MAKING DIGITAL LEARNING WORK

SUCCESS STRATEGIES FROM SIX LEADING
UNIVERSITIES AND COMMUNITY COLLEGES

MAKING DIGITAL LEARNING WORK

SUCCESS STRATEGIES FROM SIX LEADING UNIVERSITIES AND COMMUNITY COLLEGES

ALLISON BAILEY

NITHYA VADUGANATHAN

TYCE HENRY

RENEE LAVERDIERE

LOU PUGLIESE

CONTENTS

FOREWORD

I N 1998, MY COLLEAGUES and I launched Blackboard, higher education's first enterprise-scale foray into digital teaching and learning. Our aim was to help instructors deliver course content to the 18- to 24-year-old students one would expect to find on a typical four-year campus—so the product design reflected the relatively homogeneous demands and demographics of American colleges and universities in the late 1990s. Oh, how times have changed.

More than one-third of current college students are over the age of 25. The phenomenon of up-credentialing, which is reflected in the growing number of jobs—even low-level jobs—that require a postsecondary degree, means that a credential beyond a high-school diploma is fast becoming table stakes for our modern labor market. Performance funding measures are forcing institutions to think, and organize themselves, differently. And the shrinking shelf life of skills may soon render the one-and-done approach to higher education obsolete.

It's hard to imagine that a one-size-fits-all product strategy would be effective today. Digital learning environments now defy barriers of time and space, decreasing time to completion in response to radical demographic shifts—and providing pathways for unprecedented program expansion.

Gone is the so-called 50% rule, which once barred federal aid for institutions that enrolled more than half of their students in online courses. More than a quarter of students—nearly 6 million people—now take at least one course online.

The maturity of digital technologies has supported innovations in instructional design that allow institutions to address the many challenges that modern learners encounter on their academic journeys. Advances in adaptive learning and artificial intelligence have begun to transform the learner experience in ways we never imagined possible. And yet the most promising byproduct of digital learning may be an explosion of data that indexes learner behavior and is opening doors to pedagogical innovations rooted in an unprecedented understanding of the learning science.

Consider the outputs of a similar data-driven revolution in retail. So advanced are Amazon's predictive models of human behavior that the retail giant has patented an algorithm for packaging and shipping products before the customer has even made a purchase. Imagine the implications for higher education. Groundbreaking developments in

data science have enormous implications for institutions working to reimagine the learner experience.

This report examines the multifaceted roles that digital learning plays from the perspectives of practitioners who lead the field. Each case study offers not just anecdotes, but quantitative measures designed to help institutional leaders understand and evaluate the real-world implications of efforts that are underway across a range of institution types.

We hope that this study's findings and comprehensive analysis will arm leaders, faculty, and change agents in higher education with the insights necessary to consider, shape, and scale digital programs that will extend the mission of American higher education to meet the needs of tomorrow's learners.

Lou Pugliese
Senior Innovation Fellow and Managing Director of the Action Lab
EdPlus at Arizona State University

EXECUTIVE SUMMARY

HOW CAN THE USE of digital technologies in postsecondary education impact students' access to education, student outcomes, and the return on investment for students and institutions? What are the biggest challenges for an institution seeking to implement high-quality digital learning opportunities? What promising practices enable an institution to achieve impact at a larger scale?

Those are the questions that fueled this research study, conducted by the Arizona State University Foundation and The Boston Consulting Group, with support from the Bill & Melinda Gates Foundation.

The answers, at least in part, lie in case studies of six colleges and universities: Arizona State University, the University of Central Florida, Georgia State University, Houston Community College, Kentucky Community and Technical College System, and Rio Salado Community College. The first three institutions in this list are public research universities, representing different geographic populations and access missions. The other three institutions include two community colleges and a state-wide community college system.

These six institutions have a strong track record of using digital learning to serve large, socioeconomically diverse student populations, and each has been a pioneer in innovating to expand access to postsecondary education, improve student outcomes, and provide higher education at an affordable cost. The diverse nature of the case study institutions underscores the point that colleges and universities can apply digital learning in various ways that take into account individual contexts. Within these various examples are promising practices that a wide variety of colleges and universities can adopt to meet disparate needs, from accommodating enrollment growth to addressing a decline in funding.

The study's methodology was designed specifically to examine the return on investment (ROI) of digital learning under different condi-

tions and scenarios. We carefully examined both the upfront and on-going costs of supporting digital learning, as well the returns in terms of student access, student outcomes, and economic impact on both students and institutions.

The study found that when colleges and universities take a strategic approach to digital learning and invest in the design and development of high-quality courses and programs, they can achieve three critical objectives:

- **Deliver equivalent or even improved student learning outcomes.** Institutions in the study reported higher retention and graduation rates for students who took least a portion of their degree program online. Such students also earned their degrees faster, saving them money on tuition and fees, and enabling them to enter or return to the workforce sooner.

- **Improve access, particularly for disadvantaged students.** The institutions we studied increased access on multiple levels—in the total volume of student enrollment and in the proportion of specific populations, including Pell Grant–eligible students, older students, and female students.

- **Improve the financial picture by growing revenue while reducing operating costs.** When we compared the overall costs of online courses with average costs at four of the institutions in the study, we found that the savings for online courses ranged from $12 to $66 per credit hour, a difference of from 3% to 50% of the average credit hour costs.

The findings provide a better understanding of how each institution adopted successful digital learning approaches and what impact they had. On the basis of our review of the six institutions, we identified seven promising practices:

- **Take a strategic portfolio approach to digital learning.** The most successful institutions have developed a portfolio of digital delivery models tailored to the particular needs of different student populations.

- **Build the necessary capabilities and expertise to design for quality in the digital realm.** Effective online learning depends on courses and curricula that are properly designed for the unique challenges and opportunities of the modality. Institutions committed to achieving online outcomes that are similar to or better than those for face-to-face courses must make significant investments in instructional design, learning science, and digital tools and capabilities.

- **Provide the support that students need to succeed in fully online learning.** To help students meet the challenges that many of them experience when learning online, institutions need to offer a network of remotely accessible support structures adapted to the needs of online learners.

- **Engage faculty as true partners in digital learning, and equip them for success.** One common barrier to success in digital learning is faculty skepticism. Institutions need to engage and support faculty in the digital learning journey—for instance, by giving faculty a voice in key decisions, providing professional development opportunities, and fostering a culture of pedagogical innovation.

- **Fully commit to digital learning as a strategic priority, and build the infrastructure necessary to ensure lasting impact.** Higher-education leaders who want their digital initiatives to continue long after they have departed from the scene need to attract a groundswell of support among faculty and build an infrastructure that ensures high-quality instruction and sustained momentum (such as a central team that can manage the digital learning portfolio).

- **Tap outside vendors strategically.** The institutions in our study identified their strategic goals and then carefully determined which functions or capabilities they wanted to develop in-house versus outsourcing. Often, institutions can advance innovation, expand capabilities, and increase enrollment faster through successful partnerships than by trying to build everything in-house.

- **Strengthen analytics and monitoring.** In the digital realm, faculty and administrators have access to a cornucopia of data that they can use to engage in continuous improvement. To harness that data, institutions must develop strong research and analytical capabilities, along with the reporting systems necessary to make the data actionable.

Colleges and universities that want to increase enrollment, expand access to high-quality education, and improve student performance—all at lower cost—should strongly consider investing in the improvement and scaled enterprise implementation of high-quality digital learning. The accumulating evidence indicates that well-planned and well-executed digital learning can be enormously valuable for institutions and students. The evidence also demonstrates that the more experience colleges and universities obtain, the faster they can successfully scale up innovations.

Now is the time for leaders to champion the potential of digital learning to open the doors of higher education wider and to improve student outcomes, while operating more efficiently and at lower cost. The journey of each college or university will be unique, but the set of promising practices described in this report may serve as a useful guide for all institutions.

INTRODUCTION

WITH RISING TUITION, SKYROCKETING student debt, and falling enrollment, US institutions of higher education are under more pressure than ever. Today's industrialized nations have a growing need for college graduates to fill higher-skilled jobs, and a postsecondary degree is now a prerequisite for meaningful employment. But a number of employers harbor concerns that many college graduates lack the necessary skills to succeed in higher-level jobs. The shrinking shelf life of skill sets in a quickly evolving tech-centric economy is partly to blame.

The demographics of college students are changing, too. Increasingly, US institutions seek to educate adult learners, many of whom must balance their studies with career and family responsibilities. Many institutions are rightly striving to recruit and support more students of color, low-income students, and those who are the first in their family to attend college.

Faced with these pressures, more and more US colleges and universities are finding solutions in digital learning technologies—leveraging digital tools and broadband access to grow enrollment, improve student academic outcomes, and reduce the costs of delivering a college education. To better serve their students and communities, they are experimenting with a variety of formats, from offering fully online degree programs that target working adults to introducing mixed-modality approaches that combine in-person instruction with personalized and individually adapted online learning. Biology instructors are using virtual reality to place students inside a human body or even inside a single microscopic cell. Courses incorporate adaptive learning technologies that track students' progress, enabling them to master the course material at a pace that works best for them. Powerful analytics tools have unlocked troves of data and information on how students learn.

Students are embracing these digital formats. Although overall postsecondary enrollment is declining at an annual rate of 1% to 2%, and the number of students taking all of their courses on campus has declined at an annual rate of 2.5% over the past four years, online learning remains a bright spot: the number of students taking some or all of their courses online has grown at a 5% annual rate during the same period, according to the Integrated Postsecondary Education Data System (IPEDS). As of 2014, 28% of all undergraduate students were taking at least some courses online. Included in this figure are the 12% of undergraduates who were enrolled in fully online programs. At the graduate level, online-only numbers were even more dramatic, with 25% of students enrolled in fully online programs in 2014.

Despite this booming interest, research on the impact of digital learning on student outcomes and institutional economics has been limited. Earlier studies have tended to focus on the impact of using courseware or online learning in particular courses. In particular, previous analyses have taken a limited approach to measuring the economics of digital learning, producing few sophisticated comparisons of the cost differences between online and on-campus learning. As a result, higher education leaders lack a clear understanding of the strategic choices they must make and the practices they must adopt at an institutional level if they are to ensure that digital learning initiatives flourish and produce meaningful results.

As colleges and universities formulate strategies in the digital realm, they face a number of important questions. How can digital learning support their overarching strategic goals? Which formats of digital learning will yield the highest return on investment (ROI) in terms of expanding access and improving student outcomes? How can colleges and universities best engage and support faculty in their transition to digital learning? What capabilities does the institution need in order to ensure the quality and relevance of online or digitally enabled courses? Which capabilities are best built in-house, and which should be acquired via partnership? How should institutions think about developing an operating model—a system of governance, roles and responsibilities, organizational structure, key performance indicators, and incentives—to support digital learning?

To strengthen the research base and help universities address these questions, the Arizona State University Foundation and The Boston Consulting Group (BCG), supported by a grant from the Bill & Melinda Gates Foundation, examined the ROI of digital learning in various implementation scenarios. The methodology focused on in-depth case studies of six major institutions of higher education that have been pioneers in digital learning, evenly split between research universities (the University of Central Florida, Arizona State University, and Georgia State University) and community colleges (Houston Community College, the Kentucky Community & Technical College System, and Rio Salado Community College). The study had three aims:

- Define what ROI means in a digital learning context, and identify appropriate metrics for measuring ROI.

- Deeply assess the impact of digital learning formats on institutions' enrollment, student learning outcomes, and cost structures.

- Examine how these institutions implemented digital learning, and identify lessons and promising practices for the field.

A group of nine higher-education, foundation, business, and technology leaders provided additional thought leadership and expertise:

- Susan Cates, former chief operating officer of 2U

- Peter Davis, senior advisor at BCG and The Conference Board and former president of McGraw-Hill Education

- Bill Dillon, executive vice president of the National Association of College and University Business Officers

- Rufus Glasper, president and chief executive officer of the League for Innovation in the Community College and chancellor emeritus of Maricopa Community Colleges

- Lev Gonick, chief information officer of the University Technology Office at Arizona State University

- David Gray, senior vice president for finance and business/treasurer at the Pennsylvania State University and former chief executive officer of UMass Online

- Joel Hartman, vice president for information technologies and resources at the University of Central Florida

- Sally Johnstone, president of the National Center for Higher Education Management Systems

- Susan Metros, former vice chair and secretary of EDUCAUSE Board of Directors, and founder and principal at Metros Consulting

The study found that approaching digital learning strategically and investing in the creation of high-quality courses and programs enabled the six institutions we examined to achieve three critical outcomes:

- **Improved Access.** The institutions provided greater opportunity by making college more affordable and accessible, particularly for disadvantaged students.

- **Improved Financial Picture.** They succeeded in growing revenue while reducing operating costs—a particularly important outcome in an era of declining enrollment and dwindling public subsidies for postsecondary education.

- **Improved Academic Outcomes.** They delivered equivalent or even improved student learning outcomes.

This report presents key findings on the ROI of digital learning as implemented in these six institutions; case studies of each of the six institutions, highlighting unique aspects of their programs that help them drive improved access and learning outcomes, often at lower costs; and seven promising practices for higher education leaders to consider as they devise their own digital learning strategies.

The report also includes sidebars examining what existing research has to say about the ROI of digital learning and describing the case-study methodology that we employed. We hope that these findings and lessons learned will encourage many other institutions to embrace digital learning technologies and realize their potential to enhance student learning and surmount the traditional compromises between access, quality, and costs.

DIGITAL LEARNING FORMATS AND DEFINITIONS

THE TERM *DIGITAL LEARNING* refers to technology-enabled instruction that gives students and faculty greater flexibility in how, when, and where learning occurs. (See the sidebar "What the Research Base Says About Digital Learning.") Such learning can involve formats ranging from entirely online to some mix of online and face-to-face settings.

While digital learning can take many forms, we focus in this report on three primary types of digital learning implementations:

- **Fully online programs** conduct all courses—including class lectures and discussion sessions—entirely online. Included in this category are synchronous models, which attempt to replicate the face-to-face classroom experience online, and competency-based models that enable students to move through a course at their own pace. The institution provides advising, tutoring, and all other student support services online, as well.

- **Online courses** are individual online courses that the institution offers entirely online but that are available both to students enrolled in fully online programs and to students who also take some traditional face-to-face classes on campus.

- **Mixed-modality courses** offer some mix of online and face-to-face components,

with the online portion typically replacing some traditional face-to-face delivery modes. Students may meet fewer times in person—perhaps once a week—but attend online video lectures and perform other online work during the rest of the week.

Any of these modalities may include particular teaching methods or approaches that further leverage digital technologies. We examined two in particular: adaptive courseware and open educational resources.

The adaptive courseware approach involves using software to guide students along their own particular learning pathways, with assistance often provided by intelligent tutoring software, which uses artificial intelligence to deliver customized responses. This approach personalizes learning by offering individualized feedback and additional content tailored to each student's learning needs. Universities may use adaptive courseware in an entirely online course or in a face-to-face group setting in a classroom or lab supervised by faculty or teaching assistants. We examined adaptive learning practices primarily at two institutions: Georgia State University and Arizona State University.

The use of open educational resources (OER) relies on low-cost or free open-source curricular materials that are available online. In an effort to reduce students' costs, colleges and

WHAT THE RESEARCH BASE SAYS ABOUT DIGITAL LEARNING

Prior to launching our study, we surveyed the existing research base to develop a better understanding of what is already known about the different ways in which digital learning occurs and the impact that various approaches can have on access to higher education, student academic outcomes, and college and university finances. We were particularly interested in what research literature said about cost structures, since exploration of this topic has thus far been quite limited, and significant knowledge gaps persist.

We examined 24 studies published between 2010 and 2016, including academic research, peer-reviewed articles, and field guides developed by practitioners. Overall, our review of the research base indicated that digital learning has had mixed academic impacts and that researchers have devoted limited attention to the economic impact of digital learning.

Findings About Students' Academic Performance

Several of the studies we looked at did not find any meaningful difference in academic performance between online and face-to-face educational offerings, while others found worse outcomes (such as higher drop-fail-withdraw rates or wider achievement gaps) in digital implementations. But other, more seminal studies suggested that digital learning can have a greater positive impact on student academic outcomes under certain conditions.

One formative study indicating that digital learning can positively affect academic outcomes appeared in 2010.[1] Through a meta-analysis of 50 empirical studies of online learning published over more than 15 years, this study found that students performed slightly better in mixed-modality implementations of digital learning than in face-to-face implementations. Students also performed better in fully online implementations than in face-to-face implementa-

tions, though to a slightly lesser extent. However, other factors not taken into consideration—such as additional learning time and different content in the digital implementations—might have been responsible for the observed effects.

Another important study pointing to potentially positive outcomes from digital learning emerged in 2014.[2] This study provided a meta-analysis of 139 courses representing about 90% of the Gates Foundation's investment in postsecondary courseware from 2009 to 2015. It found several correlates of program or course design features with more positive effects on student learning:

- Effects on student learning were greater for projects that redesigned entire courses than for those that just developed supplementary resources.

- Mathematics courses were correlated to more positive effects than courses in other subject areas were.

- Effects were larger for self-paced courses than for classes that used cohort pacing.

- Courseware with embedded assessments had a relatively strong positive impact on student learning.

- Mixed-modality models with at least 50% of the course taught online produced better student outcomes.

- Adaptive technology yielded improved learning outcomes, although the sample sizes surveyed were quite small.

Recent data drawn from the larger context of undergraduate programs suggests that students in online courses can perform comparably to those in face-to-face courses. For example, a study published in 2015 concluded that "students in online courses will receive a grade point average that is

0.39 points (almost 40% of a letter grade) higher than a student taking a face-to-face course."[3] Similarly, a recent large-scale study by Arizona State University's Action Lab Research Group of a fully online undergraduate program reported completion and performance gaps of just a few percentage points, on average.[4]

Finally, much of the data available on academic performance in digital environments focuses on simple descriptive statistics, such as means and proportions. This information can be useful for business intelligence and program review reports, where easy-to-compare, easy-to-compute data on completion rates, passing rates, and other transactional data is valuable. But a more accurate picture of program efficacy and causality requires a more rigorous research approach, which can be time-consuming and difficult to communicate. The difference in rigor rests not in the type of data used, but in the methodology, which incorporates three key features:

- Careful modeling that uses appropriate modeling frameworks

- Inclusion of appropriate covariates and control variables in these models

- A large and diverse sample that ensures both reliability and generalizability

Although the SRI-Gates study helped identify some key features that correlate to improved learning outcomes, additional rigorous research needs to be conducted to provide further insight into how the design and implementation of digital courseware can impact student success at scale.

Findings About Financial Impacts

Most studies that addressed the economic impact of digital learning focused on the course level and did not take into account central administrative and program-level costs. Those studies also analyzed cost

impacts over a short period, limiting the researchers' ability to capture scale effects, as institutions expanded programs beyond pilots, and to account for improvements that might occur along a learning curve, as institutions became more experienced at implementing digital learning.

Although the evidence base regarding the overall financial costs and benefits of digital learning remains limited, some studies have shown that institutions that have implemented digital learning have improved their financial outlook. For example, in a 2009 study examining this issue, researchers discovered course-level savings in 31 of 32 implementations of an emporium model used in community colleges' remedial math courses.[5] (In the field of education, the term *emporium* often refers to a classroom redesigned as a computer lab where students can use interactive software to read materials, watch online lectures, and complete practice exercises, and where faculty or teaching assistants are available for direct human assistance.) The savings primarily arose from larger section sizes and more efficient faculty utilization.

There is little evidence regarding the financial impact that online learning may have on students. Digital learning may offer some students the opportunity to earn a degree while working (and thus avoiding lost wages) or to earn a degree and the associated higher wages more quickly. One study published in 2014 found that students who took online classes tended to be more successful in graduating or transferring to a four-year institution than those who took only traditional classes, despite lower course success rates.[6] As the study noted, "for students juggling school, family, and work obligations, the ability to maintain a full-time load by mixing in one or two online courses each term may outweigh the lower chances of succeeding in any particular online course. Moreover, if a student's

WHAT THE RESEARCH BASE SAYS ABOUT DIGITAL LEARNING (Continued)

choice is between taking an online course and waiting for the course to be offered at a convenient time, taking the course online can help expedite completion or transfer." The second-order impact of a college degree on future wages is well documented.

This study seeks to fill some of the gaps in existing research, such as the lack of information about the academic and financial returns that colleges and universities receive for their investments in digital learning. Our study focuses on the following course of action:

- Examine the impact of digital learning on access, academic outcomes, and institutional finances, and create a broader framework with a detailed methodology for measuring ROI at the institutional level along these lines.

- Use this framework and a small set of case study institutions to report on the richness of ongoing digital-learning efforts at certain colleges and universities.

- Extrapolate lessons for the broader field of colleges and universities regarding what institutional best practices must be in place to achieve the desired results.

NOTES

1. Barbara Means, Yukie Toyama, Robert Murphy, Marianne Bakia, and Karla Jones, "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies"; published by SRI International for the US Department of Education, revised September 2010. Available at https://www.ewa.org/sites/main/files/finalreport.pdf.

2. Barbara Means, Vanessa Peters, and Ying Zheng, "Lessons from Five Years of Funding Digital Courseware"; conducted by SRI Education for the Bill and Melinda Gates Foundation, September 2014. Available at https://postsecondary.gatesfoundation.org/wp-content/uploads/2014/10/SRI_Lessons-from-5-Years-of-Funding-Digital-Courseware1.pdf.

3. Joseph K. Cavanaugh and Stephen J. Jacquemin, "A Large Sample Comparison of Grade Based Student Learning Outcomes in Online vs. Face-to-Face Courses"; Wright State University, Lake Campus, 2015. Available at https://files.eric.ed.gov/fulltext/EJ1062940.pdf.

4. Action Lab Research Group (Thomas Fikes, Philip Arcuria, Carlos Valcarcel, William Morgan, and Lou Pugliese), *ASU Online Phase 1 Report*. Unpublished manuscript. EdPlus Action Lab: Arizona State University, 2017.

5. Carol A. Twigg, "Improving Learning and Reducing Costs: Program Outcomes from *Changing the Equation*"; National Center for Academic Transformation, 2009. Available at http://www.thencat.org/Mathematics/CTE/CTE%20Lessons%20Learned.pdf.

6. Hans Johnson and Marisol Cuellar Mejia, *Online Learning and Student Outcomes in California's Community Colleges*, Public Policy Institute of California, May 2014. Available at http://www.ppic.org/content/pubs/report/R_514HJR.pdf.

universities are increasingly including OER-based materials and courseware in their courses. Although still nascent, OER is a fast-growing field that continues to develop in quality and course coverage. We studied OER mainly at Houston Community College.

ROI FRAMEWORK AND INSTITUTION SELECTION

IF HIGHER-EDUCATION LEADERS ARE to make better decisions about implementing their digital strategy, they need to think systematically about the costs and benefits of digital learning. Such thinking includes, crucially, understanding in detail what ROI means in the context of education. In addition to clearly defining this term, we set about establishing the analytical methods we would use to measure ROI in this study and identifying a set of pioneering institutions where we could examine digital learning in practice.

ROI Framework

Working with a team of university leaders, members of our advisory group, and other experts, we determined that our framework would need to define and evaluate ROI from two perspectives—that of students and that of the institution. We noted that ROI in the relevant sense is a composite of three factors:

- The impact on student access to higher education

- The impact on learning and completion outcomes

- The impact on economics

We chose to compare the ROI of digital learning with what we defined as the base case— face-to-face or on-campus instruction.

In studying access, we focused on both expanding the number of seats available at these high-quality institutions and increasing the participation of disadvantaged groups, such as Pell Grant recipients and minorities.

For student academic outcomes, we focused on a number of criteria—in particular, students' degree completion, retention, graduation, and transfer-out rates. Using summary grade-book data only, we examined the rate at which students earned an A, B, or C in a class (*ABC rates*), the rate at which students earned a D or F or withdrew from a class (*DFW rates*), and students' course passage rates. We also scrutinized the academic performance of community college students after transferring to four-year universities.

Measuring the economic impact was the most challenging task. At the student level, we considered such factors as how shortening the time to degree can reduce students' total cost of education by reducing their tuition expenditures, by increasing their earnings potential, and by enabling them to start earning a salary sooner. At the institutional level, estimating the total incremental cost of digital learning instruction entails tracking spending in a manner that is inconsistent with the method that most institutions use.

Estimating the total incremental cost of digital learning thus involves several factors:

- Differences in actual class size between face-to-face and online instruction

- Differences in faculty mix (including the mix of tenured and nontenured faculty, full-time and part-time faculty, and adjuncts and teaching assistants, among others) between the two modalities

- Allocation of additional expenses such as for instructional design staff that might not be needed in face-to-face courses

- Accounting for classroom construction and maintenance costs that might not be fully incurred in digital offerings

- Accounting for the cost of IT support services (for faculty and students) that are specifically tied to digital learning initiatives, without including the cost of general IT support

Exhibit 1 depicts the resulting framework, with vertical columns reflecting the institu-

tion perspective and the student perspective, and the three horizontal rows depicting the three impacts that make up our definition of ROI: outcomes, access, and economics. Listed within each category are the metrics used to assess ROI on that dimension.

The resulting model for measuring ROI provides a framework that institutions of higher education can use to assess whether their own implementations of digital learning are paying off. The framework helps organize concrete evidence for assessing the value of digital learning, and it supports more accurate measurement of expenses and savings in areas such as facilities operations and maintenance, and instructional delivery costs, thus promoting operational efficiency.

The framework we have devised may also help leaders think strategically about how they implement digital learning, and may help them choose digital formats that better suit student needs and institutional needs in order to achieve a greater ROI.

EXHIBIT 1 | The Study's ROI Framework for Digital Learning Considers Access, Outcomes, and Economics

	INSTITUTIONAL PERSPECTIVE	STUDENT PERSPECTIVE
Access	• Total enrollment and growth over time by modality • Representation of socioeconomically diverse students (such as % Pell Grant recipients and % underrepresented minority) and students with family/work commitments (% over age 25, average age, % female) by modality	
Outcomes	• **Overall student outcomes:** Degree completion, retention, graduation, and transfer-out rates, by modality • **Course-level outcomes:** ABC grades (%), passing rates, DFW grades (%), and so on • **Closing the achievement gap and other outcomes:** Success measures disaggregated by demographics; workforce readiness; transfer success; and so on	

Economics	• **Income:** Grants, and tuition and fees
	• **Costs:**
	  – Periodic investments
	  – Infrastructure
	  – Technology
	  – Course development
	  – Management and administration
	  – Instructional delivery
	  – Student support
	  – Marketing and student acquisition
	  – Difference (%) versus average of face-to-face costs
		• Tuition and fees
		• Nontuition expenses
		  – Travel
		  – Textbooks
		  – Accommodation

Source: BCG research and analysis.

Institution Selection

Because each higher education institution exists in a unique context (depending on its size, mission, degree offerings, and so on), and because conducting this type of analysis requires rigorous and deep institutional data, we determined that a case study approach would be the most effective way to capture comprehensive findings. The case study approach enabled us to synthesize promising practices regarding how to implement high-quality digital learning in different institutional contexts, and it permitted us to capture a more detailed picture of institutional economics, reflecting variations in enrollment, funding, leadership priorities, and historical investments in information technology or professional development. (See the sidebar "Case Study Approach.")

For the case studies, we sought institutions with a strong track record of positive academic outcomes and other successes in using digital learning to serve large, socioeconomically diverse student populations. With the help of experts in the field, we identified an initial list of approximately 50 candidate institutions cited as exemplars in the implementation of digital learning.

We then narrowed down the initial list to those that met the following four criteria:

- **Size.** The institution had to have at least 20,000 undergraduate students.

- **Scale.** At least 20% of the institution's students had to be enrolled in "distance education," as defined in IPEDS data. (IPEDS measures have some limitations, but the IPEDS treatment of distance education is the only publicly available national statistic that supports making consistent comparisons of one US institution with another in connection with student enrollment in some form of distance or online education.)

- **Target Population.** At least 20% of the institution's students had to be eligible to receive Pell Grants.

- **Graduation Rates.** The institution had to meet a minimum threshold of academic performance with regard to 150% graduation rate—the rate at which students graduate within one-and-a-half times the normal time period for completing a degree program (six years for a four-year degree, three years for a two-year degree, and so on).

Applying these criteria reduced the list of candidate institutions to about 30. Within the group of 30, we identified the largest institutions and the ones with the best graduation and retention rates when compared with US national averages for two-year and four-year institutions and normalized for student population (adjusted for the percentage of students receiving Pell Grants and the percentage of minority-group members, for example).

Conducting a case study analysis requires rigorous and deep institutional data.

In this way we identified a subset of institutions that collectively represented the archetypes ideal for our study. Key features included online programs, online courses, hybrid programs, mixed-modality courses, some use of adaptive technology, and open educational resources. We included both two- and four-year institutions, as well as at least one institution representing a statewide system. Apprised of the level of institutional commitment required to undertake this study, a number of colleges and universities that we initially contacted declined to participate, saying that they lacked the necessary data and resource availability to do the work.

Ultimately, we included six colleges and universities in our final set of case study institutions:

- **Arizona State University** (**ASU**) is a large four-year public research university with four campuses in the Tempe-Phoenix metropolitan area. It has successfully operated digital learning programs in multiple online formats, including ASU Online, a rapidly growing online-only

CASE STUDY APPROACH

Each of the six institutions chosen for this study has adopted its own approaches to expanding access to postsecondary education, improving student outcomes, and controlling costs. We examined each case study institution for two months, conducting site visits with institutional leaders to understand institutional context, key success factors, and methods of addressing implementation challenges. We also held detailed discussions regarding data requests with institutional research and finance teams, and conducted working sessions with the project teams to review findings along the way. This process helped us identify areas in which data collection or analysis posed greater challenges than we had expected—for example, in distinguishing between actual class sizes and theoretical caps on maximum class size. Few institutions routinely considered calculating their actual class sizes, a factor that has a meaningful impact on instructional costs.

Ultimately, the case study approach proved to be practical and offered a great deal of flexibility with regard to sources of requested data within the institution. None of the colleges and universities that we studied maintains a budgetary line item for online learning. Instead, each spreads relevant expenses across many departments in the institution. As a result, information about the costs of online course development rarely came from the same source as information about the ongoing costs of building maintenance.

We refined our general framework to suit specific case studies. The high quality of the information we collected is due in large part to the extensive support that individual staff members at each institution gave us. Institutions were extremely cooperative in directly engaging with this extensive research endeavor.

The case study approach has some limitations. Randomized control trials might provide a tighter causal link between the different choices of universities and the resulting outcomes, but the limited number of scaled implementations of digital learning in the field today rendered this approach impracticable. Furthermore, the institutional intricacies of implementing randomized control trials in an academic setting are far from trivial. Our focus was not simply on performance in a single course but on broader, longer-term institutional impact, and this type of deep analysis at the institution level would not have filtered through in a study designed with a randomized control trial format.

We defined the institutions in our study at scale. Consequently, some choices they make may differ significantly from those that smaller institutions might make in implementing digital learning. For example, a small college will not need a 90-person central team to run the online offering. To address this limitation, we normalized the data to show findings as measured per student credit hour.

Even with these adjustments, our findings are imperfect and require interpretation. For example, personnel costs can vary widely depending on the local cost of living. Larger institutions may obtain discounts owing to the volume of their investment, and institutions at the forefront of implementing new technologies may co-develop them with third parties and thus have nonreplicable cost structures. Nevertheless, research findings are valuable to the field, especially given the relatively small number of existing studies that focus on the economics of digital learning. Our hope and belief is that the case study approach—which is less time-consuming for the institutions involved and provides rich detail about the broader context of each institution—will contribute substantially to knowledge about digital learning.

program that offers undergraduate and graduate degrees to a nationwide student enrollment composed primarily of working adults and other nontraditional students. Arizona State offers an array of individual online iCourses for its traditional on-campus students; a suite of support services is available for online and in-person students. The university has also been engaged in pioneering efforts to use adaptive learning in large, introductory gateway courses. ASU serves about 80,000 undergraduate students, of whom 36% are Pell Grant eligible.

- **The University of Central Florida** (**UCF**) is a large four-year public research university with a main campus in Orlando and ten regional campuses throughout central Florida. Overall, students take almost one-third (31%) of their credit hours online, either in online-only courses or in mixed-modality courses. As its digital learning offerings have expanded since the early 2000s, UCF has expanded its enrollment to 56,000 undergraduate students (of whom approximately 38% are Pell Grant eligible) without a commensurate increase in the size of its physical footprint.

- **Georgia State University** (**GSU**) is a large four-year public research university with seven campuses in Atlanta. It has been engaged in a pilot effort to use adaptive learning courseware to improve academic outcomes, especially in introductory gateway courses that have a track record of high enrollment but low student performance. It began these efforts in math in the 2005–2006 academic year and expanded to other courses with high rates of poor student performance in 2015. GSU serves 33,000 undergraduate students, of whom about 59% are Pell Grant eligible.

- **Houston Community College** (**HCC**) is one of the nation's ten largest higher-education institutions, with six two-year community colleges and 19 campuses in

Houston. It serves some 56,000 community college students through a blend of on-campus and online offerings. About 36% of students are Pell Grant eligible, and about half of all students take at least one online or mixed-modality course in any given semester. Although HCC offers 19 credentials that students can earn entirely online, it does not separately market online-only degrees, although it may do so in the future.

- **Kentucky Community and Technical College System** (**KCTCS**) is a state system of two-year community colleges with 16 independent campuses. KCTCS offered us the opportunity to examine a system-level implementation of digital learning, including its efforts to develop a more centralized administrative approach and comparable student support services at all of its colleges, and to ensure consistent course quality across all of these institutions. The KCTCS system serves more than 100,000 students, of whom at least 60% are Pell Grant eligible.

- **Rio Salado Community College** is a two-year community college based in Tempe, Arizona, and is one of ten member institutions of the Maricopa County Community College District (MCCCD). Unlike its fellow community colleges, Rio Salado offers only online classes, although its students can enroll in in-person courses at other MCCCD community colleges. Currently, Rio Salado students complete 56% of their credit hours online and 44% in face-to-face courses at other colleges. Rio Salado serves about 47,000 students, of whom about 18% are Pell Grant eligible.

All of the data points that we cite in this report came from the institutions themselves, and most involve data from fall 2015 or from the 2015–2016 academic year.

SUMMARY OF FINDINGS

HOW CAN DIGITAL LEARNING IMPACT ACCESS, OUTCOMES, AND ECONOMICS?

O**N THE BASIS OF** our examination of the six case study institutions, we concluded that digital learning initiatives enable institutions to progress on multiple fronts. In several cases they yielded improved student outcomes (higher retention rates, higher graduation rates, and a shorter average time to degree), increased access to education, and a stronger overall financial outlook. We identified key findings in each of these three areas:

Online courses can be more rigorous and challenging than some face-to-face classes.

- **Student Academic Outcomes.** Findings in this area focus on course-level outcomes, such as students' ABC rates and DFW rates. We also analyzed retention rates, graduation rates, and time to degree, and examined the impact of adaptive courseware on the achievement gap.

- **Access.** These findings encompass overall enrollment growth and increases in the student population's diversity. In particular, we examined increases in the proportion of specific populations such as Pell Grant–eligible students, minority students, older students, and female students.

- **Costs.** These findings relate to changes in operating costs, capital costs, and investments required to run effective digital learning portfolios.

Findings About Impact on Student Academic Outcomes

There is a myth that digital learning fails to produce outcomes that are equal to or better than those attained through face-to-face-only instruction, and that it widens the achievement gap. Faculty who have never taught a blended or online course but who believe that such learning experiences cannot match the quality of face-to-face instruction have bolstered this myth. Although their view might be accurate in relation to low-quality implementations of online instruction, the institutions we studied often achieved equal or better student outcomes through digital learning. Furthermore, many instructors who have taught mixed-modality and online courses believe that these courses can be more rigorous and challenging than some face-to-face classes.

Mixed-modality learners experienced improved retention and graduation rates. Three of the four institutions in our study that offered both face-to-face and online courses recorded higher retention and graduation rates for students who took at least some portion of their degree program online. At Houston Community College,

retention rates for first-time freshman were 9 to 10 percentage points higher for students who took at least one fully online or mixed-modality course than for students who took all of their classes face-to-face. (See Exhibit 2.) HCC also saw graduation rates that were up to 17 percentage points higher for students who took some form of digital courses than for students who took all of their classes face-to-face.

The optimal scenario for students at HCC seemed to be to take a combination of face-to-face and digital classes. Such students achieved better graduation rates than did students who took all of their classes face-to-face or who took all of their classes online. Although students who took all of their classes online did better than students who took all of their classes face-to-face, they did only about half as well as students who took a combination of online and face-to-face classes. We recognize that some degree of selection bias may be at work, as the population of students who take only face-to-face classes may differ in some way from the population of students who opt to take at least one online

class—such as students' preference for working independently and at their own pace, or their comfort level with new technologies.

Questions for institutions to explore in the future include what opportunities or support systems they can provide to encourage more students to take classes online or in mixed modalities, and how they can help students develop the types of skills they need to succeed in digital learning settings.

Echoing the HCC finding about the benefits of a mixture of online and face-to-face classes are results from a forthcoming study of 45,000 students from 30 community colleges in the State University of New York system, discussed in *The Chronicle of Higher Education*.[1] The researchers determined that the optimal course load ratio for a full-time student is two online courses and three face-to-face courses. They also concluded that students who take a greater proportion of their classes online "lose some of the benefits that help lead to degree completion." The study will be published in the *International Review of Research in Open and Distributed Learning*.

EXHIBIT 2 | First-Time HCC Freshmen Who Took at Least One Digital Course Had Above-Average Retention Rates

First-year retention rate for first-time freshmen (%)

	Face-to-face only	At least one mixed-modality course	At least one fully online course
Fall 2011	36	58	53
Fall 2012	46	60	55
Fall 2013	49	58	56
Fall 2014	48	56	51
Fall 2015	49	59	58
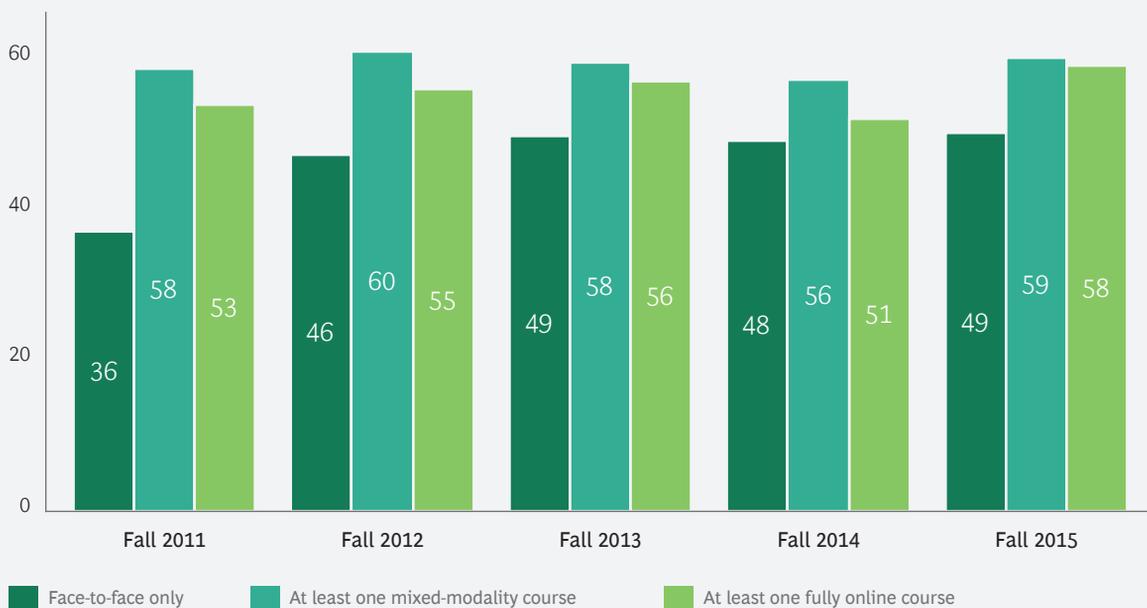
Sources: HCC Office of Institutional Research; BCG analysis.
Note: Number of returning students > 1,000 for each category.

Research based on the Predictive Analytics Reporting Framework further reinforces the value of mixed-modality models.[2] It found that students who took a mix of online and on-ground (that is, face-to-face) courses had slightly better odds of retention than students who took courses either exclusively on-ground or exclusively online.

Taking some courses online is thus positively associated with a greater likelihood of graduating. Doing so may also decrease the amount of time a typical student needs to graduate. At the University of Central Florida, for example, students taking 41% to 60% of their credit hours in online courses completed their degrees, on average, in 3.9 years, whereas students taking no classes online did so, on average, in 4.3 years. (See Exhibit 3.) And as noted earlier, students who complete their degrees faster not only save on tuition and fees, but also gain additional wages by entering or returning to the workforce sooner and at a higher level.

The digital learning paradox was observed in course grades. The percentage of students who earned an A, B, or C in online or mixed-modality courses versus the percentage of students who earned an A, B, or C in face-to-face classes varied by institution, ranging from 4 percentage points higher to 12 percentage points lower. Results were most promising in mixed-modality courses; at UCF, the ABC rates were 3 percentage points higher for students in mixed-modality instructional settings than for students in exclusively face-to-face instruction. UCF attributes this result primarily to shifts in the faculty role. At Arizona State University, between fall 2013 and fall 2016, the ABC rates of students in online courses were on a par with those of students in face-to-face instruction.

Unlike the four-year institutions, the two-year institutions generally registered lower course grades for online learning than for face-to-face learning. Higher-education researchers have observed this phenomenon in the past

Exhibit 3 | UCF Students Who Take More Courses Online Tend to Graduate Sooner

Average years to complete degree
(AY 2015–2016 graduates)

Student credit hours in online courses (%)

- Undergraduate FTIC full time (N = 4,382)
- Undergraduate FTIC part time (N = 311)
- Undergraduate transfer full time (N = 4,746)
- Undergraduate transfer part time (N = 3,060)
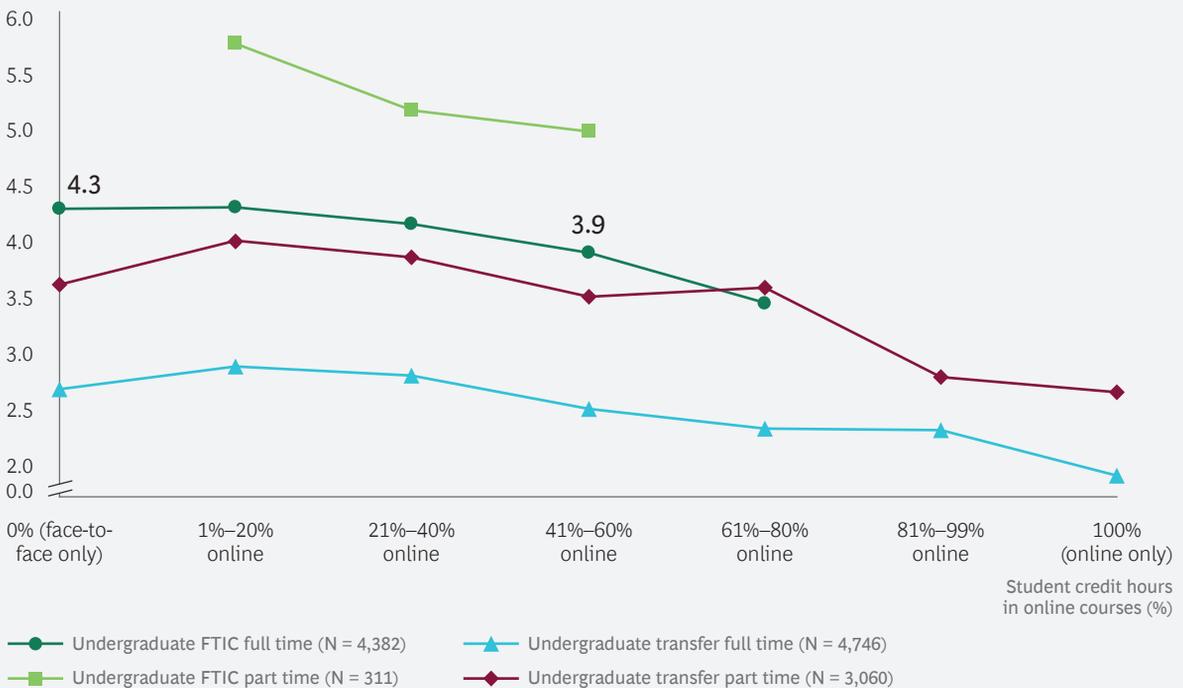
Sources: UCF IKM team; BCG analysis.
Note: Time-to-degree data is for 2015–2016 graduates who started in summer 2005 or later; online activity is shown. Points are excluded where N was less than 30 students. "Student credit hours in online courses (%)" includes student credit hours in fully online and lecture capture courses. AY = academic year; FTIC = first time in college.

and refer to it as "the digital learning paradox." Retention rates and graduation rates were often higher for students who took a portion of their course load in digital modalities, but course grades were in some cases lower, and the difference varied by format (such as mixed-modality or fully online) and by quality of online implementation.

At KCTCS, students who took a mix of face-to-face and online courses were 18 percentage points more likely to be retained and 21 percentage points more likely to graduate than students who took only face-to-face classes, despite receiving grades that were, on average, 8 to 9 percentage points lower in online courses than in face-to-face courses. Although the added flexibility of online courses permits students to take more courses at a time, students who take only online courses may be balancing heavier work and family commitments, making it more challenging to perform at the same level as students who are free of these responsibilities.

Adaptive courseware helped close achievement gaps. The use of adaptive courseware may have contributed to an observed reduction in achievement gaps for Pell Grant–eligible and minority students at Georgia State University. Minority students and Pell Grant–eligible students benefited more from successful adaptive courseware pilots than minority and Pell Grant–eligible students enrolled in nonadaptive sections of the same courses did from their classes.

The percentage of minority students and the percentage of Pell Grant–eligible students who earned grades of D or F, or who withdrew from a class declined. For example, the DFW rate for minority students across all adaptive sections of an introductory writing course at Georgia State was only 8%, compared to a DFW rate of 19% for minority students enrolled in the nonadaptive sections of the same English course. Similarly, Pell Grant–eligible students had a DFW rate of only 7%, compared to a DFW rate of 21% in the nonadaptive sections of the same course. Although DFW rates for minority and Pell students dropped substantially, the corresponding rates for non-Pell and nonminority students remained fairly flat (DFW rates for

nonminority students rose by 1 percentage point, from 13% to 14%; DFW rates for non-Pell students fell by 3 percentage points from 14% to 11%).

Findings About Impact on Access

Student access to the case study institutions improved on multiple levels, with increases in total student enrollment and increases in the proportions of specific populations, including Pell Grant–eligible students, minority students, older students, and female students.

"The digital learning paradox" is lower grades but higher retention and graduation rates.

Student enrollment as a whole grew. The case study institutions experienced an overall increase in enrollment, providing opportunities for more students to pursue an education and enabling institutions to expand the number of students they serve without vastly increasing their campuses' physical footprint. "We are very capacity constrained on campus," said an administrator at the University of Central Florida. "Offering digital courses has allowed us to continue to create access for students even in an environment of constrained funding for new buildings."

Over the past two decades, UCF has become one of the largest public institutions in the country. Today it is educating more than 64,000 undergraduate and graduate students, up from 26,000 students in 1996. Most of the enrollment growth over the past decade has occurred in UCF's digital offerings. Students currently take 31% of the university's credit hours in fully online or mixed-modality courses. (See Exhibit 4.) "Teaching online is now a norm and expectation," a UCF administrator said. "It is part of the fabric of what we do and who we are."

Flexible enrollment options have helped institutions make digital learning more accessible. Some institutions are moving beyond the traditional academic year, increasing their

31% OF UCF STUDENT CREDIT HOURS IN 2016 WERE IN FULLY ONLINE OR MIXED-MODALITY COURSES

Total student credit hours (1,000s)

Lecture capture   Mixed modality   Fully online   Face-to-face
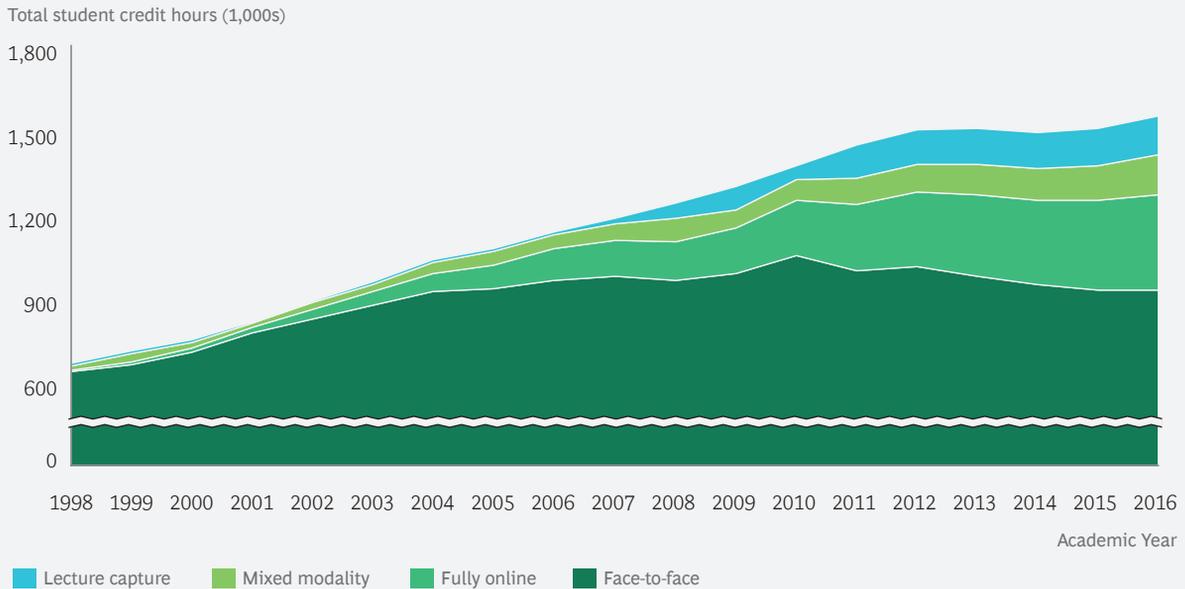
Sources: Data shared by UCF; UCF interviews; UCF website; BCG analysis.
Note: In total, approximately 40% of UCF student credit hours are in digital modalities, including lecture capture courses (which are not a focus of this case study).

number of enrollment periods to serve online students who may need greater flexibility because of work and family commitments.

Arizona State University's ASU Online offers six, rather than three, sign-up periods per year for fully online students. It has also shortened its admissions timeline from two weeks to 24 hours by streamlining transcript evaluation, credit transfers, and financial aid communications to give it a competitive edge over institutions that take longer to process applications. These measures helped fuel annual growth in online program enrollment of 52% between 2010 and 2015, and probably contributed to the makeup of the online student body, which has a higher percentage of Pell Grant–eligible students, female students, and older-than-average students than does the student body that takes all courses face-to-face.

Rio Salado Community College took flexible enrollment a step further, offering start dates on more than 40 Mondays throughout the year to serve its primarily online student base. This policy allows the community college to attract students who are looking for more on-demand learning opportunities where and when they can find them, with timing that fits their availability, especially if their work and personal schedules do not align with the traditional beginning of a college semester. Rio Salado's rolling start option has encouraged the emergence of a highly fluid student body in which 24% of all students are enrolled concurrently at other institutions. The rolling course starts also help students obtain the credits they need to graduate on their own timeline and at a lower cost.

Students pay $86 per student credit hour at Rio Salado versus $521 to $535 per student credit hour (depending on the number of courses taken) at ASU, one of the four-year institutions at which Rio Salado students co-enroll. Faculty members have responded positively to the rolling start approach, saying that it gives them more flexibility and greater control over their own calendars. Rio Salado makes the finances work by paying faculty on a stepwise basis. In such a system, pay is tied to enrollment: instructors receive incremental pay bumps each time they add a specific number of students to their class enrollment.

The enrollment of student populations of special interest increased as a proportion of total enrollment. Digital learning is also helping institutions reach a more diverse population of students. At the five institutions in our study that offered both face-to-face and online-only courses, the proportion of fully online students who were Pell Grant recipients was consistently at least 5 percentage points higher than the corresponding proportion of Pell Grant recipients among students who took all of their courses in face-to-face settings in a given semester.[3] (See Exhibit 5.) At Houston Community College, 40% of students taking online courses were Pell Grant recipients, compared with 29% of students taking only face-to-face courses.

Not surprisingly, digital learning appeals to older students as well as to women. Online learning is particularly attractive to students who need more scheduling flexibility to balance work and family commitments—such as the option to study at different times of the

day or on weekends—and who may require a different set of supports than most traditional 18- to 24-year-old students need.

On average, online undergraduate students were six to eight years older than their on-campus, face-to-face-class counterparts in our study's four-year institutions, and two to five years older than face-to-face students in our study's two-year institutions. At ASU, for example, the average age of an online-only student was 30, and the average age of an on-campus student was 22.

Women, the study found, are more likely to take courses online than men are—and they are more likely to take courses online than to take them face-to-face. At four-year institutions, women are 18 to 24 percentage points more likely to take all of their courses online than to take all of them face-to-face; and at two-year institutions they are 7 to 17 percentage points more likely to do so. As noted earlier, 67% of the students taking all of their

EXHIBIT 5 | Female Students, Older-Than-Average Students, and Pell Grant Recipients Are More Likely to Take All Classes Online

Institution	Pell Grant recipients (%)	Female (%)	Average age	Nonwhite (%)
Arizona State University	32 / 39	39 / 57	22 / 30	51 / 35
University of Central Florida	35 / 40	43 / 67	22 / 28	48 / 44
Houston Community College	29 / 40	53 / 70	25 / 30	85 / 83
Kentucky Community & Technical College System	60 / 67	53 / 67	25 / 27	21 / 15
Rio Salado College	18–49 / 25	56 / 63	22 / 25+	37 / 31

■ Fully face-to-face ■ Fully online
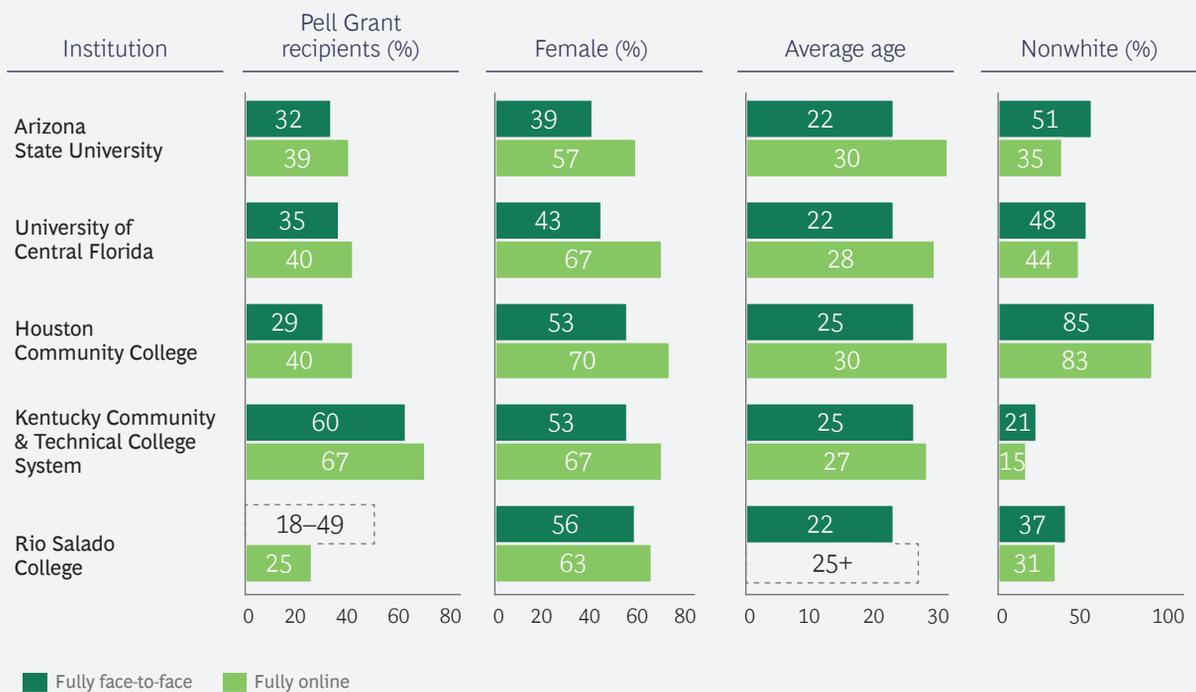
Sources: Institutional data; BCG analysis; IPEDS.
Note: Rio Salado has no traditional face-to-face offerings, so comparisons are based on the average of the Maricopa County Community College District; Rio Salado is one of ten colleges in the district; and because data on Pell Grant recipients is not available, estimates are derived from the other nine colleges. The relatively low Pell share overall at Rio is likely due to the fact that students must declare their intention to receive a credential to be Pell eligible (and eventually receive Pell funding), and 24% of Rio's students are concurrently enrolled in another institution. Average age is not available for Rio Salado; however, 57% of students at the other nine campuses are older than 25.

classes online at UCF were female, compared to 43% of students taking all of their classes face-to-face. This split emerged at the same time that UCF's overall demographics became increasingly diverse, which in turn occurred as the university increased its digital learning initiatives and enlarged its student body overall. The proportion of UCF students who were Pell Grant recipients increased from 20% of enrollment in the fall of 2004 to 38% in the fall of 2014, and the percentage of UCF students who were minority group members increased from 25% to 43% during the same period.

Findings About Impact on Economics

Although institutions pursuing high-quality implementations of digital learning must make some strategic investments, institutions can control costs and achieve greater fiscal sustainability over time in various ways. A number of prior studies focused on the cost of online learning to the student, suggesting that it was more expensive, but they did not fully take into account the operating costs to the institution. Digital learning can help institutions reduce costs and pass along savings to students through three primary mechanisms: raising student-to-instructor ratios, drawing on a broader network of adjunct faculty, and avoiding additional operations costs.

Online courses have higher ratios of students to instructors. At ASU, section sizes for online courses are significantly larger than those for on-campus courses: lower-division undergraduate online courses are about twice the size of lower-division face-to-face courses, and upper-division online courses are about 50% larger than upper-division face-to-face courses. The differences are significant but not quite as great in the community colleges included in the study, because section sizes tend to be smaller. For instance, the average section size for online courses at Houston Community College is only about one-fourth larger than that for the face-to-face course (26 versus 21 students per section). (See Exhibit 6.)

Online learning lowers instructional costs. Some universities and community colleges among our case study institutions use more

---

EXHIBIT 6 | Larger Online Versus Face-to-Face Class Sizes Yield Ongoing Savings at Case Study Institutions

Average section size

Institution	Face-to-face	Online	Increase
Kentucky Community & Technical College System	14	21	+50%
Rio Salado College	21	25	+19%
Houston Community College	21	26	+24%
Arizona State University	28	50	+79%
University of Central Florida	30	54	+80%

Face-to-face   Online
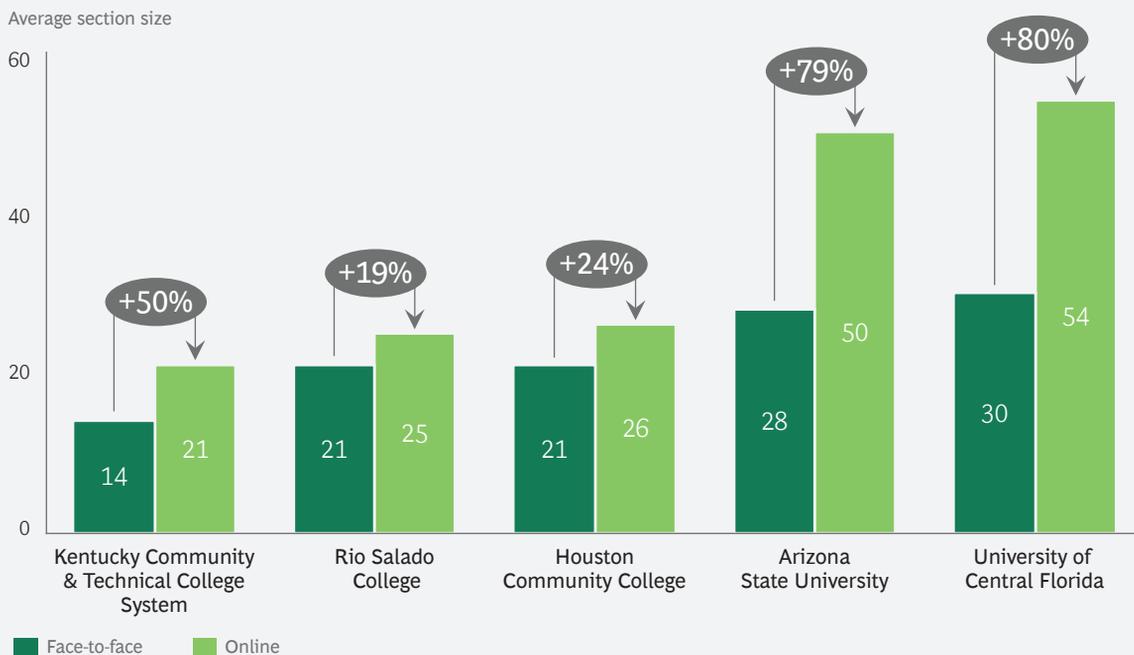
Sources: Institutional research teams at each case study institution; BCG analysis.
Note: Rio Salado does not have any traditional face-to-face classes, so comparison is against the average class size for the other nine colleges in the Maricopa County Community College District.

adjunct or part-time faculty—who tend to be less costly to hire than tenure-track faculty (who focus on both research and teaching)—to teach online courses.

At one major university, part-time or adjunct faculty taught 85% of online courses, compared with 70% of on-campus courses. In upper-division courses, the ratio of tenure-track to non-tenure-track faculty was roughly 40/60 for campus-based courses and 10/90 for online courses. The shift in faculty type seems not to have lowered the quality of the learning experience: students in fully online courses performed comparably to students in traditional face-to-face courses. The faculty mix at two-year institutions differs between online and face-to-face courses, too, although most two-year faculty and instructors focus more on teaching than on research. At KCTCS, for example, part-time faculty teach 46% of online credit hours and 42% of face-to-face credit hours.

Cumulatively, the higher student-to-instructor ratios and greater use of adjunct instructors

lowered the cost of instructional delivery in online modalities, relative to face-to-face, by anywhere from $19 to $67 per student credit hour, depending on the case study institution. (See Exhibit 7.) Local labor markets and the instructional model needed to serve students influence an institution's instructional spending, so we have normalized these effects in Exhibit 7 as a portion of the average expense per student credit hour. For example, the average section size at KCTCS is 21 students in online courses and 14 students in face-to-face courses. This difference, along with slightly greater reliance on part-time faculty to teach online courses, reduces instructional delivery costs at KCTCS by $46 per student credit hour for online learning compared with face-to-face learning. This $46 reduction translates into a savings of 8% compared with the average cost per student credit hour at KCTCS.

These trends in class section size and faculty mix could also occur in traditional face-to-face classes; however, factors such as ease of scheduling, elimination of room capacity as a limit on class size, and redeployment of faculty's

EXHIBIT 7 | Online Courses Tend to Cost Less Overall per Student Credit Hour Than the Institutional Average

	University of Central Florida	Houston Community College	Kentucky Community & Technical College System	Rio Salado College
Online operations (technology, management, course development)	+$14	+$4	+$2	+$9
Instructional delivery	−$67	−$19	−$48	−$39
Operations and maintenance	−$13	—	—	−$30
Student support	—	—	—	−$5
Student acquisition	—	+$3	—	+$9
Total per student credit hour (% lower versus average)	−$66 (16%)	−$12 (~3%)	−$46 (8%)	−$56 (50%)

Sources: Interviews and institutional research at each case study institution; MCCCD Comprehensive Annual Financial Report for AY2015; BCG analysis.
Note: Rio Salado does not have traditional face-to-face classes, so the counterfactual is the Maricopa County Community College District average. Avoided operations and maintenance cost is relevant only if the institution is at capacity; for those at capacity, we estimated savings by determining the additional required building space (for example, classrooms, study spaces, teaching auditoriums, and space for student services) and estimating O&M savings per square foot for that space type.

instructional time make it easier for institutions to optimize class size or alter their faculty mix in online courses. In making these tradeoffs, most universities may be investing in instructional quality in other ways, such as by providing more and better professional development opportunities, enabling students to engage with course content more interactively, or providing tailored student support such as coaches who follow students throughout their enrollment, thus ensuring a high-quality overall learning experience.

By raising enrollment, digital learning lowers average tech and support service costs.

Online options help institutions reduce their need to provide and maintain physical campus-based facilities. Digital learning can enable institutions to attract and serve more students with their existing physical campus resources, avoiding the large capital expansion costs involved in adding classrooms, study spaces, teaching auditoriums, and space for student support services, as well as the operations and maintenance costs associated with these facilities. For example, faced with campus space shortages, UCF added capacity through its fully online and mixed-modality course offerings. It increased student enrollment by the equivalent of 11,000 full-time students with only a marginal increase in the physical size of the campus, saving an estimated $150 million in projected construction costs. This strategy enabled UCF to expand quickly to serve its online students, without first having to construct additional campus buildings. UCF also avoids about $13 per student credit hour (roughly 5%) in expenses for ongoing facilities operations and maintenance for students enrolled in digital courses.

Furthermore, UCF's cost to deliver online or mixed-modality courses was about 11% to 16% lower than its average cost per student credit hour for all courses, largely due to larger section sizes in online courses.[4] The average number of students per online class at UCF is 54, while the comparable figure for

face-to-face classes is 30. Section sizes remain larger in fully online and in mixed-modality formats for both lower-division and upper-division courses. The resulting savings more than compensate for the university's initial investments to ensure high-quality implementation, which included funding a central team of instructional designers, offering extensive professional development for faculty regarding how to design and teach online courses, and establishing a set of course review processes dedicated to quality assurance. This study, said an administrator at UCF, "revealed some powerful, previously unseen outcomes of our approach, both academic and fiscal." (See the case study "University of Central Florida: Transforming Undergraduate Education" in the appendix.)

The savings in ongoing expenses is less substantial at two-year institutions such as HCC, where the facilities are not at full capacity and even online students may often visit the campus to use computers or the library.

By supporting student population growth, digital learning can help lower the costs of investments in tech and support services per student credit hour by spreading them across a larger student base. A larger student population can help institutions and systems negotiate larger volume-based discounts from third parties and obtain higher returns on larger-scale marketing. Well-coordinated digital learning amplifies a higher-education system's ability to manage course offerings as a portfolio, permitting specialization across campuses and reducing course duplication—a crucial advantage that can yield further cost savings. (See the case study "Houston Community College: Solving the Digital Learning Paradox" in the appendix.)

Some investments are necessary to make online course offerings work well. Digital learning does require institutions to make some upfront investments, such as converting auditoriums into labs or other classroom spaces suitable for online learning. But most colleges and universities find that digital learning requires less in the way of wholly new investments than of shifts in the timing of planned spending, such as accelerating the expansion of Wi-Fi bandwidth or server

capacity. For example, ASU sped up existing plans to add Wi-Fi to its campus shuttle buses so that students could access course materials and work online while in transit.

Ongoing investments in support of a high-quality implementation of digital learning are largely offset by lower costs associated with delivering digital learning. Such investments may include a central team of instructional designers, web designers, multimedia personnel, data analysts, quality assurance experts, and student support services staff (for instance, UCF spends $8.6 million annually on its 90-member central team); professional development—such as UCF's 80-hour boot camp on digital learning—to help faculty learn how to teach effectively in a new medium; and other technology costs such as student and faculty support services, proctoring and quiz software, and online collaboration platforms.

Arizona State University spends about $1 million annually on technology for its digital learning offerings, about half of which goes to its student success center. The remainder of the expenditure covers licensing and hosting costs, technology for the instructional design team (such as an online collaboration platform), a transcription service, and online quiz software. ASU has also employed third-party services for student acquisition at institutions that recruit students in new demographic markets.

Institutions in our study invested from $2 to $14 per student credit hour in online operations, technology, and course design. Rio Salado annually invests about $2.9 million (chiefly for salaries) in course development and refreshes for approximately 300 new courses or major revisions, $6 million in online student services (such as advising), and $2.4 million in marketing and student acquisition. Offsetting these substantial investments are lower instructional costs, a lean management profile, and the avoidance of various costs associated with face-to-face student services and with operations and maintenance.

In sum, a comparison of overall average costs for online courses with overall average costs for all courses reveals that the costs for online courses ranged from $12 to $66 less per student credit hour at four of the six institutions in the study, a difference of from 3% to 50% below the institution's average student credit hour costs, as summarized in Exhibit 7.

These findings on institutional and student costs may seem surprising in view of recent research findings that students generally pay higher prices for distance education than for face-to-face courses, since they often pay the same tuition but may incur additional fees. And many institutions believe that most components of a distance course cost the same or more than their face-to-face alternatives do, owing to the costs of additional accreditation, instructional design, and the like. But our analysis—which takes into account cost factors such as higher course section size, different faculty mix, and avoided operations and maintenance—suggests that institutions that carefully plan their strategic initial investments can reduce ongoing delivery costs.

NOTES
1 Beth McMurtrie, "What's the Ideal Mix of Online and Face-to-Face Classes?" *The Chronicle of Higher Education*, October 30, 2017. Available at http://www.chronicle.com/article/What-s-the-Ideal-Mix-of/241616.
2 Scott James, Karen Swann, and Cassandra Daston, "Retention, Progression and the Taking of Online Courses," *Online Learning*, June 2016. Available at https://files.eric.ed.gov/fulltext/EJ1105922.pdf.
3. Rio Salado, one of 10 community colleges in the Maricopa County Community College District, has historically been the online provider for the district. Because Rio Salado does not offer traditional face-to-face instruction, our comparisons on most metrics here represent the average for MCCCD as reported in the fiscal year 2015 "MCCCD Comprehensive Annual Financial Report." The Pell Grant percentage for MCCCD is the range for the other nine colleges as reported on IPEDS; the MCCCD average was not available.
4. The UCF case study benefited from details on UCF costs to deliver digital learning that appeared in Affordability Workgroup, "The Cost of Online Education," a state report initially presented to the Innovation and Online Committee of the Florida Board of Governors, October 17, 2016. Available at http://www.flbog.edu/documents_meetings/ 0259_1022_7699_2.3.2%20IOC%2003a_2016_10_07_ FINAL%20CONTROL_Cost%20Data%20Report_rev.pdf. This report provided a more granular view of the cost of face-to-face education than we were able to obtain in most instances.

PROMISING PRACTICES IN IMPLEMENTING DIGITAL LEARNING

FOR COLLEGES AND UNIVERSITIES, the question is not whether to adopt digital learning, but rather how and for what purpose is digital learning most effective? There is no one-size-fits-all answer. Instead, leaders in higher education must ask whom it benefits, at what cost, when, and under what circumstances—and they must use this information to articulate a clear vision and mission for digital learning that specifically addresses the needs of both their students and their organization. Leaders must also think long term about what strategic choices they should make to develop, improve, and support their institution's capacity to provide high-quality digital offerings.

Through our research, we identified seven promising practices for college and university leaders to consider when looking to roll out or expand digital learning.

The Strategic Portfolio Approach

Too many universities think of digital education as fully online programs focused largely on graduate-level education. But the greatest potential to improve access and outcomes while reducing costs lies in increasing the integration of digital learning into the undergraduate experience, particularly through mixed-modality models. The six institutions that we examined expanded access and improved some academic outcomes by developing a digital learning portfolio containing a mix of digital delivery models tailored to the particular needs of their students.

For example, Arizona State University offers three primary study formats, giving students increased flexibility. Students can take traditional face-to-face courses, or take a subset of courses online or in a mixed-modality format, or take all courses online through a fully online degree program. From 2011 to 2015, the percentage of student credit hours taken online increased from 22% to 33%. Initially, the digital courses grew organically, with ASU faculty posting content online without central coordination; but in 2009, the university implemented a more systematic, centralized approach, in order to realize economies of scale and match the technology to the needs of students. "Now we take a much more deliberate approach," said an administrator at ASU. "Departments used to decide what was uploaded; now we target departments where there is a demand from students and faculty for greater flexibility."

This portfolio approach to courses and programs allows institutions to manage course offerings more efficiently, too, reducing course duplication and improving the institution's ability to specialize. For example, Houston Community College has created a Centers of Excellence model that organizes 19 campuses and 6 colleges into units based on discipline

instead of geographic location, with a single dean for each academic discipline across the system. In the past, each college might have had its own introductory English course—but now all funding flows into a single central English department, regardless of where students take their classes. This approach reduces duplication of courses within each discipline and decreases internal competition for students among member colleges, because digital courses are accessible anywhere.

At the heart of the strategic portfolio approach is an institutional focus on prioritizing students' needs. In designing initiatives, institutions put students at the center of the learning process, and they design new educational experiences around what helps students learn better and achieve their educational goals. "If we started again we would be more strategic about launching programs," observed an administrator at HCC. "We were responsive to student demand, but we responded incrementally rather than systematically, and that's beginning to change now."

Building Needed Capabilities and Expertise to Design for Quality

Often, students who enroll in fully online programs must balance multiple competing demands. And online courses, especially those delivered asynchronously, may require greater self-motivation and discipline on the student's part than face-to-face classes do. To address the challenges that students who take online-only courses face, and to help them succeed, institutions must develop resources that improve the overall quality of digital learning. This means applying first-class instructional design principles to digital courses across the institution and providing expert digital design support to help faculty develop courses that take maximum advantage of the benefits of digital delivery.

Universities that want to make their digital offerings available at significant scale will find it beneficial to build this capability in-house. A common success factor in our case studies was the presence of a central digital learning team with professional instructional designers dedicated to overseeing course development, course quality, and student outcomes. The team may include other media personnel as well. Centralization can help institutions avoid costly course duplication and standardize the course development process. By using third-party courseware, institutions can reduce their need for large numbers of instructional designers.

<div style="color: teal; font-size: larger;">

With the strategic portfolio approach, institutions aim to prioritize students' needs.

</div>

The central team's responsibilities include working with faculty to structure the curriculum for each course, setting specific learning objectives, monitoring course quality and student outcomes, coordinating student support services, and optimizing scheduling. Team members can offer professional development support, too, such as coaching faculty on basic principles of good pedagogy in digital instruction, which differs in some respects from traditional instruction. Professional instructional designers bring a level of technical expertise in digital modalities and effective course design that faculty may not possess. They can enhance the usability of the course interface by ensuring that it has clear instructions and is easy to navigate, and they can coach faculty on the unique aspects of online teaching. Exhibit 8 details the structure of UCF's Center for Distributed Learning.

Team size may vary considerably: Houston Community College's central team consists of 40 people who focus primarily to online learning, while Arizona State University employs approximately 300 people in support of a range of digital offerings, from ASU Online to Global Freshman Academy open courses on the edX platform. Whatever its size, a central team can improve both the scale and the overall quality of course offerings. Over a five-year period, ASU's central team reduced its average course development time by half as the team's instructional designers became more experienced and adopted standardized processes—such as the use of templates and checklists in interactions with faculty. They also repurposed course materials. Over time,

Exhibit 8 | The Center for Distributed Learning Is the Central Team Supporting UCF's Digital Offerings

Vice president and CIO		

Administrative assistant
1 person embedded in marketing[1]

Cost for CDL and related units: approximately $8.6 million

Associate vice president		

CDL operations	Research Initiative for Teaching Effectiveness	Strategy, compliance, and infrastructure
Includes coordinator, administrative assistants, and office assistants	Includes supporting scholarship in teaching and learning, data collection, and course evaluations	Includes information technology specialists
Approximately 6 people	Approximately 3 people	Approximately 5 people

1 person embedded in institutional knowledge management team

Course design and delivery	Learning systems and technology	Instructional resources
Includes instructional design, personalized learning, LMS administration, and student/faculty tech support for digital learning	Includes web applications and technology, systems integration, operations/reporting web apps, and web developers	Includes graphics and video production teams, nonacademic online learning, special projects, and accessibility
Approximately 34 people	Approximately 21 people	Approximately 15 people

Sources: UCF interviews; data provided by UCF; organizational charts provided by UCF; BCG analysis.
Note: About 25 members of the staff work part time or are students. This structure was current in 2016; some organizational changes have occurred since then. LMS = learning management system.
[1]CDL occupies 50% of this person's time; the other 50% is dedicated to new fully online market-rate programs overseen by regional campuses.

ASU has also conducted more focused hiring efforts and attracted better talent, which in turn shortens course development time.

With dedicated personnel to conduct quality assurance, ASU offers some best practices for other institutions to learn from. During the process of course development, for example, instructional designers benchmark courses against a rubric adapted from the nonprofit education organization Quality Matters. This establishes a threshold of quality that every course must meet, with multiple checkpoints along the way to ensure fulfillment of the rubric. Faculty members control the curriculum and the learning outcomes design. Prior to the first day of class, online courses undergo readiness checks to ensure that all website links are functioning properly. A team is in place to respond to student and faculty com-

plaints, and the tech support team is on-call 24/7 to help students resolve any problems that arise. At the end of each semester, ASU administrators assess course outcomes in a 360-degree review that evaluates both student satisfaction and course grades—a process that can help routinely improve course quality over time. (See the case study "Arizona State University: A Multichannel Approach" in the appendix.)

Rio Salado Community College offers a unique model in standardized course development that promotes high-quality instruction and a consistent student experience. At Rio Salado, 22 full-time faculty chairs develop courses with the support of a central team that includes subject-matter experts, instructional designers, media support staff, and production staff. About 1,500 adjunct faculty

members teach the courses, which they can personalize by adding an introductory message or video for each module. The faculty chairs constantly monitor course outcomes, identify needed changes, and pass the changes along to instructors. The digital learning tools and courseware equip instructors with an array of data that they can use to adjust their teaching and better meet the needs of individual students. The best adjuncts can apply to become subject-matter experts, who receive additional compensation to support further course development. (See the case study, "Rio Salado College: Focus on Online Education," in the appendix.)

Many institutions struggle to reduce the variability in course quality attributable to individual faculty members' differing levels of experience with digital formats. The use of a master course developed by senior faculty or by third-party courseware providers working in conjunction with content experts can help promote a higher-quality, standardized student experience. This contributes to greater coherence and rigor in high-enrollment courses and in gateway courses that students must complete successfully before proceeding to higher-level study. Master courses can also be relevant and helpful as applied to introductory general-education courses that are a required part of numerous degree pathways. This strategy may be especially promising at institutions that have a large adjunct base, as many adjuncts prefer enhancing a course to building a new course from scratch—or they may be called on at the last minute to teach a section. As a secondary benefit, the use of master courses or courseware can lower or nearly obviate course development costs.

At the Kentucky Community and Technical College System, leaders wanted to provide a higher-quality, more consistent experience for students at its 16 community colleges across the state, including ensuring that all students had access to similar academic services and resources at each institution. To achieve this, KCTCS created a central team (to help faculty improve online course quality) and centralized student support services, such as a digital tutoring service available to all students enrolled in online or face-to-face courses. KCTCS also centralized administrative functions (in-

cluding course registration, financial aid, and grading) to standardize the overall student experience further, and it contracted with third-party institutional software vendors at a system-wide level to secure significant volume discounts and ensure standard interfaces. (See the case study "Kentucky Community and Technical College System: A System-Level Approach" in the appendix.)

Providing Differential Supports for Students to Succeed in Fully Online Learning

Today, as the enrollment of nontraditional students increases, more students need flexible schedules to balance work and family commitments with their studies. At the same time, some colleges and universities face limits on physical campus space and on capital budgets, while others must grapple with shrinking on-campus enrollment. In either case, digital education has emerged as a possible solution to the challenges, serving as a growth engine for adding new students.

A master course developed by senior faculty can improve instruction in digital formats.

But developing an online program requires more than stringing together a series of online courses. It requires creating a network of remotely accessible support structures that are adapted to the distinctive challenges facing online students, which warrant a customized student support model.

Arizona State University and Rio Salado Community College provide examples of how institutions can integrate online student support throughout the student life cycle to address common trouble spots. These include retention coaching and dedicated online tutoring for online students, as well as automated alerts and predictive analytics to help faculty and academic advisors support online learners. ASU students taking courses online have access to 24/7 tech support, on-campus and online tutoring services, and success

coaches who provide individualized, holistic support to help online students navigate their coursework and balance their studies with other work and family commitments.

In addition to providing new forms of student support services, universities must find creative ways to enhance faculty-student engagement in the digital realm. Such engagement, though critical to success, is different in the digital realm. In an online or hybrid environment, faculty members are typically course facilitators rather than primary content deliverers, and they need to focus on resolving specific learning gaps by providing individualized feedback to students in real time and linking content to assessments. On a positive note, numerous digital solutions that support both peer and faculty engagement are now available on the market.

Some institutions adopt tools that facilitate and monitor student-faculty touch points.

Lacking physical proximity, instructors need to establish a presence in the course via frequent check-ins, timely feedback, and targeted support. When leading mixed-modality courses, instructors can improve the quality of face-to-face time with students by focusing class time on higher-level or more dynamic learning activities that encourage peer interaction, working in teams, or project-based learning, while reserving online learning time for tasks such as watching lectures. Even if classes meet in person less often, the quality of classroom time can be richer and more interactive than that of a standard lecture class.

With this in mind, some institutions are putting tools in place to facilitate and monitor student-faculty touch points. For example, Rio Salado has developed GEAR (Guided Evaluation Assessment and Responses), an online platform that helps faculty provide personalized feedback to students, integrating additional content and examples based on student learning gaps. According to the college, students in the holistic advising co-

hort who used GEAR (and other tools) achieved 7% higher retention from one term to the next and a slight higher GPA than members of a comparative cohort did. Rio Salado also uses RioLearn, its proprietary learning management system to monitor faculty responsiveness to students. RioLearn sends automated alerts to department chairs when faculty members exceed maximum specified response times (24 to 48 hours to respond to a student's email or phone call, and 48 to 72 hours to grade assignments).

Engaging Faculty as Partners in Digital Learning and Equipping Them for Success

One commonly cited challenge involves figuring out how to engage faculty constructively in the adoption of digital learning to help them succeed and to help the institution progress. When first exposed to the prospect of digital learning, faculty may worry (perhaps rightfully so) about course quality, poor outcomes, the time commitment involved, and their own inexperience with the modality. Indeed, digital learning sometimes suffers from uneven faculty support and adoption, especially at the undergraduate level. But one 2015 study found some promising results regarding faculty experience with and attitudes toward digital learning.[1] More than half (54%) of the 2,700 faculty and administrators who were surveyed reported that they used digital courseware, and a similar proportion (52%) said that they valued its impact. Still, 40% of faculty said that the time needed to adopt digital courseware was an obstacle, and 26% said that they were concerned with the courseware's effectiveness.

In another study, instructional designers described lack of faculty buy-in as the number one barrier to successful implementation of digital learning and attributed that circumstance to "part lack of knowledge, part lack of understanding."[2] Instructional designers also suggested that some faculty may have difficulty adjusting to new teaching approaches because they are more comfortable with what they already know how to do well. To address this problem, the study recommended involving instructional designers "early, often, and throughout your technology transition" and

developing clear standards for everyone involved in some component of digital learning, including institution leaders, instructional designers, faculty, and students. It also encouraged institutions to point out the benefits of working with instructional designers, who can help faculty learn how to engage their students online more effectively, work with online tools in innovative ways, and even use online activities to free up more class time for other in-person learning activities, such as more interactive and engaging exercises, discussions, or team projects.

We found that the most successful institutions in our study addressed faculty concerns by providing professional development, engaging senior faculty and other well-respected faculty early on, involving faculty in platform decisions, offering financial and recognition-based incentives, and fostering a culture of innovation.

After completing UCF's 80-hour professional development boot camp for digital offerings, faculty reported that the training and coaching they received prompted them to take a

fresh look at how they teach face-to-face classes, too. (See Exhibit 9.) The online course design process typically requires faculty to map out learning objectives tied to each assignment and assessment in a new online class, so faculty began reflecting about how they could engage in the same deliberate process as they planned their in-person instruction. "Online has to be so much more rigorously constructed, because it has certain pieces you don't have in a face-to-face course where you can amend and connect before you see them," said a professor at UCF. "If they [students] get lost online, you're stuck."

In building support for the shift to digital learning, institutions should consider reaching out to senior faculty and other influential and peer-respected faculty leaders, soliciting their feedback and asking them to serve as early adopters for new technologies and teaching approaches and to act as ambassadors who will share their experiences with their colleagues. At UCF, leaders sought to counteract potential faculty opposition by seeking out senior tenure-track faculty and other academic leaders to lead their digital

EXHIBIT 9 | UCF's Ten-Week (80-Hour) Boot Camp Course for Teaching Online Uses a Mix of Modalities

COURSE OVERVIEW

Week	Focus for the week	Modality or activity
0	Getting started	on id
1	Navigating the online environment	f2f
2	Content in the online environment	on
3	Designing interactive course activities	on id
4	Effective online assessments	on
5	Using CDL services to enhance an online course	f2f
6	Designing with social media in mind	on id
7	Managing an online course	on
8	Technical support, scholarship, and peer review	f2f id
9	Production week	on
10	Course showcase	f2f

on Online content   id Instructional design consultation   f2f Face-to-face meetings

ADDITIONAL NOTES

- The course has both online and face-to-face components
  - This familiarizes the faculty with the modalities they will be using
- The course gives faculty exposure to CDL services
- Completing the course equips faculty to develop online courses with CDL support
  - Faculty take the leading role in development; CDL provides support
- The course helps build a norm of online instruction

Sources: University of Central Florida; UCF interviews.
Note: CDL = Center for Distributed Learning.

learning initiative. This strategy also helped build prestige around faculty involvement with digital learning. "That history of senior faculty teaching online helped mainstream teaching online," said an administrator at UCF. "We knew if senior faculty were the first to teach online, they would demonstrate its value to other faculty, and understand its value when making promotion decisions."

Taking the long view and giving faculty time to adapt are crucial to program success.

Georgia State University won faculty support by working on multiple levels, including involving faculty in the vendor selection process for choosing the adaptive courseware technology, so they didn't feel that they were being force-fed software that they had had no role in choosing. GSU also provided professional development to help prepare faculty to excel in online teaching and offered incentives such as stipends, fellowships, and publishing opportunities related to digital learning. It used a "pilot, evaluate, and scale" methodology to test digital learning innovations, demonstrate academic returns, and build confidence among faculty—an approach that has attracted faculty interest and participation in adaptive learning. GSU's top leaders contributed to the successful adoption of digital learning by fostering a culture promoting innovation as a powerful force for student success. Sustained efforts to celebrate and encourage innovation and to showcase data demonstrating digital learning's promise had a cumulative effect on faculty buy-in. (See the case study "Georgia State University: Innovating with Adaptive Courseware" in the appendix.)

Taking the long view and giving faculty time to adapt are important to program success. One online program manager, anecdotally observing a correlation between faculty experience with digital modalities and student outcomes, said "grades tend to pick up after faculty teach in adaptive mixed modality or emporium course three times. It takes them a while to get used to the new style of teaching."

Committing to Digital Learning as a Strategic Priority and Building Infrastructure for Lasting Impact

The institutions in our study benefited from steady, long-term leadership. Indeed, to judge from comments we heard at institutions that have struggled with this process, one of the greatest inhibitors to developing high-quality digital learning appears to be inconsistent leadership support, usually as a result of high turnover in leadership positions. In general, the institutions that have been most successful in developing a high-quality online learning program have tended to retain their leaders for longer terms—on average, only one university/college president over the previous decade.

As leadership shifts its focus, funding levels vary, making it difficult to keep dedicated capacity directed on the effort (for example, if instructional design positions are terminated at the end of a grant term) and constricting grassroots support (if faculty and staff perceive that their work on digital learning initiatives is likely to go unrewarded). Another common casualty of shifting leadership priorities is proper attention to measuring what works. For digital learning programs to succeed, the institution must regularly evaluate the impact of interventions, to determine whether participating students are performing better. Inadequate attention to the task of measuring progress can further inhibit institutions from investing in efforts to improve the quality of digital learning.

Of course, not all institutions can count on such stability. New leaders have their own priorities, and faculty and staff naturally adapt to them. With this in mind, leaders who initiate a digital learning program should strive to build a base of support among faculty and staff that is strong enough to advance digital learning initiatives and prevent a loss of institutional momentum following the departure of a president, provost, or other key leader. This includes assembling a central team that can drive implementation forward, confirm that core systems (including data and analytics capabilities) are in place, and embed digital learning in the strategic plan to ensure establishment of a high-quality program.

Having a central team to manage the digital offering appears to be beneficial across the board, but it is especially useful in the absence of consistent leadership support or turnover at the presidential or provost level. In that situation, a central team can provide strategic goal setting and tracking, instructional design support, support services for faculty and students, and ongoing quality assurance.

Tapping Outside Vendors Strategically

Universities can create strategic partnerships with outside vendors for such purposes as providing adaptive and personalized courseware to support students in online courses or marketing digital learning programs to reach new types of students. Successful partnerships can help accelerate innovation, expand capabilities, and boost enrollment faster than it would be able to do if it tried to build everything in-house. For institutions that have a limited ability to initiate innovative approaches, strategic vendor partnerships can open a door to more creative solutions.

Vendor-provided services often have lower ongoing maintenance costs, too. "We believe in third parties," said an administrator at GSU. "Even if we have the ability to do something, we think the cost to maintain it would be very expensive. If there is a product someone will pay to develop and refine, then we choose to buy over developing and maintaining it ourselves." This approach does have some disadvantages: contracting with third-party vendors can be more expensive than relying on in-house development, and it can make securing faculty buy-in more difficult.

Some case-study institutions partnered in deeper ways with courseware providers, relying on their assistance to develop and customize courseware and other online tools to be a better fit for their particular campus. Such partnerships give the institution's faculty an opportunity to contribute content (in one instance, more than 400 videos for some courses) and other input on the design and development of these and future tools. "Innovation in the adaptive space is moving toward a blended model," observed an administrator at Arizona State University. "Institutions take

what is on the shelf and enhance it so professors don't have to start from scratch; but the content is still tailored to meet their needs."

Beyond course content, schools can tap into many other products and services from vendors. ASU partnered with Pearson for student acquisition and marketing support, given the university's goal of reaching a target audience beyond current students and the population that typically enrolls in its on-campus programs. In contrast, Houston Community College fills its online courses with little outside marketing and does not separately brand its online courses as ASU has done with its ASU Online program. HCC found that it did not need outside support, because it was not trying to attract additional students from outside its natural constituency. Rather, HCC's primary focus was to better serve students who were already enrolling.

Strengthening Analytics and Monitoring

As digital learning continues to evolve, institutions will need to improve and adapt their offerings. Doing so will require a robust data infrastructure, strong analytical capabilities, and continuous feedback loops, so college and university leaders can apply lessons learned to unceasingly improve digital learning.

———

Partnerships with outside vendors can accelerate innovation and boost enrollment.

———

Recently, the University of Central Florida launched an ambitious institution-wide effort to revamp its data architecture. The initiative included everything from defining the exact types of data being tracked to ranking the value of different types of data analysis. Leaders asked faculty and staff across the entire institution to determine which types of analysis were most valuable, using their input to compile a data dictionary with clear definitions of a "full-time student" and of different kinds of digital modalities. UCF's institutional research and IT teams then built a new dash-

board tool to track a vast range of data related to how students perform in online classes versus face-to-face (including course grades, retention rates, and time to degree completion), student enrollment demographics, number of faculty completing training, section capacity and utilization rate for each course, and costs of implementing digital learning. This dashboard enables UCF leaders to rapidly extract and analyze vast amounts of better-quality data, which they can use to inform and improve their decision making about digital learning initiatives.

Some college and universities use sophisticated digital tools such as adaptive courseware to personalize and individualize the learning experience for students. With the detailed student learning data available from these tools, leaders can make course adjustments in close to real time, a hallmark of a high-quality implementation. This is part of a broader trend toward using increasingly sophisticated data analysis to reach more granular findings about instruction. For example, when a student is not performing well in a particular class, the faculty instructor can look up how frequently the student has logged on to the course site and can see the work that the student did during each online visit.

"When I saw the academic data I almost felt off my chair," said an administrator at HCC. "We had never really disaggregated the data by modalities before, and it was so enlightening to see the impact of flexibility on student progression through a degree [program]. Had we known this earlier, we would have doubled down."

NOTES

1. Emily Lammers, Gates Bryant, Adam Newman, and Terry Miles, "Faculty Perspectives on Courseware," in *Time for Class: Lessons for the Future of Digital Courseware in Higher Education*; Tyton Partners, 2015. Available at https://www.onlinelearningsurvey.com/reports/EGA009_CourseWP_Upd_Rd7.pdf.

2. Intentional Futures, "Instructional Design in Higher Education: A Report on the Role, Workflow, and Experience of Instructional Designers"; Intentional Futures, 2016. Available at https://intentionalfutures.com/wp-content/uploads/2017/08/Instructional-Design-in-Higher-Education-Report.pdf.

CONCLUSION AND CALL TO ACTION

Colleges and universities looking for ways to grow enrollment, expand access to high-quality education, and improve student performance at the same time that they lower costs should consider investing in the scaled enterprise implementations of high-quality digital learning. Our case studies of six institutions show that well-planned and well-executed digital learning was extremely valuable both to the institutions we examined and to their students. Looking toward the future, institutions that delay their embrace of digital learning may find themselves at a disadvantage when they compete for students and faculty.

Well-planned, well-executed digital learning is valuable to institutions and to students.

Institution leaders who are thinking about how to shape their portfolio of digital learning offerings should try to answer questions such as these:

- What are my institution's strategic goals, and what forms of digital learning can best help it achieve those goals? For example, an institution whose primary aim is to improve its revenues and financial stability may look into launching online programs to help increase overall enrollment, while an institution focused on improving its retention rates and academic outcomes may find mixed-modality courses or adaptive learning more relevant.

- What is the composition of my institution's student body today? What are their unique needs, and how might digital learning be used to better meet those needs? For instance, are many students working adults who would benefit from greater flexibility, or are they primarily younger people, in their first or second years of postsecondary education, who may be more likely to benefit from the structure and accountability of a face-to-face setting?

- What should be the composition of my institution's student body in five to ten years? How can digital learning help reshape the student population?

- What is my institution's capacity to invest in digital learning, and how will it deploy investment capital? How much risk is my institution willing to take on in making digital learning bets?

- How much should my institution focus on innovation versus taking best practices from other institutions and tailoring them to its particular context?

To realize the full benefits of digital learning, institutions should use seven promising practices as a guide for implementation:

- Take a strategic portfolio approach to digital learning programs.

- Build the necessary capabilities and expertise to design for quality in the digital realm.

- Provide the differential supports that students need in order to succeed in fully online learning.

- Engage faculty as true partners in digital learning, and equip them for success.

- Fully commit to digital learning as a strategic priority, and build the infrastructure necessary to ensure lasting impact.

- Tap outside vendors strategically.

- Strengthen analytics and monitoring.

It is clearly important for colleges and universities to adopt a more entrepreneurial approach to digital learning, making innovation a part of their institutional culture and embracing evidence-driven decision making. Successful institutions are experimenting with cutting-edge ideas, tools, and models for learning. Digital learning also gives universities access to an incredible amount of data, as well as opportunities to analyze information and patterns and to reflect on these findings; and institutions can use the findings to scale up their most successful initiatives. As the field evolves, we observe a learning process in which the more experience college and universities obtain, the faster they can successfully scale up innovations.

Institutions should build up their capacity and support for digital learning. Leaders can champion digital learning for its potential to open the doors of higher education wider and improve student outcomes—and to increase operating efficiency and lower costs. Each institution's journey will be unique, but we believe that the set of best practices described here can offer useful guidance for all.

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 on-line. 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 redundan-

cies. 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 non-white), 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 up-front 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 strate-

gically 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 mil-

lion 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 non-adaptive 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 re-think 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.

BIBLIOGRAPHY

Action Lab Research Group, *ASU Online Phase 1 Report*. Unpublished manuscript. EdPlus Action Lab: Arizona State University, 2015.

Affordability Workgroup, "The Cost of Online Education," a state report initially presented to the Innovation and Online Committee of the Florida Board of Governors, October 17, 2016. Available at http://www.flbog.edu/documents_meeings/0259_1022_7699_2.3.2%20IOC%2003a_2016_10_07_FINAL%20CONTROL_Cost%20Data%20Report_rev.pdf.

I. Elaine Allen and Jeff Seaman, "Going the Distance: Online Education in the United States: 2011"; Babson Survey Research Group, Babson College, November 2011. Available at https://www.onlinelearningsurvey.com/reports/goingthedistance.pdf.

William G. Bowen, Matthew M. Chingos, Kelly A. Lack, and Thomas I. Nygren, "Interactive Learning Online at Public Universities: Evidence from Randomized Trials"; Ithaka S+R, May 22, 2012. Available at http://www.sr.ithaka.org/wp-content/uploads/2015/08/sr-ithaka-interactive-learning-online-at-public-universities.pdf.

Joseph K. Cavanaugh and Stephen J. Jacquemin, "A Large Sample Comparison of Grade Based Student Learning Outcomes in Online vs. Face-to-Face Courses"; Wright State University, Lake Campus, 2015. Available at https://files.eric.ed.gov/fulltext/EJ1062940.pdf.

Integrated Postsecondary Education Data System (IPEDS). Available at https://nces.ed.gov/ipeds/.

Intentional Futures, "Instructional Design in Higher Education: A Report on the Role, Workflow, and Experience of Instructional Designers"; Intentional Futures, 2016. Available at https://intentionalfutures.com/wp-content/uploads/2017/08/Instructional-Design-in-Higher-Education-Report.pdf.

Scott James, Karen Swann, and Cassandra Daston, "Retention, Progression and the Taking of Online Courses," *Online Learning*, June 2016. Available at https://files.eric.ed.gov/fulltext/EJ1105922.pdf.

Hans Johnson and Marisol Cuellar Mejia, "Online Learning and Student Outcomes in California's Community Colleges"; Public Policy Institute of California, May 2014. Available at http://www.ppic.org/content/pubs/report/R_514HJR.pdf.

Emily Lammers, Gates Bryant, Adam Newman, and Terry Miles, "Faculty Perspectives on Courseware," in *Time for Class: Lessons for the Future of Digital Courseware in Higher Education*; Tyton Partners, 2015. Available at https://www.onlinelearningsurvey.com/reports/EGA009_CourseWP_Upd_Rd7.pdf.

Beth McMurtrie, "What's the Ideal Mix of Online and Face-to-Face Classes?" *The Chronicle of Higher Education,* October 30, 2017. Available at http://www.chronicle.com/article/What-s-the-Ideal-Mix-of/241616.

Barbara Means, Vanessa Peters, and Ying Zheng, "Lessons from Five Years of Funding Digital Courseware"; conducted by SRI Education for the Bill and Melinda Gates Foundation, September 2014. Available at https://postsecondary.gatesfoundation.org/wp-content/uploads/2014/10/SRI_Lessons-from-5-Years-of-Funding-Digital-Courseware1.pdf.

Barbara Means, Yukie Toyama, Robert Murphy, Marianne Bakia, and Karla Jones, "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies"; published by SRI International for the US Department of Education; revised September 2010. Available at https://www.ewa.org/sites/main/files/finalreport.pdf.

Trends in College Spending Online; Delta Cost Project at American Institutes for Research. Available at http://tcs-online.org/Home.aspx.

Carol A. Twigg, "Improving Learning and Reducing Costs: Program Outcomes from *Changing the Equation*"; National Center for Academic Transformation, 2009. Available at http://www.thencat.org/Mathematics/CTE/CTE%20Lessons%20Learned.pdf.

NOTE TO THE READER

Institutions looking to start or improve their digital learning offerings can tap into the array of expert resources listed below.

Experts Involved in the Development of This Report

Arizona State University
Lou Pugliese, senior innovation fellow, EdPlus, and managing director, Technology Innovation Action Lab

The Boston Consulting Group
Allison Bailey, senior partner and managing director, leader of the Education practice in North America

Nithya Vaduganathan, partner and managing director

Tyce Henry, associate director and senior education expert

Renee Laverdiere, principal

Bill & Melinda Gates Foundation
Rahim S. Rajan, senior program officer, Postsecondary Success

Nazeema Alli, program officer, Higher Education Technology

Daniel Greenstein, director, Postsecondary Success

Tyton Partners
Gates Bryant, partner

Jeff Dinski, director

Case Study Institution Contacts

Arizona State University
Lou Pugliese, senior innovation fellow, EdPlus, and managing director, Technology Innovation Action Lab

Georgia State University
Tim Renick, vice provost and vice president of enrollment management and student success

Tracy Adkins, director of learning technology

Houston Community College
Steve Levey, associate vice chancellor for academic instruction

Kentucky Community & Technical College System
Lisa Jones, system director of distance learning initiatives

Ella Strong, dean of distance learning, Hazard Community and Technical College

Rio Salado Community College
Kate Smith, vice president of academic affairs

Roslyn Knight, interim dean of instruction and academic affairs and faculty chair, Reading and ESL

University of Central Florida
Joel Hartman, vice president of information technologies and resources

Tom Cavanagh, vice provost for digital learning

About the Authors

Allison Bailey is a senior partner and managing director in the Boston office of The Boston Consulting Group. She also leads BCG's Education practice in North America.

Nithya Vaduganathan is a partner and managing director in the firm's Boston office.

Tyce Henry is an associate director and senior education expert in BCG's Washington, D.C. office.

Renee Laverdiere is a principal in the firm's Houston office.

Lou Pugliese is a senior innovation fellow and managing director of technology innovation at the EdPlus Action Lab at Arizona State University.

Acknowledgments

The authors would like to extend a special thank you to their colleagues Rahim Rajan at the Bill & Melinda Gates Foundation and Arthur Blakemore and Richard Stanley at Arizona State University for their contributions, collaboration, and support in developing this report. The authors are appreciative of their many BCG colleagues who conducted the background research for the report, including Briar Thompson, Claudia Newman-Martin, Caroline Pringle, Samuel Harris, Jorge Vazquez Anderson, and Melanie Diaz.

The authors are also grateful to Meg Sommerfeld for her writing assistance, and to Katherine Andrews, Gary Callahan, Kim Friedman, Abby Garland, Steven Gray, Sean Hourihan, Sara Strassenreiter, and Taylor Tinmouth for their contributions to the editing, design, production, and marketing of this report.

For Further Contact

If you would like to discuss this report, please contact one of the authors.