio, students don’t get lost, because no one can just sit in the back corner—because I am talking to you, to every single student,” said an administrator at Rio Salado, describing how online learning requires more student engagement. “Everyone is in the front row.”

Rio Salado’s success provides a number of useful lessons about digital education. The college has managed costs through three noteworthy measures: a unique faculty model that enables the institution to offer digital learning at a significantly lower expense; extremely limited use of physical space (because all courses take place online); and sustained emphasis on course development and student engagement models to maintain high-quality educational offerings.

Rio Salado’s faculty model is unique in that its only full-time faculty are the 23 full-time faculty chairs. Some 1,500 adjunct faculty members, who are paid on an enrollment basis rather than a per-course basis, teach nearly all courses. The 23 faculty chairs oversee and guide program and course development. This structure allows Rio Salado to standardize the cost of instructional delivery per student credit hour, at a rate that is about 50% of the district average. To maintain course quality at this lower cost, Rio Salado has taken a number of steps to retain its adjunct faculty base: it fosters a tight-knit culture, provides strong faculty support in professional development and technology, and gives adjuncts a high level of flexibility in setting their schedules. Together, these efforts have enabled Rio Salado to retain about 90% of its faculty base from one year to the next.

Another way in which Rio Salado has maintained low costs is by limiting the size of its physical footprint. The college provides space for institutional leadership, computer labs, and testing centers, but it has avoided many capital expenditures because of its minimal physical space needs. Because it is primarily an online institution, it has no auditorium, no traditional classrooms, and relatively few faculty offices—providing them only for its 23 faculty chairs, who serve as subject-matter experts. As a result, Rio Salado avoids an estimated \$6 million in operations and maintenance costs per year, and more than \$200 million in upfront construction costs that would be necessary to enable the college to serve a comparable number of face-to-face students.

Rio Salado’s success in keeping the cost of providing digital education low may be its most eye-catching accomplishment, but its ability to simultaneously maintain the quality of its online offerings provides several insights into the effective implementation of digital learning. First, Rio Salado’s unique course development model sets a high level of academic quality across courses and instructors—a particularly significant achievement at an institution where adjunct faculty deliver nearly all instruction. Each new course is designed by a team of at least three individuals including a faculty chair, an instructional designer who designs the course’s flow and interface to optimize the student experience, and a course developer (often a top-performing adjunct faculty member who assists in designing the course). Faculty members receive a \$2,500 stipend to develop new courses.

At Rio Salado College, the only full-time faculty are the 23 full-time faculty chairs.

This course development process leads to the creation of standardized, high-quality courses at relatively low cost—typically under \$10,000 for each new course.

Finally, Rio Salado’s emphasis on advising students, particularly through extensive faculty--student engagement, enhances the quality of education that students receive. Rio Salado has developed RioAchieve, which emphasizes using five pillars to improve student success: advisors and peer mentors to provide outreach when prompted by Rio Salado’s intervention system; a faculty-designed evaluation tool that provides personalized and targeted feedback to students; an

intervention dashboard that uses data from student requests and instructor notes to alert advisors and peer mentors; Rio PACE, which uses predictive analytics to prompt intervention from advisors and peer mentors; and Rio Campus, which monitors a students' progress toward a specific credential.

Obtaining these advisory tools required an initial investment of \$1 million, but the tools pay for themselves by increasing Rio Salado's term-to-term retention by 7%, increasing ROI through improved student progress and the additional tuition dollars that the institution receives from retained students.

Overall, Rio Salado's unique approach to digital learning drives ROI from both a qualitative perspective and a financial one, resulting in higher student success rates and strong financial performance at the institution level.

Arizona State University: A Multichannel Approach

Arizona State University, a pioneer in digital learning, is a large public research university with four campuses in the Tempe-Phoenix metropolitan area and a total student body of 80,000 undergraduate students.

ASU has taken a multichannel approach to digital learning, offering a variety of modalities to suit different student populations. For working adults (primarily), the university offers ASU Online, an array of fully online programs serving students nationwide. Traditional students seeking greater flexibility in their schedules can take iCourses—online courses designed for on-campus students. For students seeking either college credits or an alternative path of entry to ASU, the university offers the Earned Admission program, which leverages Global Freshman Academy, a suite of first-year courses hosted on the edX platform. In addition, ASU has deeply integrated software into both online and face-to-face courses, emphasizing the use of adaptive learning to help students succeed in gateway courses in math, science, history, psychology, and economics.

In this study, we focused on iCourses, which are ASU's fully online programs, and on its adaptive learning implementations. The university created each of these three digital learning offerings independently for unique reasons, but ASU gradually brought them together under centralized leadership to permit more systematic management, with an eye to realizing economies of scale.

EdPlus is the name of the roughly 300-person central innovation team that supports all of ASU's digital learning programs; about 170 of them manage ASU Online. The team includes 22 instructional designers (each of whom supports 50 to 75 faculty members) along with media and technology experts, student support services staff, data analysts, and others. ASU brought in outside support, too, hiring Pearson to assist with student acquisition, including marketing, recruiting, and enrollment services. Another external partner, Starbucks, offers its benefits-eligible employees full tuition reimbursement for taking ASU Online classes—an option that encourages course enrollment among those employees.

To meet online learners' needs, ASU has developed a differentiated student support model. All students have access to a 24/7 tech support desk, tutoring services, including Pearson's Smarthinking online tutoring service, and retention coaches who provide individualized, holistic support. ASU has also equipped its faculty to teach rigorous adaptive learning courses. During the course development process, for example, instructional designers benchmark courses against a rubric containing 25 indicators adapted from those used by the nonprofit education organization Quality Matters. Each semester, ASU conducts a 360-degree review process to evaluate student satisfaction and course grades, in order to improve course quality over time.

These initiatives have enabled ASU to raise student enrollment and enter new markets without undertaking a major expansion of campus facilities, and with minimal investments to upgrade

technology or modify existing classrooms. Although the ASU Online program began as a smaller venture compared with the iCourse offerings, it has grown rapidly: ASU Online recorded 39% annual student-credit-hour growth between the 2011–2012 and 2015–2016 academic years, versus 2% annual student-credit-hour growth in traditional face-to-face classes and 5% annual student-credit-hour growth in iCourse during the same period. The proportion of student credit hours in online classes is now evenly split between iCourses and ASU Online. Collectively, enrollment in iCourses and ASU Online constituted one-third of all student credit hours at the university during the 2015–2016 academic year, up from 22% of student credit hours in 2011–2012. Adaptive learning claims a smaller portion of enrollment; over five years (2011–2016), more than 50,000 students enrolled in adaptive learning classes across multiple formats (mixed-modality and emporium courses as well as fully online classes).

Across the three types of courses that we examined, student outcomes have been mixed. Retention rates were highest for on-campus first-time full-time freshmen students taking at least one online course (88% versus 81% for fully face-to-face students in fall 2015), but they were considerably lower in the ASU Online programs—probably because the online-only student body faces greater challenges in balancing work and family commitments, financial constraints, and other concerns. ASU notes another challenge of measuring retention for fully online students: just because they skip one enrollment period, does not mean that they have dropped out entirely; - often they enroll in the subsequent period, but they are not counted in retention figures.

Student outcomes in adaptive courses are promising in some subjects, especially biology, where ABC rates are 2 percentage points higher in adaptive mixed-modality course sections than in traditional mixed-modality sections (82% versus 80%). Outcomes appear even stronger when controlled for common assessments and faculty: one faculty member saw ABC rates improve by 14 percentage points in the adaptive section compared to the lecture version of the same course, using common assessments. In part, ASU attributes the strong outcomes in biology to the highly personalized courseware.

On the other hand, student outcomes in adaptive college algebra are more mixed. In the adaptive sections of an online college algebra course, students' ABC rates were up to 11 percentage points higher than those in the traditional mixed-modality sections of the online course, although they were still lower than those in traditional face-to-face classes. ASU switched courseware providers in 2016 due to the older courseware's limited adaptive functionality (for instance, the older courseware used repetitive assessment cycles rather than additional content to provide reinforcement to students).

Student outcomes in ASU's adaptive biology courses are especially promising.

ASU hypothesizes that several factors can improve student outcomes in adaptive courses: faculty experience, with outcomes improving once the faculty member has mastered the new teaching style (often after the third time teaching the course); underlying modality, with mixed modality the best format for ensuring that students spend sufficient time on material; technology that uses formative assessments to identify knowledge gaps; and synchronous course pacing, to give students more exposure to the same concepts.

Online courses can cost more to develop (due to investments in instructional design, additional student support services, technology infrastructure, and other expenses such as faculty stipends that range from \$3,500 to \$5,000 to spur interest). Adaptive learning courses are especially costly to develop because of their complexity. Faculty compensation is higher because it takes more time to personalize the course experience (writing modules, filming videos, and so on), and this has implications for the media team and instructional designers as well. But because the

technologies used to teach adaptive learning courses are still emerging, ASU avoided some costs as they co-developed courses with Cogbooks, McGraw Hill, and other curriculum publishing and technology partners.

Even so, in our study, online courses ended up having lower net costs than face-to-face courses, owing to larger section sizes and a faculty mix that relies somewhat less on tenured faculty for course delivery.

The section sizes for online courses are about two-thirds larger than those for face-to-face courses, lowering the per-student instructional delivery costs. Online courses have also reduced demand for classrooms, allowing ASU to serve a much larger student population with its existing campus facilities. Instructional design costs have decreased by about 50% over seven years, due to greater standardization in the course design process, enhanced ability to repurpose content, targeted hiring efforts to attract better talent, and increased staff experience with teaching online.

“You should not bring programs online just for the sake of it, and you shouldn’t necessarily start where you have the largest existing course catalog,” said an administrator at ASU. “Institutions should ask themselves three things: Can we deliver the program? Is there a sufficient market or importance to our reputation? And does the faculty want to do it?”

Georgia State University: Innovating with Adaptive Courseware

Our case study of Georgia State University focused on how it uses adaptive courseware to improve student access and outcomes while reducing costs. GSU is one of eight public universities to receive a grant from the Association of Public Land Grant Universities for this purpose, as part of a broader initiative underwritten by the Gates Foundation. Collectively, those eight universities are using adaptive courseware to transform educational and business aspects of teaching and learning, and in particular to improve student performance in courses that have high enrollment but low student performance.

Adaptive courseware is software designed to personalize the learning process, permitting students to move through educational material on unique pathways. The software provides ongoing feedback and tailored content in response to the way students answer questions or perform tasks, helping them move toward mastery of the material in a more individualized manner.

Based in Atlanta, GSU has seven campuses throughout the region, collectively serving more than 33,000 undergraduate students across ten different colleges and schools. As a part of its adaptive learning initiative, GSU offers 15 lower-division courses across nine disciplines, including English, economics, humanities, mathematics, science, and social science. Math is the largest of these, with about 8,000 seats per year. Since 2005, when the effort was launched, enrollment in adaptive courses has grown at a 12% annual rate, from 2,162 students in the 2005–2006 academic year, to 7,003 students in the fall of 2016.

Most of GSU’s adaptive learning courses use an emporium model, which combines online and face-to-face learning, but three courses are fully online. Emporium classes meet infrequently in person; more often, students go to campus resource centers or labs, where they work independently online at computer stations. At the labs, faculty, graduate teaching assistants, or peer tutors are available for assistance. Students use interactive software to read course material, watch online lectures or other educational videos, complete practice exercises, and take online quizzes and tests, among other activities. “With the courseware delivering content, instructors can spend more time in class linking the material to assignments that directly impact grades,” said an administrator at GSU. In the emporium courses, students initially attended a lecture once

a week and spent three hours at the lab at a time of their choosing. More recently, GSU has shifted to having students work at the lab on a fixed schedule, mainly in response to capacity constraints.

GSU is already seeing evidence of improved access: minority students and Pell Grant-eligible students benefited more from successful adaptive courseware pilots, with their DFW performance—defined as when students earn a D or F grade, or withdraw from a class—declining. DFW rates for minority and Pell Grant-eligible students declined by up to 11 percentage points in comparison with DFW rates for nonminority, non-Pell students.

Student outcomes are consistently higher in adaptive fully online courses than in nonadaptive fully online classes, likely because of the courseware's personalized feedback. Indeed, student performance in one adaptive online course in economics slightly exceeded performance in traditional face-to-face sections of the same course, with 21% of students getting a D or F grade or withdrawing, a DFW rate 12 percentage points lower than that for the face-to-face version of the course.

Emporium and other mixed-modality courses have had variable results, and GSU has modified them in response—for example, by shifting several math classes from a format with two hours of class time and two optional hours of lab time, to a format with one hour in class and three mandatory hours in the lab. This change contributed to a 6-percentage-point drop in DFW rates in college algebra and precalculus. GSU administrators have observed that the only hybrid courses with lower student academic outcomes are courses in their first few years of implementation, when faculty are typically still experimenting with course formats. In all courses that have existed in hybrid form for more than a few years, student outcomes are improving.

Adaptive learning required GSU to invest upfront in software, course development, and classroom infrastructure to support the new model (about \$120,000 per classroom for equipment, installation and engineering, furniture, and other renovation costs), but these expenses have been partly offset by reduced instructional costs, such as through greater use of untenured and non-tenure-track faculty in adaptive learning courses.

GSU has worked to build faculty interest in and support for adaptive learning, beginning with inviting faculty to help choose the adaptive courseware technology and to play a role in developing courses that use it. The university has also provided professional development to help faculty learn to teach online more effectively. It has offered faculty multiple incentives to participate in digital learning initiatives, including stipends, fellowships, and publishing opportunities, to communicate clearly that the institution values faculty investment of time and effort.

“Building an adaptive course is a substantial time commitment because you have to rethink the entire course structure,” said an administrator. “You need to invest a lot of time considering the learning objectives and how they map to one another. I worked 40 hours a week for six weeks to build a viable course.”

The university started small, first testing innovations in a module to confirm that they achieved positive academic returns, and then expanding them to a course section and eventually to a full course. Efforts by GSU leaders to celebrate and encourage a culture that promotes innovation and to highlight early success stories generated momentum among faculty to build on this initial progress. “We don't make changes for the sake of making changes, but because we have the data and can show the changes will be better,” said an administrator at GSU.

GSU's plans for continued work in 2018 focus on further reducing DFW rates and increasing enrollment to 20,000 seats (each seat representing a student enrolled in a course). The university aims to pursue these objectives by using a strong central team for strategic planning, expanding

its multivendor strategy, offering diversified formats that go beyond the emporium model, and using open enrollment resources to reduce student costs.